2/24/09

FINAL

FISHERY MANAGEMENT PLAN FOR REGULATING OFFSHORE MARINE AQUACULTURE IN THE GULF OF MEXICO

(Including a Programmatic Environmental Impact Statement, Regulatory Flexibility Analysis and Regulatory Impact Review)

JANUARY 2009

Gulf of Mexico Fishery Management Council
2203 North Lois Avenue, Suite 1100
Tampa, Florida 33607
813-348-1630
813-348-1711 (fax)
888-833-1844 Toll Free
gulfcouncil@gulfcouncil.org
www.gulfcouncil.org

National Oceanic & Atmospheric Administration
National Marine Fisheries Service
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701
727-824-5305
727-824-5308 (fax)
http://sero.nmfs.noaa.gov

This is a publication of the Gulf of Mexico Fishery Management Council Pursuant to National Oceanic and Atmospheric Administration Award No. NA05NMF4410003.

This page intentionally blank

TABLE OF CONTENTS

Acronyms/Abbreviations

ABC	Acceptable Biological Catch
ACOE	Army Corps of Engineers
ADCNR	Alabama Department of Conservation and Natural Resources
AP	Advisory Panel
APA	Administrative Procedures Act
APHIS	Animal and Plant Health Inspection Service, US Department of Agriculture
B	Biomass
$B_{CURRENT}$	Current Biomass of Stock
B_{MSY}	Biomass at MSY
BMP	Best Management Practices
BOD	Biological Oxygen Demand
CFR	Code of Federal Regulations
CI	confidence interval
Council	Gulf of Mexico Fishery Management Council
CPUE	Catch per Unit Effort
CV	coefficient of variation
CVM	Center for Veterinary Medicine
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DACS	Florida Department of Agriculture and Consumer Services
DEIS	Draft Environmental Impact Statement
DO	Dissolved Oxygen
DOA	Department of Agriculture
DOC	U. S. Department of Commerce
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EFP	Exempted Fishing Permit
EIS	Environmental Impact Statement
ELMR	Estuarine Living Marine Resources
E.O.	Executive Order
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FAO	Food and Agriculture Organization (United Nations)
FMP	Fishery Management Plan
F_{MSY}	Fishing Mortality Rate Producing MSY
FMU	Fishery Management Unit
FWC	Florida Fish and Wildlife Conservation Commission
FWRI	Florida Fish and Wildlife Research Institute
GC	NOAA General Counsel
GMFMC	Gulf of Mexico Fishery Management Council
GMMSEP	Gulf of Mexico Marine Stock Enhancement Program
Gulf	Gulf of Mexico

HAPC	Habitat Areas of Particular Concern
HMS	Highly Migratory Species
IFQ	Individual Fishing Quotas
IQA	Information Quality Act
IRFA	Initial Regulatory Flexibility Analysis
LDWF	Louisiana Department of Wildlife and Fisheries
LOA	Letter of Acknowledgement
MARFIN	Marine Fisheries Initiative
MBTA	Migratory Bird Treaty Act
MFMT	Maximum Fishing Mortality Threshold
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MP	Million Pounds
MPA	Marine Protected Area
MRFSS	Marine Recreational Fishery Statistics Survey
MSAP	Mackerel Stock Assessment Panel
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
NEPA	National Environmental Policy Act
nm	nautical mile
NMFS	NOAA's National Marine Fisheries Service
NMSA	National Marine Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
OOA	Open Ocean Aquaculture
OMB	Office of Management and Budget
OCSLA	Outer Continental Shelf Lands Act
ORP	Oxidation Reduction Potential
OY	Optimum Yield
PEIS	Programmatic Environmental Impact Statement
ppm	parts per million (e.g., oxygen)
ppt	parts per thousand (salinity)
RA	Regional Administrator of NOAA Fisheries Service
RDSAP	Red Drum Stock Assessment Panel
RFA	Regulatory Flexibility Act
RIR	Regulatory Impact Review
SAFMC	South Atlantic Fishery Management Council
SAV	Submerged Aquatic Vegetation
SBA	Small Business Administration
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast Data Assessment Review (stock assessment)
SEFSC	Southeast Fisheries Science Center of NOAA Fisheries Service
SEIS	supplemental environmental impact statement
SERO	Southeast Regional Office (NOAA Fisheries Service)

SMZ	Special Management Zone
SPL	Saltwater Products License (FL)
SPR	Spawning Potential Ratio
SRD	Science and Research Director, Southeast Region
SSB	Spawning Stock Biomass
SSB/R	Spawning Stock Biomass per Recruit
TAC	Total Allowable Catch
TOC	Total Organic Carbon
TPWD	Texas Parks and Wildlife Department
UNH	University of New Hampshire
U.S.	United States
USCG	United States Coast Guard
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WSSV	White Spot Syndrome Virus

Programmatic Environmental Impact Statement (EIS) Cover Sheet

Responsible Agencies and Contact Persons

Gulf of Mexico Fishery Management Council	813-348-1630
2203 N. Lois Avenue, Suite 1100	888-833-1844 (toll-free)
Tampa, Florida 33607	813-348-1711 (fax)
Carrie Simmons	
http://www.gulfcouncil.org	

National Marine Fisheries Service	727-824-5305
Southeast Regional Office	727-824-5583 (fax)
263 13th Avenue South	
St. Petersburg, Florida 33701	
Andy Strelcheck	
http://sero.nmfs.noaa.gov	

Name of Action

Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico

Type of Action

(X) Administrative	( ) Legislative
( ) Draft	(X) Final

Filing Dates with EPA

Scoping Hearings: February-March 2004 (Appendix H)
Notice of intent (NOI) to prepare EIS published: September 2, 2004 (69 FR 53682).
DPEIS filed with EPA: September 12, 2008 (73 FR 53001)
DPEIS comment period ended: October 27, 2008
NOA of FPEIS published: (insert date; FR citation)
FPEIS wait period ends: (insert date)

Abstract

Demand for protein is increasing in the United States and commercial wild-capture fisheries will not likely be adequate to meet this growing demand. Aquaculture is one method to meet current and future demands for seafood. The Gulf of Mexico Fishery Management Council (Council) has authority to regulate fishing in federal waters, including aquaculture. Currently, NOAA Fisheries Service requires an exempted fishing permit to conduct aquaculture in federal waters. This permit is of limited duration and is not intended for commercial production of fish, making aquaculture in federal waters not viable under the current permitting process.

The purpose of this Aquaculture Fishery Management Plan (FMP) is to maximize benefits to the Nation by establishing a regional permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf of Mexico. The Council initiated this action to provide a programmatic approach to evaluating the impacts of aquaculture proposals in the Gulf of Mexico and a comprehensive framework for regulating such activities. The FMP and associated Programmatic Environmental Impact Statement (PEIS) are intended to streamline the regulatory process for authorizing current and future offshore aquaculture proposals by providing the Council and NOAA Fisheries Service the information required to review, authorize, and monitor offshore aquaculture operations. The primary goal of the proposed aquaculture permitting program is to increase the maximum sustainable yield and optimum yield of federal fisheries in the Gulf of Mexico by supplementing the harvest of wild caught species with cultured product. Other objectives for this FMP are summarized in Section 3.0.

Table of Contents for PEIS

Please note this fishery action is presented as an integrated document. It addresses different applicable laws including the National Environmental Policy Act. Therefore, the document does not follow a standard EIS format; however, elements of the PEIS are presented and identified in the following table of contents for the PEIS. The Aquaculture FMP contains 10 actions with a total of 28 alternatives. The amount of analysis required to evaluate these alternatives is thus very extensive, causing the PEIS to exceed 150 pages.

The table of contents and sections comprising the PEIS are as follows:

1.0 Executive Summary

Demand for protein is increasing in the United States. Today imports account for 84 percent of the U.S. seafood consumption, up from 63 percent a decade ago (NMFS 2008). As demand for seafood as protein continues to increase many commercial wild-capture fisheries are being fished at or above sustainable levels and are likely unable to meet such growing demand. Aquaculture of commercially and recreationally important species has been suggested as one method to meet the current and future demands for seafood; however, to date, most of these operations have been concentrated in nearshore environments.

Under the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), the Gulf of Mexico Fishery Management Council (Council) has authority to regulate fisheries in federal waters, including aquaculture. Currently, NOAA Fisheries Service requires an exempted fishing permit (EFP) to conduct aquaculture in federal waters. This permit is of limited duration and is not intended for commercial production of fish and shellfish, making aquaculture in federal waters not viable under the current permitting process.

The purpose of this fishery management plan (FMP) is to develop a regional permitting process for regulating and promoting environmentally sound and economically sustainable aquaculture in the Gulf of Mexico (Gulf) exclusive economic zone (EEZ). If this FMP is approved and implemented, an estimated 5 to 20 offshore aquaculture operations would be permitted in the Gulf over the next 10 years, with an estimated annual production of up to 64 million pounds. Establishing such a process requires the Council to develop a FMP for aquaculture. This FMP, including the Programmatic Environmental Impact Statement (PEIS), would serve as the basis for evaluating the effects of issuing permits to Gulf aquaculture operations. Effects falling outside the scope of the actions proposed herein would be further analyzed through additional National Environmental Policy Act (NEPA) analyses conducted by the Council and NOAA Fisheries Service.

This FMP considers ten actions, each with an associated range of management alternatives, for establishing a regional permitting process in the Gulf. The full range of alternatives considered in this FMP is described in Section 4.0. A detailed discussion of the environmental consequences associated with each action and alternative is provided in Section 6. The proposed measures and actions in this FMP are all intended to assist the Council and NOAA Fisheries Service in achieving the purpose of this FMP, which is to maximize benefits to the Nation via establishing a regional permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf. By establishing a regional permitting process for aquaculture, the Council will be positioned to achieve their primary goal of increasing maximum sustainable yield (MSY) and optimum yield (OY) of federal fisheries in the Gulf by supplementing harvest of wild caught species with cultured product. Other objectives of this FMP are described in Section 3.0.

The actions and management alternatives considered by the Council are listed in Table 1 and are summarized as follows:

Action 1: Aquaculture Permit Requirements, Eligibility, and Transferability – This action considers establishing a permit(s) for conducting aquaculture in federal waters of the Gulf EEZ. Offshore aquaculture in the Gulf EEZ means all activities, including the operation of an offshore aquaculture facility, involved in the propagation and rearing of allowable aquaculture species. The Council's preferred alternative (**Preferred Alternative 2**) requires a NOAA Fisheries Service Gulf Aquaculture Permit to authorize a person to deploy or operate an offshore aquaculture facility and sell allowable aquaculture species cultured at such a facility. Persons issued a Gulf Aquaculture Permit would also be authorized to harvest, or designate hatchery personnel or other entities to harvest and retain wild live broodstock of an allowable aquaculture species that is native to the Gulf of Mexico, and possess or transport fish or invertebrates in or from the Gulf EEZ to be cultured at an aquaculture facility. The Regional Administrator (RA) would review each completed Gulf Aquaculture Permit application and make a preliminary determination regarding whether the application warrants further consideration. If the RA determines that an application warrants further consideration, notification of the application will be published in the *Federal Register* with a brief description of the proposal, and the intent of NOAA Fisheries Service to issue a Gulf Aquaculture Permit. There will be a 15- to 45- day comment period and an opportunity for public testimony at a Council meeting. The RA may consult with the Council on the permit application and the applicant would be provided an opportunity to appear in support of the application at a Council meeting. After public comment ends, the RA shall notify the applicant in writing of the decision to grant or deny the Gulf Aquaculture Permit, and, if denied, the reasons for the denial. The RA will publish a notice of approval or disapproval in the *Federal Register*.

Additionally, **Preferred Alternative 2** would limit eligibility for a Gulf Aquaculture Permit to U.S. citizens or permanent resident aliens. **Preferred Alternative 2** would also allow transfer of permits only if the geographic location of the aquaculture site remains unchanged, require a dealer permit for receiving cultured organisms, prohibit landing of cultured species at all non-U.S. ports, and require any vessel, aircraft, or vehicle authorized for use in aquaculture operations to have a copy of the Gulf Aquaculture Permit onboard.

Other alternatives considered by the Council included maintaining the requirement for an EFP (**Alternative 1**) or requiring separate NOAA Fisheries Service operational and siting permits (**Alternative 3**). Commercial aquaculture under the current EFP process is not viable, while requiring a separate siting permit would be partially duplicative of other federal permitting requirements already in place (e.g., Army Corps of Engineers (ACOE) siting permits). **Preferred Alternative 2** would still provide NOAA Fisheries Service the authority to evaluate various siting criteria when deciding whether or not to issue an operational permit. Proposed criteria are summarized in Action 6 (Marine Aquaculture Siting Requirements and Conditions). In order to receive and maintain such a permit, conditions proposed in Actions 2 (Application Requirements, Operational Requirements, and Restrictions), 3 (Permit Duration), and 8 (Recordkeeping and Reporting) would also have to be met. **Alternative 1** would prohibit the development and implementation of commercial offshore aquaculture operations in the Gulf and therefore would result in no added impacts to the physical, biological, and ecological environments. **Preferred Alternative 2** and **Alternative 3** would create a regulatory permitting process and therefore would indirectly effect the physical, biological, and ecological environments by allowing for the development and long-term operations of an aquaculture industry. Impacts to the physical and biological environments would depend on numerous factors, including, but not limited to where a facility is sited, the potential for fish escapement, species allowed for aquaculture, and the business practices of operations. Preferred alternatives selected in other Actions within this FMP are intended to mitigate or prevent impacts to wild Gulf resources resulting from the permitting and implementation of marine aquaculture operations in the Gulf EEZ. Such measures include: numerous operational, reporting, and recordkeeping requirements (Actions 2 and 8); a requirement to use only species that are native to the Gulf and managed by the Council (except shrimp and corals) (Action 4); case-by-case review of allowable marine aquaculture systems (Action 5); and, siting criteria that prohibits facilities from being located in specific areas (Action 6). **Preferred Alternative 2** and **Alternative 3** would allow for commercial offshore aquaculture production in the Gulf EEZ, which could substantially increase domestic production of seafood, lower the seafood trade deficit, and increase national income and welfare. However, these two alternatives could have adverse economic and social impacts on Gulf fishermen, their families, and communities depending on the alternatives selected for the subsequent actions included in this FMP (Actions 2-10) that would additionally regulate offshore aquaculture production practices.

Action 2: Application Requirements, Operational Requirements, and Restrictions – This action proposes application and operational requirements and restrictions that would have to be met to receive a permit and operate an aquaculture facility in the Gulf of Mexico EEZ. The Council's preferred alternative (**Preferred Alternative 3**) would require the owner of an aquaculture firm to submit an application for a Gulf Aquaculture Permit at least 180 days prior to the date the applicant desires the permit to be effective. **Preferred Alternative 3** would also require applicants to submit information to NOAA Fisheries Service when applying for a permit. This would include contact information, description of the exact location of the proposed facility and site, a list of species to be cultured, estimated start up production level by species, estimated maximum total annual poundage of each species to be harvested, hatchery information, copies of other federal permits, a description of proposed aquaculture systems and equipment, documentation for vessels and aircraft, an assurance bond to cover the costs of removal of all components of the facility, certification that broodstock used to provide juveniles are from the U.S. waters of the Gulf of Mexico and from the same population where the aquaculture facility is located, certification that no genetically modified organisms or transgenic animals are used or possessed at the aquaculture facility, certification that a contractual arrangement with an aquatic animal health expert has been established, an emergency disaster plan, and other information necessary for issuance and administration of a permit. Additionally, **Preferred Alternative 3** would specify a use it or lose it provision for permits; require documentation from hatcheries that broodstock are marked or tagged; require a health certificate of inspection prior to stocking of fingerlings, require that locating devices be maintained on allowable aquaculture systems; require permittees to monitor feed usage; require permittees to report interactions/entanglements with protected resources and migratory birds; require permittees to comply with monitoring, drug, pesticide, and biologic regulations from other federal agencies; require that cultured finfish be maintained with head and fins intact and spiny lobster be landed whole; prohibit possession of wild fish, except when harvesting broodstock; and allow NOAA Fisheries Service employees access to facilities.

All of these conditions would have to be met in order to issue a Gulf Aquaculture Permit or operate an aquaculture facility in the Gulf EEZ. The assurance bond would require that the owners of an aquaculture operation remove all components of an aquaculture facility, including cultured species, as a condition of the permit; thereby diminishing long-term impacts that could result from structures and cultured organisms remaining in the environment. Certification that native, pathogen free, non-transgenic and non-genetically modified organisms would be used for aquaculture would minimize risks to wild stocks in the event that escapement occurs. The "use it or lose it" provision would require that permit holders begin operation of a facility within two years of permit issuance and stock allowable species within three years, thus discouraging speculative entry. Other requirements of **Preferred Alternative 3** include information to be used for enforcement, monitoring, and permit administration. **Preferred Alternative 3** would result in the greatest benefits to the biological and physical environments by providing necessary safeguards for authorizing, monitoring, and enforcing marine aquaculture. These safeguards would assist the Council, NOAA Fisheries Service, and other federal agencies in preventing, or minimizing to the extent practicable, impacts on water quality, benthic habitat, and wild fish stocks. **Preferred Alternative 3** would result in the greatest administrative costs to NOAA Fisheries Service and economic costs to offshore aquaculture operations of the three alternatives considered. However, these costs are expected to reduce the risk of substantially larger administrative, economic, and social costs that could result from physical, biological, economic, and social damages created by commercial offshore aquaculture operations.

Action 3: Permit Duration – This action proposes permit durations ranging from one year (EFP permit) (**Alternative 1**) to indefinitely (**Alternative 2(d)**). The Council's preferred alternative (**Preferred Alternative 2(b)**) would allow permits to be effective for 10 years, with renewals every five years thereafter. Ten years is believed to strike the best balance between providing adequate time to establish operations and funding, while not granting excessively long permit duration. Permit duration will not have any direct effects on the physical, biological, or ecological environments, but will indirectly effect those environments. Regardless of the length of the permit, NOAA Fisheries Service and other federal agencies would regularly review operations for compliance with governing regulations (Actions 2 and 8). This will ensure that aquaculture facilities are operating properly and that these facilities are not causing unacceptable impacts to the biological or ecological environments. Each Gulf Aquaculture Permit would remain valid for the period of time indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulations. All of the alternatives may displace Gulf fishermen from certain historical fishing areas, which may result in economic and social costs to fishermen, their families, and communities. While **Alternatives 1** and **2(d)** may displace fishermen from particular areas indefinitely, **Alternatives 2(a)** and **2(c)** would limit displacement for 5 and 20 years, respectively. Of the options that limit the duration of a permit, only

Preferred Alternative 2(b) would allow the permit to be renewed, which would explicitly allow the development of long-term commercial offshore aquaculture operations and the economic and social benefits that may be derived from those operations.

Action 4: Species Allowed for Aquaculture and Included in the Aquaculture Fishery Management Unit – This action considers species that would be allowed for aquaculture and included in the Council's Aquaculture Fishery Management Unit. The Council's preferred alternative (**Preferred Alternative 4**) would allow the aquaculture of all Council managed species, except corals and shrimp. Only species native to the Gulf would be allowed for culture. The Council would also request that NOAA Fisheries Service develop concurrent rulemaking to allow aquaculture of highly migratory species (HMS). There is some evidence of the detrimental effects of non-native species on ecosystems. By allowing only native, non-genetically modified and non-transgenic species (Action 2, Preferred Alternative 3(a)(2)(xii)) for culture, the potential for negative impacts on the biological, physical, and ecological environments will be eliminated or significantly reduced in the event that escapement occurs. Other alternatives considered by the Council included not specifying allowable species for aquaculture (**Alternative 1**), only allowing Council managed native finfish to be cultured (**Alternative 2**), and allowing all species managed by the Council, except shrimp, corals, and goliath and Nassau grouper (**Alternative 3**). Under all the alternatives in Action 4, the culture of live rock would continue to be regulated by management measures approved in Amendments 2 and 3 to the Coral and Coral Reef FMP. **Preferred Alternative 4**, **Alternative 2,** and **Alternative 3** would restrict the number of species allowed to be cultured in the Gulf EEZ. These alternatives would reduce the potential adverse economic and social impacts caused by the culture of potentially unlimited species unlike **Alternative 1**. **Preferred Alternative 4** would allow for the largest number of native Gulf species that can be cultured in offshore aquaculture and may yield the largest economic and social benefits. However, among the non-status quo alternatives, **Preferred Alternative 4** may cause the largest economic and social costs to fishermen, their families, and communities by putting them in direct competition with offshore aquaculture operations.

Action 5: Allowable Marine Aquaculture Systems – This action specifies the types of aquaculture systems that would be allowed for culture. The Council's preferred alternative (**Preferred Alternative 3**) would provide NOAA Fisheries Service authority to evaluate each proposed aquaculture system on a case-by-case basis. Proposed systems would be evaluated based on potential risks to essential fish habitat (EFH), endangered and threatened species, wild fish stocks, and public health and safety. Applicants would be required to submit documentation, such as computer and oceanographic model results, sufficient to evaluate the ability of an aquaculture system to withstand physical stresses associated with major storm events. The RA could approve or deny a proposed system, or specify conditions for its use. Other alternatives considered include: not specifying allowable systems (**Alternative 1**), and allowing only cages and net pens (**Alternative 2**). Unlike **Alternative 2**, **Preferred Alternative 3** would allow for new aquaculture systems to be used as they are developed and provide aquaculture operations with the greatest amount of flexibility when selecting systems for culture of a wide-array of species. **Preferred Alternative 3** would also provide for the most rigorous review of proposed aquaculture systems by NOAA Fisheries Service. For these reasons, **Preferred**

Alternative 3 would provide the greatest benefits to the physical and biological environments. However, since aquaculture grow-out systems would be reviewed on a case-by-case basis, the preferred alternative would also be a greater burden on NOAA Fisheries Service RA and staff. Both **Alternative 2** and **Preferred Alternative 3** would limit the potential adverse economic and social impacts associated with environmental damages caused by use of grow-out systems. **Preferred Alternative 3** has the potential to generate greater economic benefits to offshore aquaculture operations than **Alternative 2** because it would allow for a larger variation of grow-out systems.

Action 6: Marine Aquaculture Siting Requirements and Conditions – This action proposes designating sites or areas for marine aquaculture. Proper siting of an aquaculture facility is critical to both an operation's success and the protection of the surrounding physical, biological, and ecological environments. If a facility is not properly sited, there is potential for significant environmental impacts to occur. These could range from habitat degradation of surrounding benthos to changes in water characteristics (e.g., low dissolved oxygen or increased nutrients). To prevent impacts to the biological and physical environments, Action 6 proposes either developing pre-authorized areas for marine aquaculture (**Alternative 2**) or developing siting criteria for facilities (**Preferred Alternative 3**). The Council also considered not specifying criteria or designating areas where aquaculture may occur (**Alternative 1**). NOAA Fisheries Service would continue to comment on permits issued by the ACOE. **Alternative 2** would establish 13 aquaculture zones throughout the Gulf, encompassing approximately 5 percent of the total Gulf EEZ. These zones would allow for more rapid approval of siting locations, but additional site-specific data within a zone may be necessary to determine the suitability of a particular site. The Council's preferred alternative (**Preferred Alternative 3**) would prohibit marine aquaculture in Gulf EEZ marine protected areas and marine reserves, Habitat Areas of Particular Concern, Special Management Zones, permitted artificial reef areas, and coral areas as specified in 50 CFR 622. **Preferred Alternative 3** would also require facilities to be sited at least 1.6 nautical miles (nm) from another facility. The permitted site would also have to be twice as large as the total area encompassed by allowable aquaculture systems to allow for fallowing and rotation of systems. Permit applicants would also have to conduct a baseline assessment of the site and routine monitoring of water characteristics and sediment as specified by NOAA Fisheries Service procedures and guidelines. Lastly, NOAA Fisheries Service would be provided authority to conduct case-by-case reviews of sites based on additional criteria, such as depth and current speeds. The intent of this alternative is to determine siting locations that minimize or eliminate the potential for environmental impacts. The benefits to the biological and physical environments are expected to be greater than **Alternative 1** and **2**. **Alternative 2** would provide the least flexibility to aquaculture firms when siting a facility, while **Alternatives 1** would provide the most. **Preferred Alternative 3** would allow for rigorous case-by-case review of a proposed site by NOAA Fisheries Service. **Preferred Alternative 3** and **Alternative 2** would restrict the zones of offshore aquaculture operations which could reduce the economic and social costs associated with environmental damages and displacement of fishermen. **Preferred Alternative 3** would offer potentially greater flexibility of sites to offshore aquaculture operations than **Alternative 2.** This may generate greater economic and social benefits derived from offshore aquaculture production than **Alternative 2**.

Action 7: Establish Restricted Access Zones for Marine Aquaculture Facilities – This action proposes establishing restricted access zones around marine aquaculture facilities. **Alternative 1** would not restrict access around a marine aquaculture facility. **Preferred Alternative 2** and **Alternative 3** would restrict access around a marine aquaculture facility. Fishing and transit in or through restricted access zones by fishing vessels would be prohibited, unless the vessel had a copy of the facility's aquaculture permit with an original signature from the permit holder. The size of the restricted access zone for **Preferred Alternative 2** would correspond to the coordinates on the approved ACOE permit and must be marked with a floatation device such as a buoy at each corner of the zone. Each floatation device must clearly display the aquaculture facility's permit number and the words "RESTRICTED ACCESS" in block letters at least 6 inches in height and in a color that contrasts to the float or buoy. For **Alternative 3**, access would be restricted within 100, 500, or 1,640 feet of allowable aquaculture systems. The Council does have authority to create restricted access zones that exclude fishing or fishing vessels. Restricting access around a facility may directly affect the physical, biological, and ecological environment by protecting species known to aggregate around structure. Aquaculture facilities have been shown to act as aggregation sites for many wild species. Also, preventing access around a facility will reduce the likelihood of damage to a facility, particularly the cages and net pens, thereby reducing any potential impacts associated with fish escapement. Overall, **Preferred Alternative 2** and **Alternative 3** would provide greater benefits to the physical, biological, and social environments when compared to **Alternative 1**. Siting requirements in Action 6 require NOAA Fisheries Service to evaluate the location of a site relative to important commercial and recreational fishing grounds. **Preferred Alternative 2** and **Alternative 3** would reduce the risk of damages and associated economic costs caused by fishing vessels operating or transiting near aquaculture facilities. **Preferred Alternative 2** and **Alternative 3** may create economic and social costs caused by the displacement of fishing vessels. These two alternatives may also reduce the potential economic benefits derived from improved fishing near aquaculture sites should those sites serve as fish attractants. Of the non-status quo alternatives, only **Preferred Alternative 2** would require offshore aquaculture operations to incur the costs of marking its boundaries and maintaining these markers.

Action 8: Recordkeeping and Reporting – This action proposes recordkeeping and reporting requirements for aquaculture operations. As mentioned in the discussion for Actions 1 and 3 above, these requirements would be part of the conditions for maintaining an aquaculture permit and would allow NOAA Fisheries Service to evaluate the impacts of a marine aquaculture operation. The Council's preferred alternative (**Preferred Alternative 2**) includes numerous recordkeeping and reporting requirements. Requirements would include providing NOAA Fisheries Service current valid copies of state and federal permits and notifying NOAA Fisheries Service by phone or electronic web-based form within 24 hours of discovering a major escapement, pathogen outbreak, or entanglement(s) or interaction(s) with marine mammals and protected resources, as well as any change regarding hatcheries used for providing fingerlings or juvenile organisms. The intent of these requirements is to minimize or prevent impacts to wild stocks, habitat, and other biological resources. Other recordkeeping and reporting requirements include notifying NOAA Fisheries Service: when fingerlings or juveniles will be transported from a hatchery to an aquaculture facility; the estimated amount in pounds (whole weight) of species of fish to be harvested; the port of landing for any vessel with cultured organisms harvested from an aquaculture facility; as well as the applicable bill of lading through the first point of sale. The intent of these requirements is to aid enforcement. The Council also considered another alternative (**Alternative 1**) that would allow the RA to specify recordkeeping and reporting requirements as specified in EFP regulations. **Preferred Alternative 2** requires a more comprehensive list of recordkeeping and reporting requirements than **Alternative 1**, and therefore would be more beneficial to the physical and biological environments. Recordkeeping and reporting is an administrative function and would directly affect the administrative environment. Applicants would incur costs associated with preparing reports and maintaining records and the burden on NOAA Fisheries Service and staff would be increased to review records and reports for compliance with permit conditions. However, these costs are outweighed by the environmental safeguards afforded to the physical and biological environments. **Preferred Alternative 2** would reduce the potential environmental damages and associated economic and social costs of **Alternative 1** by requiring offshore aquaculture operations to incur recordkeeping and reporting costs.

Action 9: Biological Reference Points and Status Determination Criteria – The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) was written in part to establish the legal framework for managing wild fisheries resources of the United States. Many of the principles and concepts that guide wild stock management under the MSFCMA are either of little utility or are not generally applicable to the management of offshore aquaculture. Despite this lack of conceptual similarity, offshore aquaculture falls within the realm of activities subject to regulatory control under the MSFCMA, and therefore must meet the MSFCMA legal requirements, until additional legal authority specifically suited for management of offshore aquaculture is established. One such legal requirement is establishment of biological reference points (maximum sustainable yield (MSY), optimum yield (OY)) and status determination criteria (minimum stock size threshold (MSST), maximum fishing mortality threshold (MFMT)). **Alternative 1** would not establish biological reference points and status determination criteria specific to aquaculture in the Gulf. This alternative would not satisfy MSFCMA legal requirements to establish such criteria and reference points. **Preferred Alternative 2** would establish biological reference points and status determination. MSY would be set equivalent to the total annual production capacity of all aquaculture operations in the Gulf EEZ, or 16, 32, 36, 64, or 190 million pounds (mp). The Council's preferred alternative is to set MSY equal to 64 mp. Optimum yield would be specified as the total yield harvested by all permitted aquaculture operations annually, but could not exceed 16, 32, 36, 64, or 190 mp annually. The Council's preferred value for OY is 64 mp. This OY proxy is likely substantially less than the yield that can be achieved by aquaculture operations over the long-term, allowing the Council to take a more precautionary approach to management while the aquaculture industry develops and more information about production becomes known for offshore aquaculture. If planned production happens to meet or exceed the OY specified by the Council, then the Council would initiate review of the aquaculture program and OY proxy, and NOAA Fisheries Service would publish a control date, after which entry into the industry may be limited or restricted. **Preferred Alternative 2** also specifies that definitions for overfished and overfishing status used for wild stocks, which would be used as proxies to assess the effects of aquaculture production on these stocks. Additionally, **Preferred Alternative 2**

would cap production by individuals, corporations, or other entities at 5, 10, or 20 percent of OY. This provision is necessary to ensure entities do not obtain an excessive share of the allowable yield. The Council's preferred alternative would cap production at 20 percent of OY for any individual, corporation, or other entity. Overfished and overfishing definitions contained in the various FMPs to manage wild stocks will be used as proxies for assessing the status of wild stocks potentially affected by excessive aquaculture facility production. **Preferred Alternative 2** is preferable because it specifies status criteria and biological reference points, and it establishes conservative levels of production until more is known about the impacts of aquaculture in the Gulf. **Preferred Alternative 2** would limit both the quantity of cultured fish and shellfish that can be produced by the offshore aquaculture operations. The intent of the **Preferred Alternative 2** is to reduce the risk and magnitude of adverse economic and social impacts to fishermen, their families, and fishing communities, which could be caused by direct competition and the competitive advantages of offshore aquaculture operations.

Action 10: Framework Procedures – This action includes three alternatives. **Alternative 1** would not specify framework procedures, while **Alternative 2** and **Preferred Alternative 3** would specify framework procedures. Both **Alternative 2** and **Preferred Alternative 3** would rely on an Aquaculture Advisory Panel (AP) that would meet bi-annually to provide recommendations to the Council. The authority of the AP would be much more limited under **Alternative 2**; they could only recommend changes to MSY and OY. Under **Preferred Alternative 3**, the AP would have broader authority, which would include recommending changes to: MSY and OY; application and operating requirements; recordkeeping and reporting requirements; siting requirements; and allowable aquaculture system requirements.

Under **Alternative 2**, if the Council supported the AP's recommendations, it could then submit the recommendations to the RA for further consideration. The RA would have the authority to approve or deny the proposed changes to MSY and OY. If the RA approved the changes, then the changes would be published in the *Federal Register*. **Preferred Alternative 3** is similar to **Alternative 2**, except the Council would need to develop a regulatory amendment for proposed regulatory changes recommended by the Panel. The framework procedures described in **Alternative 2** and **Preferred Alternative 3** are both intended to allow more timely implementation of regulatory measures necessary to prevent or mitigate impacts to the physical, biological, and administrative environments. For both **Alternative 2** and **Preferred Alternative 3**, several opportunities for public comment and input would be available before any proposed changes to regulatory measures would be approved. **Preferred Alternative 3** and **Alternative 2** would be expected to reduce the economic and social costs that would otherwise derive from an undermanaged fishery (**Alternative 1**). Of the non-status quo alternatives, **Preferred Alternative 3** could generate the largest long-term economic and social benefits to aquaculture operations, fishermen, their families, communities, and others who benefit from the use and conservation of marine resources.

Table 1. Summarized actions and alternatives considered by the Council in the Aquaculture FMP.

Action 1: Aquaculture Permits Requirements, Eligibility, and Transferability	
Alternative 1	No Action: an exempted fishing permit for conducting aquaculture is required.
Alternative 2 (Preferred)	Require an aquaculture permit for conducting offshore marine aquaculture. The permit would authorize: deployment and operation of an offshore aquaculture facility and sale of allowable aquaculture species. Persons issued an aquaculture permit would also be authorized to harvest or designate hatchery personnel or other entities to harvest broodstock, and possess or transport fish and invertebrates to and from an offshore aquaculture facility. Dealer permits are required to receive cultured organisms and are non-transferrable. Aquaculture permits are transferable (except under limited conditions) and eligibility is limited to U.S. citizens and permanent resident aliens. Landing of cultured species at non-U.S. ports would be prohibited, unless first landed at a U.S. port. Any vessel, aircraft, or vehicle authorized for use in aquaculture operations must have a copy of the facility's aquaculture permit onboard.
Alternative 3	Require separate siting and operating permits for conducting offshore marine aquaculture. Eligibility for permits is limited to U.S. citizens and permanent resident aliens. Permits would be transferable, except under limited conditions.

Action 2: Application Requirements, Operational Requirements, and Restrictions	
Alternative 1	Do not specify application or operational requirements or restrictions.
Alternative 2	Require exempted fishing permit application and issuance requirements as specified at 50 CFR 600.745(b).
Alternative 3 (Preferred)	Establish application requirements, operational requirements, and restrictions for aquaculture permits. Application requirements include submission of an application, providing general contact information, descriptions of allowable aquaculture systems and equipment, providing site location coordinates, documentation of an assurance bond, an emergency disaster plan, a contractual arrangement with an aquatic animal health expert, certification that broodstock used for juveniles were harvested from waters of the U.S. Gulf, and certification that no genetically modified or transgenic species will be used for culture. Operational requirements would include: a use it or lose it provision, documentation that broodstock are marked or tagged at the hatchery, certification that cultured animals are pathogen free prior to stocking, gear stowage requirements, and various monitoring requirements. Requirements also include the use of drugs, biologics, and pesticides in compliance with regulations of other federal agencies, and maintenance of one locating device on each allowable aquaculture system used for grow-out.

Action 3: Duration of the Permit	
Alternative 1	No Action: an exempted fishing permit is effective for no longer than 1-year unless otherwise specified in the permit or a superseding notice or regulation
Alternative 2 (Preferred)	An aquaculture permit(s) is effective for: a) 5 years, b) 10 years and may be renewed in 5-year increments (Preferred), c) 20 years, or d) indefinitely.

Action 4: Species allowed for Aquaculture and Included in Fishery Management Unit (FMU)	
Alternative 1	No Action: do not specify species allowed for aquaculture and do not develop an Aquaculture FMU.
Alternative 2	Allow aquaculture of all finfish native to the Gulf in the reef fish, red drum, and coastal migratory pelagics FMPs and include these species in the Aquaculture FMU.
Alternative 3	Allow aquaculture of all species native to the Gulf that are managed by the Council, except goliath and Nassau grouper, shrimp, and corals, and include these species in the Aquaculture FMU.
Alternative 4 (Preferred)	Allow the aquaculture of all species native to the Gulf managed by the Council, except shrimp and corals, and include those species in the Aquaculture FMU. The Council will request NOAA Fisheries Service develop concurrent rulemaking to allow aquaculture of highly migratory species.

Action 5: Allowable Marine Aquaculture Systems	
Alternative 1	No Action: do not specify allowable systems for growing cultured organisms in the Gulf EEZ.
Alternative 2	Allow only cages and net pens for aquaculture in the Gulf EEZ.
Alternative 3 (Preferred)	Evaluate each proposed aquaculture system used for culturing organisms on a case-by-case basis. Applicants must submit documentation sufficient to evaluate a system's ability to withstand physical stresses associated with storm events. NOAA Fisheries Service may deny use of a proposed system or specify conditions for its use if it poses potential risks to essential fish habitat, endangered and threatened species, marine mammals, wild fish and invertebrate stocks, public health, or safety.

Action 6: Marine Aquaculture Siting Requirements and Conditions	
Alternative 1	No Action: do not designate areas in the Gulf EEZ where offshore aquaculture would be allowed. NOAA Fisheries Service and the Council would continue to comment on ACOE siting permits.
Alternative 2	Establish 13 marine aquaculture zones throughout the Gulf EEZ, within which individual sites would be permitted (Figure 4.6.1).
Alternative 3 (Preferred)	Prohibit marine aquaculture in Gulf EEZ marine protected areas and marine reserves, HAPCs, SMZs, permitted artificial reef areas, and coral reef areas. No aquaculture facility may be sited within 1.6 nm of another facility. Permitted sites must be 2X as large as the area encompassed by the allowable aquaculture systems used for growing organisms to allow for fallowing and rotation of growout systems. Applicants must conduct a baseline assessment and monitoring at the site in accordance with NOAA Fisheries Service guidance and procedures. Additionally, NOAA Fisheries Service will review other siting criteria on a case-by-case basis. These criteria include, but are not limited to: the depth of the site, current speeds and benthic sediments, the frequency of harmful algal blooms or hypoxia at the proposed site, marine mammal migratory pathways, and the location of the proposed site relative to important fishing grounds and habitats.

Action 7: Restricted Access Zones for Marine Aquaculture Facilities	
Alternative 1	No Action: do not establish restricted access zones around marine aquaculture facilities.
Alternative 2 (Preferred)	Create a restricted access zone for each aquaculture facility. The size of the restricted access zone would correspond with the coordinates on the approved ACOE siting permit. No fishing may occur in the restricted access zone and no fishing vessels may operate in or transit through the zone unless they have a copy of the facilities' aquaculture permit onboard. The restricted access zone must be marked at each corner with a floating device, such as a buoy.
Alternative 3	Prohibit fishing and the operation and transit of federally permitted fishing vessels within: a) 100 feet, b) 500 feet, or c) 1,640 feet of allowable marine aquaculture systems used for growing cultured organisms.

Action 8: Recordkeeping and Reporting Requirements	
Alternative 1	No Action: the NOAA Fisheries Service RA has authority to specify recordkeeping and reporting requirements in an EFP.
Alternative 2 (Preferred)	Establish 17 recordkeeping and reporting requirements that address escapement, entanglements and interactions with marine species and migratory birds, pathogens and disease, broodstock harvest, and numerous law enforcement requirements. An electronic reporting process would be used to collect and monitor most data and information submitted by permittees. See Section 4.8 for a detailed list of these recordkeeping and reporting requirements.

Action 9: Biological Reference Points and Status Determination Criteria	
Alternative 1	No Action: do not establish biological reference points or status determination criteria specific to aquaculture in the Gulf EEZ.
Alternative 2 (Preferred)	The proxy for maximum sustainable yield is: a) the total yield harvested by all aquaculture operations in a given year, b) 16 million pounds whole weight (mp ww), c) 32 mp ww, d) 36 mp ww, e) 64 mp ww (Preferred), or f) 190 mp ww. The proxy for optimum yield is the total yield harvested by all permitted aquaculture operations annually, but not to exceed: a) 16 mp ww, b) 32 mp ww, c) 36 mp ww, d) 64 mp ww (Preferred), or e) 190 mp ww. No individual corporation or other entity can produce more than: a) 5 percent, b) 10 percent, or c) 20 percent (Preferred) of optimum yield. If planned production exceeds optimum yield, NOAA Fisheries Service would publish a control date after which entry in to the aquaculture fishery may be limited or restricted. Production of juvenile fish by a hatchery in the Gulf EEZ will not be counted toward optimum yield or the 20 percent production restriction. Overfishing and overfished definitions contained in the various FMPs to manage wild stocks will be used as proxies for assessing the status of wild stocks potentially affected by excessive aquaculture production.

Action 10: Framework Procedures	
Alternative 1	No Action: do not specify framework procedures for modifying aquaculture management measures, status determination criteria, or biological reference points.
Alternative 2	Specify framework procedures for modifying biological reference points (i.e., maximum sustainable yield and optimum yield) for offshore marine aquaculture in the Gulf EEZ.
Alternative 3 (Preferred)	Specify framework procedures for modifying biological reference points and management measures for offshore marine aquaculture in the Gulf EEZ. Measures that could be adjusted through framework procedures include: a) adjustments to maximum sustainable yield and optimum yield, b) permit application requirements, c) aquaculture operational requirements and restrictions, d) requirements for allowable aquaculture systems used for growing cultured organisms, e) siting requirements, and f) recordkeeping and reporting requirements.

Areas of Controversy

Development of a regulatory framework for aquaculture has been controversial. Controversy has stemmed from several factors including, but not limited to:

- Concerns about potential impacts to the environment (e.g., water quality, habitat degradation, etc.) and wild fish stocks (e.g., genetic modification, competition, entanglement, etc.);

- Competing interests between fishermen, fishing communities, and aquaculture operations;
- The exclusive use of public resources for private profit;
- Multiple federal agencies having authority to regulate various aspects of offshore marine aquaculture; and,
- Whether or not NOAA Fisheries Service has legal authority to regulate aquaculture.

Section 6.1 discusses each of these potential impacts and environmental consequences in greater detail and Section 6.16 discusses several unavoidable adverse effects that may result from the proposed actions. The proposed actions and preferred alternatives in this FMP are intended to minimize, to the extent practicable, impacts to the physical, biological, social, and economic environments. Measures to mitigate the impacts mentioned above, which are often the major causes of controversy, are discussed in Section 6.14. These include the exclusive use of non-genetically modified, non-transgenic, native species from the Gulf (Actions 2 and 4) for aquaculture, extensive permitting, siting, recordkeeping, and monitoring requirements (Actions 2, 6, and 8), and the use of reliable offshore aquaculture systems that would be approved on a case-by-case basis (Action 5). Implementation of the Council's Aquaculture FMP will require NOAA Fisheries Service to closely coordinate with other federal agencies, such as the ACOE and EPA, when approving, monitoring, and reviewing offshore aquaculture operations.

2.0 Introduction

2.1 Background

Worldwide demand for protein is increasing and fisheries production will not be adequate to supply the needs of the world's population without supplementation through aquaculture (NOAA 1998). In the United States, nearly 80 percent of all seafood consumed is currently imported from other countries, creating a 9.2 billion dollar trade deficit (NOAA 2008). It is estimated by 2025, two million more metric tons of seafood will be needed over and above what is consumed today (NOAA 2004). Commercial wild-capture fisheries will not likely be adequate to meet this growing demand considering commercial fishery production has remained stable or declined in recent decades, due to overfishing and increasingly stringent management restrictions (Tidwell and Allan 2001; NOAA 2004).

Aquaculture is one method to meet current and future demands for seafood. NOAA's Aquaculture Policy defines marine aquaculture as the propagation and rearing of aquatic animals in controlled or selected aquatic environments for any commercial, recreational, or public purpose. Marine aquaculture is analogous to terrestrial farming in many ways and involves animal husbandry such as maintaining broodstock, spawning broodstock, stocking, feeding, and maintenance of culture systems. Marine aquaculture includes coastal and offshore aquaculture operations as well as saltwater pond and tank systems. Offshore aquaculture refers to marine aquaculture operations located in the exposed open ocean environments. In the U.S., offshore or open ocean sites with deep water and open ocean conditions may be found in both state (e.g., Hawaii and Puerto Rico) and federal waters. Floating or submerged net-pens or cages are the most commonly used offshore aquaculture systems. Other aquaculture systems use arrays of cages, bags, or vertical and horizontal line matrices for culture of targeted species.

The Council has authority to regulate fisheries in the U.S. Gulf EEZ, which extends from state territorial waters to 200 miles offshore. Based on a legal opinion by NOAA General Counsel (GC), landings or possession of fish in the EEZ from commercial marine aquaculture production of species managed under fishery management plans (FMPs) constitutes "fishing" as defined in the MSFCMA [Sec. 3(16)]. Fishing includes activities and operations related to the taking, catching, or harvesting of fish. Any FMP prepared by the Council, or by the Secretary, must include provision specified in Sec 303(a) of the MSFCMA. Additionally, numerous discretionary provisions may be prescribed, including measures, requirements, or conditions and restrictions determined to be necessary and appropriate for the conservation and management of a fishery (Sec. 303(b)(14) of the MSFCMA). In order to allow commercial aquaculture production in the EEZ, the Council is developing an FMP to allow for such activity for managed species and for the regulation of the activity by NOAA Fisheries Service. Scientific activity for marine aquaculture in the EEZ is currently regulated by an EFP under 50 CFR 600.745 (Appendix A).

There has been interest in conducting offshore aquaculture in the Gulf in recent years. NOAA Fisheries Service issued one EFP in 1997 for an offshore aquaculture operation off of Texas and since that time has received several additional requests for EFPs. Additionally, the Sea Grant Gulf of Mexico Offshore Aquaculture Consortium (GOAC) was formed in 2000 to create a collaborative, Gulf-wide, university-based interdisciplinary research program to address social, environmental and technological issues associated with offshore aquaculture in the Gulf. This program was later terminated because of a lack of federal funding. In 2004, the state of Louisiana created the Platforms for Mariculture Task Force to assess the economic feasibility, environmental impact, and legal/regulatory considerations of utilizing offshore oil and gas platforms for culturing marine organisms in the Gulf. In January 2005, the Task Force completed a comprehensive report for the Louisiana legislature summarizing their findings and recommendations. Most recently, the Minerals Management Service (MMS) approved an Outer Continental Shelf Alternative Energy and Alternative Use PEIS (http://ocsenergy.anl.gov/documents/). This PEIS and implementing regulations would allow for alternative uses of oil and natural gas platforms, including aquaculture. A proposed rule for this action was published on July 9, 2008.

Despite the growing interest in offshore aquaculture in the Gulf, there is currently no regulatory framework to allow commercial aquaculture production in the EEZ of federally managed species. The existing regulatory process is complex and multiple permits must be obtained from several different federal agencies, including the Environmental Protection Agency (EPA), ACOE, and NOAA Fisheries Service, before a facility can begin operation. To date, all commercial finfish and shellfish aquaculture facilities in the U.S. have been sited in state territorial waters.

Other impediments to the development of an aquaculture industry are numerous (Cicin-Sain et al. 2001) and include, but are not limited to:

1. Potential environmental impacts associated with aquaculture;
2. Public opposition;
3. User conflicts;
4. Multiple federal agencies with regulatory authority;
5. Economic risks from storm damage;
6. Availability of investment capital; and,
7. Competition from foreign markets.

Participants at the Marine Aquaculture Summit in June 2007 cited complex and uncertain regulations, lack of a supporting research and development infrastructure, and lack of economic incentives as the three major constraints to expanding marine aquaculture in the U.S.

Aquaculture in general has received criticism due to past and potential environmental effects associated with aquaculture (Tiersch and Hargreaves 2002). Criticism stems from concerns about the escape of fish, the use of antibiotics, environmental impacts associated with excess feed and wastes, and the spread of disease (Goldburg and Triplett

1997; Naylor et al. 2000, 2001; Tidwell and Allan 2001; Borgatti and Buck 2004). Many of these concerns stem from previous practices in salmon, shrimp, catfish, and other forms of aquaculture. For example, vaccination has replaced use of antibiotics and proper siting and feed management has reduced or eliminated concern about wastes. However, open ocean offshore aquaculture may present advantages over that of inshore or terrestrial aquaculture. For example, offshore aquaculture facilities may allow for more efficient assimilation of wastes and feed in the open ocean environment (Borgatti and Buck 2004). Also, because facilities are located farther offshore, user conflicts may be diminished. Several research studies are currently underway or have been previously conducted in Hawaii, New Hampshire, California, and Puerto Rico to assess the environmental and economic impacts of open ocean aquaculture operations (Benetti et al. 2008).

The Gulf represents an opportune environment for the development of offshore aquaculture, with its broad continental shelf, numerous ports, and existing infrastructure of oil and gas platforms. Development and effective management of offshore aquaculture in the Gulf EEZ will require balancing the benefits of aquaculture such as economic development, expanded protein supplies, and environmental benefits with environmental and social concerns (DeVoe and Hodges 2002). Responsible marine aquaculture will require sound management, environmental safeguards, and continued research and technological development (Stickney and McVey 2002).

2.2 Management History

National Aquaculture Policy

In 1980, the National Aquaculture Act (NAA) was passed, which established a national aquaculture policy. The NAA "declares that aquaculture has the potential for augmenting existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the U.S. in meeting its future food needs and contributing to the solution of world resource problems. It is, therefore, in the national interest, and it is the national policy, to encourage the development of aquaculture in the United States."

The NAA required the Secretaries of Commerce, Interior, and Agriculture to prepare a National Aquaculture Development Plan (NADP) within 18 months of enactment. The NADP was to identify potential species for commercial aquaculture development, and to discuss public and private actions and research necessary to carry out the objectives of the Act. The Act also called for creation of the Joint Subcommittee on Aquaculture (JSA) in the Federal Coordinating Council on Science, Engineering, and Technology (Coordinating Council). The JSA's responsibility was to increase the productivity of federal aquaculture research, technology transfer, and economic assistance programs through study and assessment, coordination, planning, collection, and dissemination of information to the Coordinating Council.

The NAA provided an important statement of policy; however, it did not address continuing federal, state, and local barriers to domestic aquaculture. Those barriers were recognized in the NADP of 1984; however, because the administration's policy was that the primary responsibility for the development of commercial aquaculture rested with the private sector, there were no recommendations to increase federal funding.

In 1985, the NAA was reauthorized and two major amendments were enacted. First, the U.S. Department of Agriculture (USDA) was designated as the lead federal agency with respect to the coordination and dissemination of national aquaculture information. Second, two new studies were commissioned to be reported to Congress. The Secretary of Commerce (Secretary) was required to study and report to Congress whether existing capture fisheries could be adversely affected by competition from commercial aquaculture enterprises; and the Secretary of the Interior was required to study and report to Congress the extent and impacts of the introduction of exotic species into U.S. waters as a result of aquaculture activities.

In April 1988, Department of Commerce's (DOC) study was completed and presented in the report, Aquaculture and Capture Fisheries: Impacts in U.S. Seafood Markets. The report focused exclusively on the effects of farm raised shrimp and salmon on wild shrimp and salmon fisheries. The report considered potential effects of increased supplies of domestically cultured shrimp and salmon on prices of the two products. However, it did not consider potential adverse impacts of lower domestic market prices on long-run revenues and/or profits of salmon and shrimp fishermen and structural changes in the industries that result from increased domestic aquaculture production.

One of the report's findings was that while domestic demand for shrimp would continue to grow, production of wild shrimp was at its biological limit and domestic cultured shrimp production was limited. Another finding was that while domestic and foreign demand for salmon would continue to grow through the 1990s, U.S. salmon fishermen and salmon farmers were at a competitive disadvantage because both foreign imports of cultured salmon entered the U.S. duty free and U.S. seafood export opportunities were hindered by foreign trade barriers. Thus, it was predicted that foreign producers of cultured salmon would have an increasing share of the domestic market.

Aquaculture policies supporting the aims of the NAA were adopted by NOAA and the DOC in 1998 and 1999, respectively. In 2004, the U.S. Commission on Ocean Policy made recommendations for the advancement of marine aquaculture as part of its comprehensive review of national ocean policy. Soon after, the Administration included the transmission of offshore aquaculture legislation to Congress in the U.S. Ocean Action Plan prepared in response to the recommendations of the Ocean Commission. The result was the National Offshore Aquaculture Act of 2005 which was transmitted to Congress on June 7, 2005, and introduced by Senators Stevens and Inouye on June 8 as S. 1195. The Senate Commerce Committee, Subcommittee on National Ocean Policy held two hearings on S. 1195 in 2006, but the Congressional session ended before Congress acted on the bill.

The Administration's bill was revised and reintroduced in both the House and the Senate in 2007 as the National Offshore Aquaculture Act of 2007 (Appendix B).

The Administration's bill was introduced as HR 2010 in the House on April 24 by Representatives Rahall and Bordallo and as S. 1609 in the Senate on June 13 by Senators Inouye and Stevens. The Fisheries Subcommittee of the House Natural Resources Committee held a hearing on HR 2010 on July 12, 2007, but the Congressional session ended before Congress acted on the bill.

The stated purpose of the 2007 bill was to provide the necessary authority to the Secretary of Commerce for the establishment and implementation of a regulatory system for offshore aquaculture in the U.S. EEZ, and for other purposes. Specifically, the bill would have authorized the Secretary to establish a process to make areas of the EEZ available to eligible persons for the development and operation of offshore aquaculture facilities, which would include:

- a permitting process;
- 20-year permits for offshore aquaculture, renewable in increments up to 20 years and transferable;
- Department of Interior (DOI) concurrence for aquaculture located on leases or authorized easements or for which a permit has been issued under the Outer Continental Shelf Lands Act (OCSLA) or within 1 miles of any other facility for which a permit has been issued under the OCSLA;
- Clear environmental requirements and safeguards for the marine environment and wild stocks;
- Requirement to conduct an environmental assessment of offshore aquaculture;
- Requirements to consult with other federal agencies, states, fisheries management councils, and the public;
- Criminal and civil penalties for permit violations;
- Anyone is eligible to apply for permits, but non-U.S. residents or companies must have a U.S. agent;
- All existing laws and regulations still apply;
- Exemption from the MSFCMA definition of fishing, but not from other provisions of MSFCMA; and,
- Ability for states to "opt out".

In 2007, NOAA completed and adopted the 10-Year Plan for Marine Aquaculture as an agency-wide policy document. The plan is intended to guide the agency as its works towards establishing marine aquaculture as an integral part of the U.S. seafood industry and as a viable technology for replenishing important commercial and recreational fisheries. The plan provides specific goals for the NOAA Aquaculture Program and an assessment of the challenges the agency will face.

The goals in the 10-Year Plan are:

- Development of a comprehensive regulatory program for environmentally sustainable marine aquaculture;
- Development of commercial aquaculture and replenishment of wild stocks;
- Public understanding of marine aquaculture; and,
- Increased collaboration and cooperation with international partners.

The plan was prepared at the request of the agency's Marine Fisheries Advisory Committee (MAFAC), which advises the Secretary on all living marine resource matters that are the responsibility of the DOC.

Also in 2007, the Secretary of Commerce hosted a National Marine Aquaculture Summit. At the Summit, national seafood and aquaculture business leaders, policy experts, government officials, non-governmental organizations, and researchers discussed the opportunities and challenges for marine aquaculture in the United States. Summit participants also made recommendations on how the United States can accelerate the integration of environmentally, economically, and socially responsible domestic aquaculture into domestic seafood production. Summit participants agreed on the need for national offshore legislation to provide regulatory certainty for those considering investing in federal waters.

Current Regulations Pertaining to Offshore Aquaculture

Currently, the only legal avenue for commercial-scale EEZ finfish aquaculture is under an EFP, as provided at 50 CFR 600.745. However, an EFP is intended to authorize the targeting or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited. Specifically, an EFP authorizes activities for limited testing, public display, data collection, exploration, health and safety, environmental cleanup, and/or hazard removal purposes.

NOAA Fisheries Service also has authority under the Fish and Wildlife Coordination Act, the EFH provisions of the MSFCMA, the Endangered Species Act, and the Marine Mammal Protection Act to comment and provide conservation recommendations on projects permitted, licensed, or funded by other federal agencies. In the case of aquaculture, this may include permits required from the ACOE, EPA, or other federal agencies.

Gulf of Mexico Fishery Management Council's Aquaculture Policy

In November 2003, the Council adopted an open ocean aquaculture policy for the Gulf EEZ (Appendix C). The policy consists of a variety of guidelines intended to encourage environmentally responsible aquaculture. The Council provided recommendations for six key areas: 1) allowable species, 2) habitat protection, 3) research, 4) location and design, 5) water quality, and 6) health management and disease control. These key areas were considered during the development of this FMP and the Council's recommendations are consistent with the proposed actions and preferred alternatives.

Federal Regulatory Management in the Gulf of Mexico

The history of federal regulatory management of aquaculture in the Gulf is brief. In 1994 and 1995, the Gulf and South Atlantic Fishery Management Councils developed and NOAA Fisheries Service implemented a regulatory regime for the culture of live rock (GMFMC 1994; GMFMC 1995). Wild live rock is coral-reef rubble that has been populated by attached organisms including anemones, sponges, tubeworms, sea squirts, bryozoans, algae, etc., as well as by mobile organisms. Because “wild” live rock is habitat and harvest reached levels exceeding 500,000 pounds annually in the early 1990s, NOAA Fisheries Service phased out harvest of wild live rock and required persons in the industry to shift to aquaculture of live rock. Aquaculture of live rock consists of placing substrate, such as calcareous rock geologically or otherwise distinguishable from naturally occurring substrate, on permitted bottom sites for several years until attached organisms populate it. Site selection is regulated by certain criteria, as are the operations, including notifying enforcement agents when harvesting or placing of substrate are to occur see GMFMC (1994) and GMFMC (1995) for details of these criteria. The state or ACOE requires permits for a site. An aquaculture permit and reporting of landings are required by NOAA Fisheries Service. In 2007, there were 35 live rock operations permitted in the southeast. This FMP would not modify existing regulations pertaining to live rock aquaculture.

<u>Offshore Aquaculture Facilities Currently Operating in the U.S.</u>

At present, there are only five operating offshore aquaculture farms in the U.S. or Puerto Rico; however, none of them operate in federal waters and, therefore, do not have an EFP. Furthermore, none of these farms operate in the Gulf. These offshore finfish farms are: 1) Hukilau Foods, LLC, which grows Pacific threadfin, also known as moi, in Hawaiian waters; 2) Kona Blue Water Farms, which grows amberjack, also known as kampachi or kahala, in Hawaiian waters; 3) the University of New Hampshire Open Ocean Aquaculture demonstration project that raises halibut, haddock, summer flounder, and cod in New Hampshire waters; 4) Isle of Shoals Mussels, a commercial longline mussel operation started by commercial fishermen in New Hampshire, and 5) Santa Barbara Mariculture, a commercial operation growing mussels on long lines in California waters. One additional operation, Snapperfarm, Inc., which raised cobia and mutton snapper off the coast of Culebra, Puerto Rico, recently ended its operations. Section 5.3 provides a description of each of these operations, as well as other notable aquaculture proposals and operations both within and outside the Gulf.

In addition, three fishermen’s cooperatives and towns in Martha’s Vineyard, Massachusetts, applied for leases in 2008 to conduct offshore mussel farming in state waters (R. Karney, director of Martha's Vineyard Shellfish Group, Inc, personal communication). Three pilot trials were conducted off Martha’s Vineyard in 2007-2008 (Martha Vineyard Gazette, August 29, 2008).

3.0 Purpose and Need

Aquaculture in federal waters is considered “fishing” under the MSFCMA. Fishing includes activities and operations related to the taking, catching, or harvesting of fish (Sec 3 (16) of the MSFCMA). Any FMP prepared by the Council, or by the Secretary, must include provisions specified in Sec 303(a) of the MSFCMA. Additionally, numerous discretionary provisions may be prescribed, including measures, requirements, or conditions and restrictions determined to be necessary and appropriate for the conservation and management of a fishery (Sec. 303(b)(14) of the MSFCMA). While current regulations authorize NOAA Fisheries Service to grant EFPs for aquaculture in federal waters, such permits are of limited duration and are not intended for the large-scale production of fish. As a result, commercial aquaculture in federal waters is not viable under the current permitting process. A FMP must therefore be developed to authorize the development of commercial aquaculture operations if aquaculture is to become a viable industry in federal waters.

Over the past few years, Congress considered national legislation that would have authorized and established a regulatory framework for offshore aquaculture in federal waters. The most recent version of the bill, titled the "National Offshore Aquaculture Act of 2007” (Appendix B), would exempt aquaculture from the MSFMCA definition of “fishing.” The bill would also provide regional fishery management councils a consultative role in the development of an offshore aquaculture industry and would not override other existing laws and regulations intended to conserve and manage wild fish stocks. Although Congress did not act on the proposed legislation, it is possible that similar legislation will be enacted in the future.

The purpose of the Aquaculture FMP is to maximize benefits to the Nation by establishing a regional permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf. The Council initiated this action to provide a programmatic approach to evaluating the impacts of aquaculture proposals in the Gulf. This action was also initiated to provide a comprehensive framework for regulating such activities. The FMP and associated Programmatic Environmental Impact Statement (PEIS) are intended to improve the regulatory process for authorizing current and future offshore aquaculture proposals by providing the Council and NOAA Fisheries Service the information required to review and authorize offshore aquaculture operations.

The primary goal of the Council’s proposed aquaculture permitting program is to increase the maximum sustainable yield (MSY) and optimum yield (OY) of federal fisheries in the Gulf by supplementing the harvest of wild caught species with cultured product. The objectives of the Aquaculture FMP are:

1. Provide for the development of environmentally sound and economically sustainable aquaculture fishery to increase the potential yields of the fishery, consistent with the goals and objectives of the MSFCMA;

2. To achieve optimum yield, while not adversely affecting wild stocks, protected resources, and essential fish habitat;
3. To conserve and protect essential fish habitat through proper aquaculture facility siting;
4. To obtain necessary data and information for issuing aquaculture permits and monitoring potential impacts of aquaculture operations;
5. To minimize user conflicts among aquaculture permit operations, commercial fishermen, and recreational anglers;
6. To prevent or mitigate to the extent practicable adverse impacts to wild stocks, protected resources, and essential fish habitat resulting from aquaculture activities;
7. To reduce the nation's dependence on imports by supplementing the harvest of domestic fisheries with cultured products to meet growing U.S. consumer demand; and,
8. To promote and facilitate effective enforcement of the aquaculture management program.

Supplementing the harvest of domestic fisheries with cultured product will help the U.S. meet consumers' growing demand for seafood and may reduce the nation's dependence on seafood imports. Currently, the U.S. imports over 80 percent of the seafood consumed in the country, and the annual U.S. seafood trade deficit is at an all time high of over $9 billion. One-half of imported seafood products are produced by aquaculture operations. This worldwide trend toward aquaculture production is expected to continue in response to consumers' continued demand for safe, healthy seafood.

The primary goal of federal fishery management, as described in National Standard 1 of the MSFMCA, is to conserve and manage U.S. fisheries to "...prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry." OY is defined as the amount of fish that provides the greatest net benefits to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems. While economic and social factors are to be considered in defining the OY of each fishery, OY may not exceed MSY, or the maximum amount of fish that can be removed without impairing the fishery's ability to replace removals through natural growth or replenishment. OY must prevent overfishing and, in the case of an overfished fishery, must provide for rebuilding stock biomass to a level consistent with that which would produce MSY.

The MSY and OY of each Council-managed fishery are currently limited by the fishery's biological potential. However, establishing an aquaculture fishery would increase total yield above and beyond that which can be produced solely from wild stocks. Increasing the seafood production potential of these fisheries will increase their contributions to national, regional, and local economies, and their capacity to meet the Nation's nutritional needs.

The environmental permitting, reporting, recordkeeping and siting conditions associated with the proposed aquaculture program are consistent with the Council's policy to encourage environmentally responsible marine aquaculture. These conditions are intended to ensure the operations of all offshore aquaculture facilities permitted in the Gulf are consistent with the MSFCMA National Standards (Section 6.12) and do not compromise Council objectives for wild fisheries. Council objectives for wild fisheries include, but are not limited to:

1. Stabilize or sustain wild stocks over the long term (Spiny Lobster FMP (1982), Coastal Migratory Pelagics FMP (1983), Red Drum FMP Amendment 1 (1987), Reef Fish FMP Amendment 1 (1990);
2. Rebuild overfished stocks (Reef Fish FMP (1984);
3. Conserve and protect fish habitat (Reef Fish FMP (1984), Red Drum FMP Amendment 1 (1987);
4. Minimize impacts on protected species, consistent with the requirements of the Endangered Species Act and Marine Mammal Protection Act (Shrimp FMP (1981); and,
5. Minimize user conflicts (Stone Crab FMP (1979), Spiny Lobster FMP (1982), Coastal Migratory Pelagics FMP Amendment 1 (1985), Reef Fish FMP Amendment 1 (1990).

These conditions will assist the Council in promoting the development of a robust commercial aquaculture fishery in the Gulf, without threatening the long-term sustainability or viability of wild fisheries or their contributions to the local, regional, and national economies.

4.0 Management Alternatives

The following section provides a discussion of the ten actions considered by the Council for this FMP to provide for regulation of offshore marine aquaculture. Section 6.0 examines the various actions and their alternatives relative to each other within the physical, biological, ecological, economic, social, and administrative environments. Appendix D provides a list of alternatives the Council considered, but rejected and the rationale for not including those alternatives.

4.1 Action 1: Aquaculture Permit Requirements, Eligibility, and Transferability

Alternative 1: No Action, an Exempted Fishing Permit (EFP) for conducting aquaculture would be required.

Preferred **Alternative 2: Require a NOAA Fisheries Service Gulf of Mexico aquaculture permit to authorize a person to:**

- **Deploy or operate an offshore aquaculture facility in the Gulf of Mexico EEZ. An offshore aquaculture facility means an installation or structure, including any allowable aquaculture systems (including moorings), hatcheries, equipment, and associated infrastructure used to hold, propagate, and rear allowable aquaculture species in the Gulf of Mexico EEZ under authority of a Gulf Aquaculture Permit; and,**
- **Sell, only at the first point of sale, or attempt to sell an allowable aquaculture species cultured at an offshore aquaculture facility in the Gulf of Mexico EEZ.**

Persons issued a Gulf Aquaculture Permit for the activities authorized above would also be authorized to:

- **Harvest or designate hatchery personnel or other entities to harvest and retain onboard a vessel wild live broodstock of an allowable aquaculture species native to the Gulf of Mexico for offshore aquaculture, regardless of where broodstock were harvested or possessed in U.S. waters of the Gulf of Mexico. Offshore aquaculture means all activities, including the operation of an offshore aquaculture facility, involved in the propagation and rearing of allowable aquaculture species in the Gulf EEZ. (Note: additional requirements for harvesting broodstock are specified in Action 8, Preferred Alternative 2(n)).**
- **Possess or transport fish or invertebrates in or from the Gulf EEZ to be cultured at an aquaculture facility (e.g., broodstock, fingerlings) or possess or transport fish or invertebrates from an aquaculture facility for landing ashore and sale.**

Require a Gulf aquaculture dealer permit to receive cultured organisms from the Gulf of Mexico EEZ. However, an owner or operator of an aquaculture facility with a Gulf Aquaculture Permit

may purchase juvenile fish from a hatchery located in the Gulf EEZ without obtaining a dealer permit. Requirements for obtaining a dealer permit are specified in 50 CFR 622.4(a)(4)(iii) and 50 CFR 622.4(b). (Reporting requirements are specified in Table 4.1.2)

Landing of allowable aquaculture species cultured in the Gulf of Mexico EEZ is prohibited at non-U.S. ports, unless first landed at a U.S. port.

In addition, require any vessel, aircraft, or vehicle authorized for use in aquaculture operations have a copy of the Gulf Aquaculture Permit onboard. Each copied permit must include an original signature of the Gulf Aquaculture Permit holder.

Eligibility for a Gulf of Mexico aquaculture permit is limited to U.S. citizens[1] or permanent resident aliens[2].
A Gulf of Mexico aquaculture permit is:
(a) transferable only if the geographic location of the aquaculture site remains unchanged. The transferor and transferee must complete the application for permit transfer, have their signatures

---

[1] The Immigration and Nationality Act of 1952, as amended, describes persons who may become U.S. citizens by birth or through naturalization (http://www.uscis.gov/propub/ProPubVAP.jsp?dockey=cb90c19a50729fb47fb0686648558dbe). No corporation, partnership, or association shall be deemed a citizen of the U.S. unless the controlling interest therein is owned by citizens of the U.S., and, in the case of a corporation, unless its chief executive officer, by whatever title, and the chairman of its board of directors are citizens of the U.S. and unless no more of its directors than a minority of the number necessary to constitute a quorum are noncitizens and the corporation itself is organized under the laws of the U.S. or of a State, Territory, District, or possession thereof, but in the case of a corporation, association, or partnership operating any aquaculture facility the amount of interest required to be owned by citizens of the U.S. shall be 75 per centum. The controlling interest in a corporation shall not be deemed to be owned by citizens of the U.S. (a) if the title to a majority of the stock thereof is not vested in such citizens free from any trust or fiduciary obligation in favor of any person not a citizen of the U.S.; or (b) if the majority of the voting power in such corporation is not vested in citizens of the U.S.; or (c) if through any contract or understanding it is so arranged that the majority of the voting power may be exercised, directly or indirectly, in behalf of any person who is not a citizen of the U.S.; or, (d) if by any other means whatsoever control of the corporation is conferred upon or permitted to be exercised by any person who is not a citizen of the U.S..

Seventy-five per centum of the interest in a corporation shall not be deemed to be owned by citizens of the U.S. (a) if the title to 75 per centum of its stock is not vested in such citizens free from any trust or fiduciary obligation in favor of any person not a citizen of the U.S; or (b) if 75 per centum of the voting power in such corporation is not vested in citizens of the U.S; or (c) if, through any contract or understanding, it is so arranged that more than 25 per centum of the voting power in such corporation may be exercised, directly or indirectly, in behalf of any person who is not a citizen of the U.S.; or (d) if by any other means whatsoever control of any interest in the corporation in excess of 25 per centum is conferred upon or permitted to be exercised by any person who is not a citizen of the U.S.

[2] The term "permanent resident alien" refers to a person lawfully accorded the privilege of residing permanently in the U.S. as an immigrant in accordance with U.S. immigration laws.

notarized, and mail the signed application to the RA at least 30 days prior to the date on which the transferee desires to have the transfer effective. Approval of the transfer by the RA is contingent on all applicable permit requirements being completed, and, if necessary, updated (Preferred);

(b) not transferable.

Alternative 3: Require separate NOAA Fisheries Service siting and operating permits for conducting offshore marine aquaculture in the Gulf of Mexico EEZ. A siting permit would authorize use of a site for conducting aquaculture. An operating permit would authorize the activities specified in Alternative 2.

Eligibility for Gulf aquaculture operating and siting permits is limited to U.S. citizens[2] or permanent resident aliens[3].

A Gulf of Mexico aquaculture permit is:

(a) transferable only if the geographic location of the aquaculture site remains unchanged. The transferor and transferee must complete the application for permit transfer, have their signatures notarized, and mail the signed application to the RA at least 30 days prior to the date on which the transferee desires to have the transfer effective. Approval of the transfer by the RA is contingent on all applicable permit requirements being completed, and, if necessary, updated;

(b) not transferable.

Discussion and Rationale

Permits are frequently required in fisheries to identify participants, limit entry, and restrict fishing activities. Regulations found at 50 CFR 622.4 summarize various fishery permits and permit requirements for the Gulf and South Atlantic. In addition to requiring a permit, regulations include permit application requirements and conditions. Application and operational requirements for aquaculture are summarized in Section 4.2 (Action 2). Additionally, there are numerous recordkeeping and reporting requirements for aquaculture specified in Section 4.8 (Action 8). All of these requirements make it necessary for NOAA Fisheries Service to specify standards and criteria for approving, modifying, or denying permits. Such criteria and standards are identified for approving, modifying, or denying allowable aquaculture systems and siting locations in Actions 5 and 6. For the remainder of the regulations proposed in this FMP, broader criteria and standards are necessary. Table 4.1.1 summarizes these broader standards and criteria that will be used to approve, modify, or deny Gulf Aquaculture Permits.

Additionally, during the Council's August 2008 meeting, the Council approved a motion to include a written notice and public comment period before issuance of each aquaculture permit.

The process would first require the RA to review each application and make a preliminary determination whether the application contains all of the required information and constitutes an activity appropriate for further consideration. If the RA determines that an application warrants further consideration, notification of receipt of the application will then be published in the *Federal Register* with a brief description of the proposal, and the intent of NMFS to issue a Gulf Aquaculture Permit. Interested persons will be given a 15- to 45-day opportunity to comment. The RA may consult with the GMFMC concerning the permit application and written public comments. Applicants would be notified by the RA in advance of any GMFMC meeting at which the application will be considered, and offer the applicant the opportunity to appear in support of the application.

As soon as practicable after the opportunity for public comment ends, the RA shall notify the applicant in writing of the decision to grant or deny the Gulf Aquaculture Permit, and, if denied, the reasons for the denial. The RA may also consider revisions to the application made by the applicant in response to public comment before approving or denying it. The RA will publish a notice in the *Federal Register* upon approval or denial of a permit. Grounds for denial of a Gulf Aquaculture Permit include, but are not limited to, the following:

1. The applicant has failed to disclose material information or has made false statements to any material fact, in connection with the Gulf Aquaculture Permit application;
2. Based on the best available scientific information, issuance of the permit would detrimentally affect the well-being of wild fish stocks, marine mammals, threatened or endangered species, essential fish habitat, public health, or safety; or,
3. Activities proposed to be conducted under the Gulf Aquaculture Permit are inconsistent with aquaculture regulations in this section, the management objectives of the Aquaculture FMP, or the Magnuson-Stevens Act or other applicable law.

Section 6.2 examines the various Action 1 alternatives relative to each other within the biological, physical, ecological, economic, social, and administrative environments. **Alternative 1**, the no action alternative, would maintain status quo regulations, which require an EFP to conduct marine aquaculture and other activities as described in 50 CFR 600.745. An EFP (Appendix A) is not intended to be used for commercial production of fish and is typically issued for no longer than one year, which is generally considered too short of a period for a lending institution to finance construction of most aquaculture facilities. While renewal is permitted under 50 CFR 600.745 (presumably in one-year increments), uncertainty as to whether the permit will be renewed would add to the uncertainty of the business venture and, hence, deter otherwise potential business ventures. For these reasons, it is unlikely that a viable commercial aquaculture industry could develop in the Gulf.

Preferred Alternative 2 would require a NOAA Fisheries Service permit that would authorize all activities associated with operating an aquaculture facility in the Gulf EEZ. The permit would authorize the deployment and operation of an offshore aquaculture facility and the sale of cultured species. Persons issued a Gulf Aquaculture Permit would also be authorized to harvest or designate hatchery personnel or other entities to harvest and retain onboard a vessel wild live broodstock, and to possess or transport fish or invertebrates in or from the Gulf EEZ to be cultured at an aquaculture facility (e.g., broodstock, fingerlings) or possess or transport fish or invertebrates from an aquaculture facility for landing ashore and sale. Stock enhancement or the intentional release of cultured fish into the wild would not be authorized by a Gulf Aquaculture Permit, and therefore would be prohibited. Given that this FMP is intended to provide for the development of a domestic aquaculture industry, only U.S. citizens or permanent resident aliens would be eligible for an operational permit. In order to facilitate continuity of offshore aquaculture operations and the development of a viable future aquaculture industry, permits would be transferable to U.S. citizens and permanent resident aliens, except if major modifications to the permit are made (e.g., site of operation changes). Before a permit could be transferred, the transferee must complete or update the permit requirements specified in this FMP (e.g., application and operational requirements specified in Action 2). ACOE siting permits and EPA National Pollutant Discharge Elimination (NPDES) permits are transferable upon modification, so this provision would be similar to existing requirements for other federal agencies that regulate various aspects of offshore aquaculture.

Preferred Alternative 2 would also prohibit the landing of allowable aquaculture species cultured in the Gulf of Mexico EEZ at non-U.S. ports, unless first landed at a U.S. port. This regulatory requirement is intended to aid law enforcement and ensure that landings are reported and accounted for when determining compliance with the MSY/OY specified in Action 9. In addition, **Preferred Alternative 2** requires any vessel, aircraft, or vehicle authorized for use in aquaculture operations to have a copy of the Gulf Aquaculture Permit onboard. Each copied permit must include an original signature of the Gulf Aquaculture Permit holder. Requiring an aquaculture permit onboard will assist law enforcement in determining compliance with aquaculture regulations.

In order to accommodate tracking of farmed species and facilitate enforcement of the program, a separate dealer permit would be required to receive cultured organisms from the Gulf EEZ. However, an owner or operator of an aquaculture facility with a Gulf Aquaculture Permit may purchase juvenile fish from a hatchery located in the Gulf EEZ without obtaining a dealer permit. Requirements for obtaining a dealer permit are specified in 50 CFR 622.4(a)(4)(iii) and 50 CFR 622.4(b). Dealer reporting requirements are summarized in Table 4.1.2 and are analogous to existing reporting requirements for dealers receiving Gulf of Mexico reef fish. NOAA Fisheries Service would review applications for an aquaculture permit and determine if the information provided by the applicant is sufficient to issue a permit. Applicants would be required to satisfy application and operational requirements described in Action 2 before receiving a permit. Additionally, NOAA Fisheries Service would ensure appropriate species and reliable grow-out systems were used for aquaculture, as specified in Actions 4 and 5, and evaluate if an aquaculture operation is sited in an appropriate location that would minimize or prevent environmental impacts (Action 6). The preferred alternative in Action 6 provides NOAA Fisheries Service authority to review sites on a case-by-case basis. If a proposed site is denied for use, the RA would provide a determination and the basis for it, in writing to the applicant. Upon issuance of an aquaculture permit, operations would be required to maintain records and submit reports as described in the Action 8 preferred alternative. An aquaculture permit would remain valid for the period of time indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulatory requirements.

Alternative 3 would require NOAA Fisheries Service to issue separate siting and operating permits. Activities authorized for operation would be the same as those described in **Preferred Alternative 2**. Siting criteria described in Action 6 would be used as the basis for issuing or not issuing a siting permit. These criteria would be in addition to any criteria considered by the ACOE for siting a facility. Requiring a siting permit would be partially duplicative of the ACOE permit process, since the ACOE already issues permits for siting. However, there would be a key difference in these two processes; under **Alternative 3**, NOAA Fisheries Service would have independent authority when approving or disapproving a proposed site. Currently, NOAA Fisheries Service only reviews and provides comments on permits submitted to the ACOE for review.

Both **Preferred Alternative 2** and **Alternative 3** would allow for the development of a commercial aquaculture industry in the Gulf EEZ. Both alternatives would also restrict eligibility to U.S. citizens or permanent resident aliens. Permits would be transferable based on the Council's preferred alternative in **Alternative 2**. In addition to the permit(s) NOAA Fisheries would require, the following permits, authorizations, and/or regulatory requirements from other federal agencies may be required:

1. Army Corps of Engineers Section 10 siting permit (Rivers and Harbors Act, 33 U.S.C. §403);
2. Environmental Protection Agency NPDES permit (Clean Water Act, 13 U.S.C. §1342, 1343);
3. Minerals Management Service Alternative Use Rights-of-Use and Easements (Outer Continental Shelf Lands Act, 43 U.S.C. §1337; proposed rule - see 73 FR 39376);
4. U.S. Coast Guard structure marking requirements (Rivers and Harbors Act, 14 U.S.C. §85);
5. U.S. Fish and Wildlife Service requirements on importation of fish (Lacey Act, 18 U.S.C. §42);
6. Animal and Plant Health Inspection Service response to animal disease outbreaks (Animal Health Protection Act, 7 U.S.C. §8301 *et. seq.*);
7. U.S. Fish and Wildlife Service consultations on permitted activities affecting fish and wildlife, including endangered species (Fish and Wildlife Coordination Act, 16 U.S.C. §661 *et. seq*. and 16 U.S.C. §1536); and,

8. National Ocean Service regulations in national marine sanctuaries (National Marine Sanctuaries Act, 16 U.S.C. §1431 *et. seq*.).

Establishing a permitting process for offshore aquaculture would allow the Council to better achieve National Standard 1 and the primary goal of this FMP, which is: "to maximize benefits to the Nation by establishing a regional permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf of Mexico." The MSFCMA mandates that NOAA Fisheries Service conserve and manage U.S. fisheries to "...prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry". The MSY and OY of each Council-managed fishery are currently limited by the fishery's biological potential. Adding an aquaculture component would increase the total yields these fisheries could produce, thereby contributing to national, regional, and local economies, and their capacity to meet the Nation's nutritional needs.

The actions and preferred alternatives in this FMP associated with the proposed aquaculture program are consistent with the Council's policy to encourage environmentally responsible marine aquaculture. These conditions are intended to ensure the operations of all offshore aquaculture facilities permitted in the Gulf are consistent with the MSFCMA National Standards (Section 6.10), the objectives of the FMP, and do not compromise Council objectives for wild fisheries (Section 3.0). Additionally, these conditions will assist the Council in promoting the development of a robust commercial aquaculture industry in the Gulf, without threatening the long-term sustainability and viability of wild fisheries and their contributions to the local, regional, and national economies. This additional production of seafood may also assist the Council in preventing overfishing, by decreasing fishing pressure on some wild stocks.

Summary Comparison of Physical, Biological, and Ecological Consequences

Section 6.1 provides a detailed description of the potential impacts associated with marine aquaculture on the physical, biological, and ecological environments. These include, but are not limited to:

1) Modification of wild stock genetic diversity;
2) Transmission of pathogens to wild stocks;
3) Modification of benthic habitat from discharged effluents, such as solids and dissolved nutrients;
4) Reductions in water quality;
5) Escaped fish competing with wild fish;
6) Entanglement of wildlife with aquaculture structures; and,
7) Use of wild bait fishes for feed.

Table 4.1.1 – Criteria and standards that will be used for the approval, denial, or transfer of Gulf Aquaculture Permit and Gulf aquaculture dealer permits.

Application for permits Application forms for a Gulf Aquaculture Permit and a Gulf aquaculture dealer permit are available from the RA. A completed application form for a Gulf Aquaculture Permit and all required supporting documents must be submitted by the applicant (in the case of a corporation, an officer or shareholder; in the case of a partnership, a general partner) to the RA at least 180 days prior to the date the applicant desires the permit to be effective. A completed application form for a Gulf aquaculture dealer permit and all required supporting documents must be submitted to the RA at least 30 days prior to the date the applicant desires the permit to be effective.
Fees A fee is charged for each application for a permit submitted under this section and for each request for transfer or replacement of such permit. The amount of each fee is calculated in accordance with the procedures of the NOAA Finance Handbook, available from the RA, for determining the administrative costs of each special product or service. The fee may not exceed such costs and is specified with each application form. The appropriate fee must accompany each application, request for transfer or replacement.
Initial Issuance The RA will issue a permit to an applicant if the application is complete and the specific requirements for the requested permit have been met. An application is complete when all requested forms, information, and documentation have been received. Upon receipt of an incomplete application, the RA will notify the applicant of the deficiency. If the applicant fails to correct the deficiency within 60 days of the date of the RA's letter of notification, the application will be considered abandoned.
Renewal An aquaculture facility owner or aquaculture dealer who has been issued a permit must renew such permit consistent with the applicable duration of the permit. When a Gulf aquaculture facility permit is expiring, the RA will mail an aquaculture facility owner an application for renewal approximately 6 months prior to the expiration date. The RA will also mail an application to the aquaculture dealer when a permit is expiring approximately 2 months prior to the expiration date. An aquaculture facility owner or aquaculture dealer who does not receive a renewal application from the RA within the time frames indicated in this paragraph must contact the RA and request a renewal application. The applicant must submit a completed renewal application form and all required supporting documents to the RA at least 180 days prior to the date on which the applicant desires to have a Gulf Aquaculture Permit made effective and at least 30 days prior to the date on which the applicant desires to have an aquaculture dealer permit made effective. If the RA receives an incomplete application, the RA will notify the applicant of the deficiency. If the applicant fails to correct the deficiency within 60 days of the date of the RA's letter of notification, the application will be considered abandoned.
Display A Gulf Aquaculture Permit issued must be prominently displayed and available at the aquaculture facility. An aquaculture dealer permit issued under this section, or a copy thereof, must be prominently displayed and available on the dealer's premises. In addition, a copy of the dealer's permit, or the aquaculture facility's permit (if the fish have not yet been purchased by a dealer), must accompany each vehicle that is used to receive fish harvested from an aquaculture facility in the Gulf EEZ. A vehicle operator must present the permit or a copy for inspection upon the request of an authorized officer.
Sanctions and Denials A Gulf Aquaculture Permit or aquaculture dealer permit issued pursuant to this section may be revoked, suspended, or modified, and such permit applications may be denied, in accordance with the procedures governing enforcement-related permit sanctions and denials found at subpart D of 15 CFR part 904.
Alteration A Gulf Aquaculture Permit or aquaculture dealer permit altered, erased, or mutilated is invalid.
Replacement A replacement Gulf Aquaculture Permit or aquaculture dealer permit may be issued. An application for a replacement permit is not considered a new application.
Transfer An aquaculture dealer permit is not transferable. A Gulf Aquaculture Permit is transferable to an eligible person, i.e., a U.S. citizen or permanent resident alien. An eligible person who acquires an aquaculture facility that is currently permitted and who desires to conduct activities for which a permit is required may request that the RA transfer the permit to him/her. Such a person must complete and submit to the RA a permit transfer request form that is available from the RA. A request for permit transfer must be accompanied by the original permit and a copy of a signed bill of sale or equivalent acquisition papers. The seller must sign the back of the permit, and have the signed transfer document notarized. A transfer is valid only for the duration of the permit being transferred.

Table 4.1.2 Reporting requirements for dealers receiving cultured species from the Gulf of Mexico EEZ.

A dealer who purchases fish from an aquaculture facility in the Gulf EEZ must: 1) Complete a landing transaction report for each landing and sale of cultured fish via the aquaculture website at the time of the transaction in accordance with reporting form and instructions provided on the website. This report includes, but is not limited to, date, time, and location of transaction; information necessary to identify the Gulf Aquaculture Permit holder, vessel, and dealer involved in the transaction; quantity, in pounds whole weight, and estimated average weight of each species landed to the nearest tenth of a pound; and average price paid for cultured fish landed and sold by market category. A dealer must maintain such record for at least 3 years after the receipt date and must make such record available for inspection upon request of an authorized officer or the RA. 2) After the dealer submits the report and the information has been verified, the website will send a transaction approval code to the dealer and the aquaculture permit holder.

Action 1, by itself would not have any direct effects on the physical, biological, and ecological environments of the Gulf. However, Action 1 will indirectly affect these environments. **Alternative 1** would restrict the development of offshore aquaculture in the Gulf and therefore would result in no impacts to the physical, biological, and ecological environments unless an aquaculture operation was able to successfully develop under the current EFP permitting process. Only one EFP permit has ever been issued by NOAA Fisheries Service to conduct marine aquaculture in the Gulf (Section 5.3.4). Currently, no aquaculture operations have an EFP permit to conduct aquaculture in the EEZ and there is no expectation that aquaculture operations could develop a successful business over the long-term under the EFP permitting process. Therefore, the potential impacts described in Section 6.1 would not occur.

Preferred Alternative 2 and **Alternative 3** would create a permit process and therefore would indirectly affect the physical, biological, and ecological environments by allowing the development of an aquaculture industry. Impacts to the physical and biological environments, as described in Section 6.1, would depend on numerous factors, including but not limited to where a facility is sited, the potential for fish escapement, and the procedures and practices of an operation. Permitting marine aquaculture in the Gulf (**Preferred Alternative 2** and **Alternative 3**) would have greater impacts than the status quo (**Alternative 1**). However, measures considered in this FMP are intended to mitigate or prevent impacts to wild resources resulting from marine aquaculture. Such measures include facility operation, reporting, and recordkeeping requirements (Actions 2 and 8) and use of only native, non-transgenic, non-genetically modified species for culture (Action 4). Other limitations include where facilities may be sited, and case-by-case review of allowable marine aquaculture systems (Actions 5 and 6).

Conducting aquaculture offshore versus near shore is desirable for two main reasons: 1) there are fewer competing uses and users further from shore, and 2) deeper water and stronger water flows make it a more desirable location for mitigating environmental impacts, such as benthic and nutrient loading (Levings et al. 1995). As discussed in Section 6.1.3, the EPA has authority to set water quality standards for pollution discharge and has developed regulations for concentrated aquatic animal production in the United States (Appendix G). The two greatest risks to water quality and the benthic environment resulting from offshore aquaculture are increased organic loading and nutrient enrichment. Recent environmental studies off Puerto Rico and New Hampshire indicate nutrient and organic loading tends to be localized around aquaculture cages; however, nutrient and organic loading was not significantly different from nearby control sites without aquaculture facilities (Alston et al. 2005; Rapp 2006; UNH Marine Aquaculture Center 2006). Lee et al. (2006) studies off the coast of Hawaii, observed differences between control and near-cage sites with a shift toward anaerobic conditions due to carbon influx from cages. The study noted that eutrophication effects increased away from the study site, but were localized in areas immediately surrounding the enclosure site. Lee et al. (2006) suggested that this may have been attributed to more rapid dilution and dispersal of nutrient wastes due to greater volume of water flow through the enclosure site. However, they conclude that the effects of fish feed and waste on the benthic polychaete community were evident, despite the study's location and alongshore currents.

Other potential physical and biological impacts resulting from aquaculture include escapement of fish, competition with wild stocks, spread of pathogens, benthic habitat damage, increased use of bait fishes for aquaculture fish meal, and entanglement of wildlife. Non-native and genetically modified species can pose a threat to both wild stocks and biodiversity by competing for food and habitat and changing community and genetic structure. To address this risk, the Council is prohibiting the use of non-native, genetically modified, and transgenic species for aquaculture in the Gulf (Sections 4.2 and 4.4). The potential for the spread of pathogens exists because most offshore aquaculture is anticipated to be conducted in net pens or cages that allow water to move freely through these grow-out systems. Pathogen outbreaks have been observed in farmed fish (Section 6.1.2). However, if farmed fish are stocked as pathogen-free juveniles there is no scientific evidence to suggest disease transmission from farmed aquatic organisms to wild stocks or from farmed aquatic organisms escaping and intermingling with wild stocks (Section 6.1.2). The Council has addressed this potential risk by requiring certification that cultured organisms are pathogen-free prior to stocking. The Council has also provided NOAA Fisheries Service, in coordination with the U.S. Department of Agriculture (USDA), authority to remove cultured organisms infected with a reportable pathogen if it is determined that they pose a threat to the health of wild aquatic organisms (Section 4.8). The Council's preferred alternative in Action 6 would also require facilities to be sited at least 1.6 nautical miles from one another to minimize transmission of pathogens among and between facilities. Section 4.8 also includes various recordkeeping and reporting requirements if pathogens are discovered and pathogen outbreaks occur (Section 4.8).

Benthic degradation may occur through increased organic loading or direct damage from allowable aquaculture systems used for culturing organisms. To prevent or minimize habitat degradation, facilities would be properly sited to ensure adverse effects do not occur to essential fish habitat and other ecologically important areas. Aquaculture operations would be required to meet EPA water quality standards. Additionally, this FMP would provide NOAA Fisheries Service authority to evaluate potential aquaculture grow-out systems and sites on a case-by-case basis (Section 4.5 and 4.6) to ensure grow-out systems are reliable and operations are sited in areas that minimize impacts to benthic habitat. Aquaculture facilities would be prevented from being sited in particular sensitive areas, such as marine reserves, HAPCs, marine protected areas, and coral areas (Section 4.6). Permit applicants would also be required to provide NOAA Fisheries Service with video of benthic habitat at the proposed site before a site is approved for use.

Lastly, potential concerns have been expressed about the use of prey species as bait. Worldwide approximately 25-30 million tons of fish are reduced to fish meal and fish oil annually (Tacon et al. 2006). Fish meal and fish oil are used in a variety of feeds for aquaculture and agriculture (e.g., poultry). As discussed in Section 6.1.7, efforts are being made on a global scale to reduce the dependence on fishmeal and oil sourced from wild-caught forage fishes by replacing them with more sustainable protein and oil ingredients including soybeans, barley, rice, peas, canola, lupine, wheat gluten, corn gluten, algae, as well as seafood and farm animal processing co-products. The NOAA Aquaculture Program in partnership with the U.S. Department of Agriculture directly supports these efforts via the NOAA-USDA Aquaculture Feeds Initiative which was initiated during 2007 to stimulate research into alternative feeds.

The amount of fish reduced to fish meal has been relatively stable over the past few decades. In 2003, the United States accounted for 5.6 percent of the worldwide fishmeal production and 9.6 percent of the worldwide fish oil production (Tacon et al. 2006). In the United States, Gulf and Atlantic menhaden represent the greatest source of fish meal production. Neither of these species is overfished or undergoing overfishing and both are managed by states and interstate compacts. These species are regularly assessed every four to five years by NOAA Fisheries Service. If demand for these species increases due to development of an aquaculture industry in the Gulf and for livestock feeds, then stock assessments will be used to assess the status of each of these populations. Necessary management adjustments could then be made by state agencies and interstate fishery commissions to protect these species if fishing mortality is too high or stock biomass has dropped below threshold levels.

For more information on the above described physical and biological impacts see Section 6.1.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative, and under the status quo, any entity seeking to engage in activities associated with commercial offshore aquaculture operations that involve species managed under an FMP or activities in violation of fishery regulations in the Gulf of Mexico EEZ is currently required and would continue to be required to apply for an EFP. While an EFP may authorize some activities that may be associated with an aquaculture operation, an EFP does not authorize commercial offshore aquaculture. The inability to authorize commercial offshore aquaculture under an EFP is illustrated in a 2008 letter from NOAA Fisheries Service to Biomarine Technologies Inc. that states one of the reasons for rejecting the company's EFP application is that the company sought to establish a long-term, commercial-scale aquaculture operation which is not one of the purposes for which an EFP may be issued. An EFP also does not authorize commercial hatchery operations in the EEZ. Any harvest of species native to the Gulf to create broodstock has occurred predominantly for scientific purposes and a letter of acknowledgement (LOA) is sufficient for such scientific activities. However, an LOA is only appropriate for scientific research activities conducted onboard a scientific research vessel and explicitly does not include collection for product development. As a result, because neither an EFP nor an LOA would authorize the activities necessary for offshore hatchery operation, **Alternative 1** would not support the development of an integrated offshore aquaculture operation. See Section 6.2.3.1 for more information on the purposes of an EFP or LOA.

In summary, because of the types of activities they would allow and their duration of applicability, the EFP and LOA authorizations of the **Alternative 1** (the status quo) would not be supportive of the development of commercial aquaculture or hatchery operations in the EEZ.

Because **Alternative 1** would continue current regulations and business practices, this alternative would not add any economic and social impacts above the economic and social baseline. As stated in section 5.3.5, there is a U.S. seafood trade deficit, and U.S. demand for seafood is forecast to substantially increase in the next 17 years as dietary guidelines and consumer preferences change. Because many U.S. wild-catch fisheries are at their maximum production capacities (NOAA Fisheries Service 2007), future increases in domestic production and reductions in the seafood trade deficit will most likely come from aquaculture. **Alternative 1** would continue the seafood trade deficit and corresponding welfare loss, which can be reduced or eliminated, given the condition of fixed wild harvest capacity and limited onland and nearshore aquaculture production, only by increasing domestic offshore aquaculture production and reducing imports and/or increasing exports of seafood.

Preferred Alternative 2 would create an offshore aquaculture permit that would authorize a U.S. citizen or permanent resident alien to place aquaculture structures in waters of the Gulf EEZ; sell products cultured in the Gulf EEZ; harvest wild broodstock and aquaculture of species native to the Gulf of Mexico; propagate and rear species; and possess and transport young fish (or shellfish) to and market-size fish or shellfish from the Gulf EEZ. While **Preferred Alternative 2** would simply establish the permit that would enable the development of offshore aquaculture in the Gulf EEZ, the development of the industry would be expected to potentially lead to a variety of direct and indirect social and economic effects. These effects are summarized below.

It is currently assumed that 5 to 20 offshore aquaculture operations could emerge in the Gulf EEZ within the first 10 years of this proposed FMP. Assuming no restrictions on individual firm or total industry production (see a discussion of the potential production caps that may be established under Action 9), each of these operations could be projected to employ up to 59 professional and semi-professional staff and produce up to 26.3 million pounds annually, based on a production prospectus of an offshore aquaculture firm operating off Hawaii (Section 6.2.3). Collectively, the 5 to 20 operations would have 295 to 1,180 employees, pay salaries and benefits of from $17.5 million to $74 million and produce from 131 million to 525 million pounds of product per year.

Assuming an average price of fresh product of $4.00 per pound, one operation would generate annual revenues of approximately $105 million, and the 5 to 20 operations combined would generate product valued from $0.5 billion to $2.1 billion annually. Caveats to these totals would include, among other potential factors, potential production caps imposed by Council action, price effects of increased cultured product supply, and the effects of culturing different species with different production profiles. Nevertheless, despite these caveats, an increase in domestic production of seafood as a result of offshore aquaculture production would be expected to reduce the seafood trade deficit and increase national income and welfare.

Commercial offshore aquaculture's contribution to the increase in the volume of seafood would also be expected to create an increase in the scale and/or number of entities that buy seafood at the first point of sale. This in turn would generate additional employment in and income from the wholesale seafood, seafood processing, and retail seafood industries. Gulf offshore aquaculture operations would be also expected to increase demand for fish feed and other aquaculture-supporting products and services, which in turn would be expected to generate additional increases in employment, revenues and income from these industries.

A common concern with the development of aquaculture is the competition of cultured product with wild product harvested by local fishermen. If offshore aquaculture operations sell their products to dealers who also buy from fishermen, offshore aquaculture would be in direct competition with fishermen. Offshore aquaculture is expected to greatly increase the supply of seafood; and consequently, the price received by Gulf and other fishermen could fall, depending upon the increase in supply caused by offshore aquaculture. That in turn would reduce fishermen's revenues and incomes from sales of those species, *ceteris paribus*.

Actual competition would be expected to be dependent upon the species cultured, the markets targeted by offshore aquaculture operations, and the season of production and harvest. The competitive pressure would be expected to be the greatest if fishermen and aquaculture operations harvest the same species, marketed at the same time to or through the same market channels/outlets, and marketed in the same product form, and decline the more dissimilar these considerations are. Two species expected to be the most likely candidates for offshore culturing in the Gulf are red drum and cobia, both species that do not have significant commercial fisheries. The EEZ, in both the Gulf and South Atlantic, is closed to the commercial harvest of red drum, and only limited commercial harvest of red drum is allowed in state waters. Similarly, while commercial harvest of cobia in the EEZ and most Gulf States is allowed, cobia harvests are not significant because of daily possession limits and the solitary behavior of the species, cobia harvests are not significant. Therefore, offshore aquaculture operations that produce these two species would not be expected to directly compete against fishermen; however, they would be expected to directly compete with onland and nearshore aquaculture producers of these same species. To the extent that competition occurs, it can be reduced through selection of market outlet and timing of production.

It should also be noted that the potential for ex-vessel price to fall because of offshore aquaculture, should there be direct competition, is also dependent upon other factors, such as consumer demand, onland and nearshore aquaculture production, and level of imports. Nonetheless, a potential economic and social cost of the development of offshore aquaculture is declines in the ex-vessel prices of commercial species and losses of fishing and fishing-related revenues, incomes, employment and businesses. Loss of a livelihood, such as being a fisherman, is a loss of personal and social identity.

In addition to potential price effects, if any of the cultured species have domestic fisheries that are managed under an IFQ program, the values of IFQ shares and the value of the overall IFQ program, would decline with any fall in the ex-vessel price of wild-harvested fish, as would the resale value of fishing gears and vessels that target those species.

In addition to the potential effects thus far discussed, another potential effect of the development of offshore aquaculture is related to market power. If offshore aquaculture operations compete directly with fishermen, their competitive advantage of higher quantity and quality and consistent supply could result in long-term contractual arrangements and/or vertical integration with dealers, dominant market shares, and anticompetitive behaviors such that fishermen are unable to sell some or all of their landings to these dealers or are offered a substantially lower price. This would reduce fishing and fishing-related revenues, income and employment and corresponding economic and social opportunities, which would adversely affect fishermen, their families, and fishing communities.

If direct competition results in losses of employment and revenues to those presently in the marine fishing industry, it can be argued that former fishermen could work for the offshore aquaculture operators. As a result, it is possible that alternative employment opportunities could mitigate some to all of the economic losses to these fishermen, their families and communities. However, such a trade should not be viewed as even as the cultural meanings and values of working for a wage on a fish farm versus the cultural meanings and values of working for oneself as the owner and captain of a fishing vessel or even working on a fishing vessel for a share of the catch and for one's livelihood as a member of the crew are fundamentally different and the employment opportunities are not socially equivalent.

Preferred Alternative 2 would not restrict Gulf offshore aquaculture, with the exception of limiting allowable aquaculture species to those native to the Gulf. Hence, without additional restrictions, offshore aquaculture firms could produce genetically modified or transgenic species (if authorized by the FDA), abandon equipment, introduce disease to wild stocks, and engage in other environmentally damaging activities that are not regulated by other federal agencies.The resulting economic and social costs to fishermen, their families and communities could be beyond measure if native stocks, livelihoods, and fishing communities were permanently lost and essential habitats destroyed. Additional actions (Actions 2, 4, 5, 6, 8, and 9) to prevent or reduce the likelihood or severity of these externalities are included in this FMP and are discussed in subsequent sections.

Preferred Alternative 2 would not restrict the duration of time when or the location where an offshore aquaculture can operate, though both considerations are addressed by subsequent actions (Actions 3 and 6) in this FMP. Without such restriction, an offshore aquaculture operation could place cages, pens and platforms anywhere it wanted in the Gulf EEZ and occupy an area or areas of the EEZ indefinitely, thereby enclosing that area and precluding all other activities. This would create the possibility that offshore aquaculture operations could site themselves in historical and increasing fishing areas, which would displace fishermen from use of some or all of those areas and cause economic losses of some or all landings, incomes and employment, which could have significant economic and social consequences to fishermen, their families, and fishing communities. Other potential costs and benefits of legal enclosure of areas of the EEZ are described in Section 6.2.3.1.

Preferred Alternative 2 would restrict eligibility for a Gulf Aquaculture Permit to U.S. citizens or permanent resident aliens and prohibit the landing of cultured product in non-U.S. ports. This eligibility restriction is consistent with those under IFQ programs. A required first landing at a U.S. port simply ensures that the economic activity associated with the initial landing remains in the United States. Whether the U.S. landing requirement results in a net social and economic gain to the U.S. would be dependent upon the specific circumstances of the species produced and associated consumer and labor markets, and cannot be predicted.

Under **Preferred Alternative 2**, an aquaculture permit would be transferrable. A transferable permit would generate a direct economic benefit to owners of the permit because the permit would become a marketable asset for the duration of the permit, and Gulf offshore aquaculture and hatchery operations would have the incentive to preserve the economic value of the permit by engaging in practices that would not damage the long-term production capacity allowed by the permit. It also encourages efficient producers to acquire the permits of other producers, which can increase industry production. By taking ownership of an existing permit, the economically efficient producer could begin operations at the newly acquired facility immediately after it purchased the permit, and hence, reduce start-up time and associated costs.

Although **Preferred Alternative 2** would allow transfer of the aquaculture permit, the site of the aquaculture operation would have to remain fixed. Requiring that the operation site remain fixed would be expected to eliminate potential problems associated with inappropriate site location.

Under **Preferred Alternative 2**, two types of permits would be required, an aquaculture permit and a dealer permit. Although permit application costs exist for other current Gulf federal permits, the application cost and estimated time of preparation for the aquaculture permit application is unknown at this time. Costs for a Gulf aquaculture permit would be based on the NOAA Finance handbook and are expected to be significantly more than the

$50 cost of existing fishing permits in the Southeast region. Anyone who purchases cultured organisms from the Gulf EEZ would be required to have a Gulf aquaculture dealer permit with an annual cost of $12.50, if the buyer already has an annual dealer permit, and $50, if not.

Alternative 3 would divide the single aquaculture permit of **Preferred Alternative 2** into two separate permits, a Gulf aquaculture siting permit and a Gulf aquaculture operating permit. The economic and social costs of **Alternative 3** would be expected to be the same as those of **Preferred Alternative 2**, except, if the permits are separate and transferable, this alternative would: 1) increase the combinations of compatible sites and operations that do not require a new permit, and 2) increase the time and due diligence costs of purchasing compatible permits. Also, the ability to separate permits under **Alternative 3** may create compatibility issues between approved operation plans and permitted sites. It is possible that aspects of a specific operation plan are only appropriate or best appropriate if the operation is to occur at a certain (or similar) site. Conducting the operation at a different or dissimilar site may result in an operation ill-suited (from a fisheries management perspective) to the site. The separation of the operation permitting process from the site permitting process may result in unexpected consequences, with associated adverse social and economic impacts.

The creation of a permitting system will have a direct effect on the administrative environment, though the extent of that effect is difficult to determine due to the uncertainty in the number of applicants expected to apply for a permit. The administrative burden on NOAA Fisheries Service regional office staff and state/federal law enforcement officers would increase due to the review, issuance, and enforcement of offshore aquaculture permits.

4.2 Action 2: Application Requirements, Operational Requirements, and Restrictions

Alternative 1: Do not specify application requirements, operational requirements, or restrictions for aquaculture in the Gulf EEZ.

Alternative 2: Status quo. Require the Exempted Fishing Permit application and issuance requirements as specified at 50 CFR 600.745(b).

Preferred Alternative 3: Establish the following application requirements, operational requirements, and restrictions:

(a) Application Requirements

(1) A completed application and all required supporting documents for a Gulf Aquaculture Permit must be submitted by an applicant (in the case of a corporation, an officer or shareholder; in the case of a partnership, a general partner) on a form available from the NOAA Fisheries Service RA at least 180 days prior to the date the applicant desires the permit to be effective.

(2) An applicant must provide all information indicated on the application form, including, but not limited to:

i. Applicant's name, address, and telephone number.

ii. Business name, address, telephone number, and date the business was formed.

iii. Description of the exact location (i.e., GPS coordinates) and dimensions of the proposed aquaculture facility and proposed site, including a map of the site to scale.

iv. A list of allowable aquaculture species to be cultured; estimated start up production level by species; and the estimated maximum total annual poundage of each species to be harvested from the aquaculture facility.

v. Name and address or specific location of each hatchery that would provide juvenile organisms for grow-out at the proposed aquaculture facility located within the Gulf of Mexico EEZ and a copy of any relevant, valid state or federal aquaculture permits issued to the hatchery.

vi. Prior to issuance of a Gulf Aquaculture Permit, a copy of all currently valid federal permits (e.g., ACOE Section 10 Permit and EPA NPDES permit) applicable to the proposed aquaculture site, facilities, or operations.

vii. A description of the allowable aquaculture systems to be used, including, but not limited to the size and dimensions of allowable aquaculture systems, a description of the mooring system(s) used to secure the allowable aquaculture system(s), and documentation of the allowable aquaculture system's ability to withstand physical stress, such as hurricanes, wave energy, etc.

viii. A description of the equipment and methods necessary for feeding, transporting, maintaining, and removing cultured species from allowable aquaculture systems.

ix. A copy of the valid USCG certificate of documentation or, if not documented, a copy of the valid state registration certificate for each vessel involved in the aquaculture operation; and documentation or identification numbers for any aircraft or vehicles involved.

x. Documentation certifying the applicant has posted an assurance bond sufficient to cover the costs of removal of all components of the aquaculture facility, including cultured organisms remaining in allowable aquaculture systems, from the Gulf EEZ. The assurance bond would not be required to cover the costs of removing an oil and gas platform. The RA will provide applicants a form and associated guidance for complying with the assurance bond requirement.

xi. Certification by the applicant that all broodstock used to provide juveniles to the aquaculture facility were originally harvested from U.S. waters of the Gulf of Mexico, and were from the same population or sub-population of fish or invertebrates (based on best available science) where the aquaculture facility is located, or progeny of such wild broodstock, and that each individual broodstock was marked or tagged at the hatchery to allow for identification of those individuals used in spawning.

xii. Certification by the applicant that no genetically modified organisms (GMO) or transgenic organisms are used or possessed in the aquaculture facility. A GMO is an organism that has been transformed by the insertion of one or more transgenes (an isolated gene sequence often, but not always, derived from a different species than that of the recipient). A transgenic animal is an animal whose genome contains a nucleotide sequence that has been intentionally modified in vitro, and the progeny of such an animal. NOAA Fisheries may sample cultured organisms to determine genetic lineage and will order the removal of all cultured organisms upon a determination that GMOs or transgenic organisms were used or possessed at an aquaculture facility.

xiii. Certification by the applicant that a contractual arrangement with an identified aquatic animal health expert to provide services to the aquaculture facility has been obtained. An aquatic animal health expert is defined as a licensed doctor of veterinary medicine or is certified by the American Fisheries Society, Fish Health Section, as a "Fish Pathologist" or "Fish Health Inspector". A copy of the license or certification must also be provided to NOAA Fisheries Service.

xiv. A copy of an emergency disaster plan developed for and to be used by operator of the aquaculture facility, that includes, but is not limited to, procedures for preparing allowable aquaculture systems, offshore aquaculture equipment, and cultured organisms in the event of a disaster (e.g., hurricane, tsunami, harmful algal bloom, chemical or oil spill, etc).

xv. Information sufficient to document eligibility as a U.S. citizen or permanent resident alien. This information includes, but is not limited to, corporate structure and shareholder information.

xvi. Any other information concerning the aquaculture facility or its operations or equipment, as specified on the application form.

xvii. Any other information that may be necessary for the issuance or administration of the Gulf Aquaculture Permit, as specified on the application form.

(b) Operational Requirements and Restrictions

(1) At least 25 percent of allowable aquaculture systems approved for use at an aquaculture facility at the time of permit issuance must be placed in the water at the permitted aquaculture site within 2 years of issuance of the aquaculture permit, and allowable species for aquaculture must be placed in the permitted aquaculture system(s) within 3 years of issuance of the permit. Failure to comply with these requirements will be grounds for revocation of the permit. A permittee may request a one-year extension to the above time schedules in the event of a catastrophe (e.g., hurricane). Requests must be made in writing and sent to the RA. The RA will approve or deny the request after determining if catastrophic conditions exist and whether or not the permittee was affected by the catastrophic conditions. The RA shall provide the determination and the basis for it, in writing to the permittee.

(2) The permittee must obtain and submit to NOAA Fisheries Service a signed certification from the owner(s) of the hatchery from which fingerlings or other juvenile organisms are obtained indicating broodstock have been individually marked or tagged (e.g., via a Passive Integrated Transponder, coded wire, dart, or internal anchor tag) to allow for identification of those individuals used in spawning. The permittee must also obtain and submit to NOAA Fisheries Service signed certification from the owner(s) of the hatchery indicating that fin clips, or other genetic materials, were collected and submitted for each individual brood animal in accordance with procedures specified by NOAA Fisheries Service. These certifications must be provided by the permittee each time broodstock are acquired by the hatchery or used for spawning.

(3) Prior to stocking cultured animals in an allowable aquaculture system in the Gulf EEZ, the permittee must provide NOAA Fisheries Service a copy of a health certificate (suggested form is USDA/APHIS VS 17-141, OMB 0579-0278) signed by an aquatic animal health expert (as defined in (a)(2)(xiv)) certifying cultured animals were inspected and determined to be free of World Organization of Animal Health (OIE) reportable pathogens (or additional pathogens

that are subsequently identified as reportable pathogens in the National Aquatic Animal Health Plan as implemented by the USDA, Commerce, and Interior).

(4) Permittee must maintain a minimum of one properly functioning electronic locating device (e.g., GPS device, pinger with radio signal) on each allowable aquaculture system, i.e., net pen or cage, placed in the water at the aquaculture facility.

(5) The permittee must conduct feed monitoring and management practices in compliance with Environmental Protection Agency regulations at 40 CFR 451.21 (Appendix H).

(6) Permittee must comply with all applicable monitoring and reporting requirements specified in their valid ACOE Section 10 permit and valid Environmental Protection Agency National Pollutant Discharge Elimination System permit.

(7) A permittee must inspect allowable aquaculture systems, including mooring and anchor lines, for entanglements or interactions with marine mammals, protected species, and migratory birds. If entanglements or interactions are observed, they must be reported as specified in Action 8, Preferred Alternative 2(c)(2).

(8) Use of drugs, pesticides, and biologics must comply with all applicable Food and Drug Administration, EPA, and U.S. Department of Agriculture regulations (e.g., Food, Drug and Cosmetic Act, 21 USC 321; Clean Water Act, 40 CFR 122; 9 CFR 101-124; 21 CFR 500-599; and 40 CFR 150-189).

(9) Cultured finfish must be maintained whole with heads and fins intact until landed on shore. Until landed on shore, spiny lobster must be maintained whole with the tail intact.

(10) Except for authorized broodstock associated with a hatchery in the Gulf EEZ, possession of wild fish or invertebrates at or within the boundaries of an aquaculture facility's restricted access zone is prohibited (Action 7 and Alternative 2(n) in Action 8).

(11) Possession and transport of any wild fish or invertebrates aboard an aquaculture operation's transport or service vessels, vehicles, or aircraft is prohibited, except when harvesting broodstock as authorized by NOAA Fisheries Service.

(12) A permittee must provide NOAA Fisheries Service employees and authorized officers access to the aquaculture facility to conduct inspections or sampling necessary to determine compliance with the applicable regulations (e.g., sample cultured organism to determine genetic lineage) relating to aquaculture in the Gulf EEZ. NOAA Fisheries Service shall

conduct at least annual inspections of each permitted aquaculture facility.

(13) A permittee may only obtain juvenile organisms for grow-out at an aquaculture facility from a hatchery located in the U.S.

(14) Species cultured at an aquaculture facility in the Gulf EEZ can only be landed ashore between 6 a.m. and 6 p.m., local time.

(15) Any vessel transporting cultured organisms to or from an aquaculture facility must stow fishing gear as follows:

(i) A longline may be left on the drum if all gangions and hooks are disconnected and stowed below deck. Hooks cannot be baited. All buoys must be disconnected from the gear; however, buoys may remain on deck.

(ii) A trawl net may remain on deck, but trawl doors must be disconnected from the trawl gear and must be secured.

(iii) A gillnet must be left on the drum. Any additional gillnets not attached to the drum must be stowed below deck.

(iv) A rod and reel must be removed from the rod holder and stowed securely on or below deck. Terminal gear (i.e., hook, leader, sinker, flasher, or bait) must be disconnected and stowed separately from the rod and reel. Sinkers must be disconnected from the down rigger and stowed separately.

(v) All other fishing gear must be stored below deck or in an area where it is not normally used or readily available for fishing.

Discussion and Rationale

Action 2 considers three alternatives for specifying permit requirements and restrictions. In addition to the three alternatives considered above, the Council considered many other application and operational requirements and restrictions. Alternatives considered, but rejected by the Council are summarized in Appendix D.

Alternative 1 would not specify any requirements or restrictions when issuing a permit to an aquaculture facility. **Alternative 2** would require a facility to meet the requirements set forth in an EFP. **Preferred Alternative 3** would specify numerous application and operational requirements for permit issuance and aquaculture facility operation. Key application requirements for **Preferred Alternative 3** would include general contact information, documentation to determine citizenship and corporate structure, descriptions of allowable aquaculture systems and equipment, site coordinates, documentation of an assurance bond, an emergency disaster plan, identification of an aquatic animal health expert, certification that broodstock used for juveniles were harvested from waters of the Gulf, and certification that no genetically modified or transgenic species will be used for culture. Key operational requirements for **Preferred Alternative 3** include: a use it or lose it permit provision, documentation that broodstock are marked or tagged, certification that cultured animals are pathogen free prior to stocking, various monitoring requirements, gear stowage requirements, and landing restrictions. Requirements also include the use of drugs, biologics, and pesticides in compliance with regulations of other federal agencies, and maintenance of one locating device on each allowable aquaculture system.

Specifying application requirements will allow managers to assess the impacts of a proposed facility by obtaining necessary information about the operation prior to permitting. Application requirements will also be used to effectively enforce the aquaculture program. Operational requirements will allow managers to monitor and prevent, or minimize to the extent practicable, negative impacts on the physical and/or biological environments that may result from an aquaculture operation.

Summary Comparison of Physical, Biological, and Ecological Consequences

The alternatives specified in this section create (or do not create) requirements which must be met by an aquaculture facility. **Alternative 1** does not specify any application or operational requirements and would therefore have the most potential for causing negative effects on the physical, biological, and ecological environment. Not establishing application or operational requirements, which must be adhered to, would allow facilities to engage in activities that may be detrimental to the physical, biological, and ecological environments. **Alternative 2** maintains the use of the requirements and conditions specified for an EFP. However, these requirements may vary from permit to permit because the RA can set terms and conditions for the permit and there is a general lack of specificity provided in the EFP regulations. For these reasons, **Alternative 2** may not afford adequate protection to the physical, biological, and ecological environments. **Preferred Alternative 3**, in contrast, sets forth specific application and operational requirements intended to prevent or minimize impacts on the physical, biological, and ecological environments. These requirements, and the recordkeeping and reporting requirements in Action 8, are intended to ensure the operations of all offshore aquaculture facilities permitted in the Gulf are consistent with the MSFCMA National Standards (Section 6.12) and do not compromise Council objectives for wild fisheries.

All of the alternatives in Action 2 would indirectly affect the physical and biological environments. **Alternative 1** would not specify permit conditions and therefore would provide no protection to the physical or biological environments. Operations could conduct their businesses without any safeguards to prevent or mitigate environmental impacts associated with their operation. As a result, genetic modification of cultured species or use of transgenic species could occur and there could be increased risks of pathogens spreading to offshore cages and aquaculture facilities. Other operational issues include the inability to require removal of structures upon termination of an operation, little or no planning in the event of a disaster, and no or inadequate monitoring of physical, biological, and ecological impacts.

Alternative 2 would require permit applicants and permit holders meet the requirements specified for an EFP (50 CFR 600.745). EFP regulations require an applicant to submit the following information: Date of the application, relevant contact information, species expected to be harvested under the EFP, amount(s) of such harvest necessary to conduct the exempted fishing, arrangements for disposition of all regulated species harvested under the EFP, anticipated impacts on marine mammals or endangered species, and a statement of the purposes and goals of the exempted fishery for which an EFP is needed, including justification for issuance of the EFP. Additionally, the EFP applicant must provide documentation for each vessel to be covered by the EFP, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used. The RA or Science and Research Director, Southeast Region (SRD), as appropriate, may request additional information for determining issuance of an EFP. **Alternative 2** would afford more protection to the physical and biological environments than **Alternative 1**, but issuance of a permit would be based partly on information specified at the discretion of the RA or SRD.

The application and operational requirements specified in **Preferred Alternative 3** are designed specifically to minimize impacts on the physical, biological, ecological, and administrative environments and would therefore be of a greater benefit to these environments than either **Alternative 1** or **2**. Requirements under **Preferred Alternative 3**, as well as other requirements specified in this FMP, would give NOAA Fisheries Service the best scientific information available with which to evaluate proposed and permitted aquaculture operations (National Standard 2). In addition, fishing permits would be issued to those applicants most likely to ensure the most efficient and economical use of fishery resources (National Standards 5 and 7).

Alternative 3(a)(1) requires applicants to submit an application for an aquaculture permit at least 180 days prior to the desired date the applicant wants the permit effective. One-hundred-eighty days is considered a reasonable amount of time for NOAA Fisheries Service to complete all the necessary paperwork and review of an application. Additional time for processing a permit may be necessary if an application is incomplete. NOAA Fisheries Service would provide a written notice and a public comment period prior to issuance of an aquaculture permit, as described in Section 4.1.

Alternatives 3(a)(2)(i-ix and xv) would require applicants to submit the following information as part of the application: basic contact information, descriptions of the facility (i.e., coordinates), allowable systems and equipment proposed for use, a list of species to be cultured, copies of federal aquaculture permits, copies of valid certifications and documentation for vessels or aircraft, and information to document eligibility as a U.S. citizen or permanent resident alien. These requirements are intended to provide managers with basic information about the proposed aquaculture operation and facility to assist in permit approval, denial, or modification.

Alternative 3(a)(2)(x) would require permitted aquaculture firms to provide documentation that they have posted an assurance bond sufficient to cover the costs of removal of all components of an aquaculture facility. The assurance bond would also cover the costs of removing organisms with OIE-reportable pathogens, GMOs, and transgenic species if a permittee does not remove these organisms upon order by NOAA Fisheries Service (Action 2, Alternative 3(a)(2)(xiii) and Action 8, Alternative 2(d)). All oil, gas, and mineral extraction firms are required under MMS regulations to remove platforms and connecting pipe lines and return the ocean bottom to its original configuration (http://www.gomr.mms.gov/homepg/ regulate/regs/ntls/ntl00-g16.html). Additionally, the National Offshore Aquaculture Act of 2007 (Appendix B), as proposed, requires an assurance bond for removal of the aquaculture structures as a criterion of the siting permit. Requiring an assurance bond would eliminate the potential for navigation hazards in the event an operation terminates their business. It would also protect the biological and physical environment by preventing long-term damage to habitat and entanglement of wildlife in derelict gear (National Standard 9).

During public comment on the DPEIS, several organizations suggested the Council require an assurance bond to cover environmental damage. The Council discussed this issue at their October 2008 meeting and during previous meetings. The Council indicated that it is difficult to identify and define the risks for a bond to cover environmental damage. Additionally, during development of this FMP the Council included many monitoring and reporting requirements and restrictions (e.g., no GMO or transgenic species), which are intended to reduce risks to the environment.

NOAA Fisheries Service lacks the authority to retain the sum of any financial assurances as a condition of the aquaculture permit. Any funds NOAA Fisheries Service could receive through execution of an assurance bond would have to be deposited directly with the U.S. Treasury. Once deposited into the Treasury, funds cannot be withdrawn without an appropriation. Because NOAA Fisheries Service lacks the authority to retain and draw upon funds it receives, the bond may be executed with the signature of an additional entity as a surety, as is done by the ACOE. Based on ACOE regulatory guidance for assurance bonds, the surety agrees to ensure compliance with the permit if the ACOE determines the permit has defaulted.

Alternatives 3(a)(2)(xi-xiii) pertain to broodstock collection, genetic management, and aquatic animal health. Applicants would have to certify that all original broodstock used for producing juveniles were harvested from U.S. waters of the Gulf, and from the same population or sub-population where the facility is located **(Alternative 3(a)(2)(xii))**. This alternative will help ensure that the genetic make-up of cultured organisms originates from the same stock where the facility will operate. **Alternative 3(a)(2)(xiii)** would require applicants to certify that no genetically modified or transgenic species will be used for culture. In the event of escapement, this will ensure that cultured fish are genetically similar to the wild stock they originated from. **Alternative 3(a)(2)(xiv)** would require applicants to identify an aquatic animal health expert. This expert would be responsible for certifying juveniles as pathogen-free prior to stocking. Additionally, the animal health expert would be responsible for diagnosing pathogens if an outbreak occurs and reporting information about outbreaks to NOAA Fisheries Service. The aquatic animal health expert would have to be either a licensed doctor of veterinary medicine or certified by the American Fisheries Society, Fish Health Section, as a fish pathologist or fish health inspector.

Alternative 3(a)(2)(xiv) requires the applicant to have an emergency disaster plan in the event of a disaster. This plan would include, but is not limited to, procedures for preparing allowable systems, offshore aquaculture equipment, and cultured organisms. Requiring an emergency disaster plan will help businesses prepare their operations in the event of a disaster, thereby reducing risks of impacting the physical and biological environment.

The remaining alternatives (**Alternatives 3(a)(2)(xvi-xvii)**) would require other information concerning aquaculture operations and equipment necessary for issuance or administration of a permit. These alternatives are needed to ensure NOAA Fisheries Service has all relevant information necessary for making a decision to approve, disapprove, or deny issuance of an aquaculture permit.

Alternative 3(b) contains 15 operational requirements for marine aquaculture facilities. **Alternative 3(b)(1)** would specify a use it or lose it provision. Permittees would be required to deploy at least 25 percent of allowable aquaculture systems within two years of permit issuance and stock allowable species within these systems within three years. These time periods were considered reasonable for an aquaculture facility to begin operation, while also providing some flexibility in the event of a catastrophe. Failure to comply with these requirements will be grounds for revocation of the permit. In the event of a catastrophic event, permittees could apply for a one year extension to meet these requirements. If permittees do not meet these conditions, then their permit would be annulled. The intent of this alternative is to reduce the potential for speculative entry into the fishery.

Alternatives 3(b)(2) and **3(b)(3)** pertain to identification of broodstock and animal health certification. Permittees would be required to obtain documentation from the hatchery certifying broodstock are marked or tagged. Permittees would also be required to obtain and submit broodstock fin clips, or other genetic material, to NOAA Fisheries Service. Procedures for submitting genetic material would be specified by NOAA Fisheries Service. This requirement will allow for enforcement and monitoring in the event that genetic modification of cultured organisms is suspected. NOAA Fisheries Service personnel would be able to identify source broodstock using fin clips or other genetic material and compare it to the genetic make-up of offspring used for culture. **Alternative 3(b)(3)** would require cultured animals prior to stocking be certified by an aquatic animal health expert (as defined in **Alternative 3(a)(2)(xiii)**) as pathogen free. This requirement will be in the best interest of both the applicant and NOAA Fisheries Service. By inspecting and certifying cultured animals as pathogen-free, risks of transmitting pathogens to open ocean cages would be minimized or eliminated. This would also reduce the risk of wild species being infected by pathogens from cultured animals. If pathogens are discovered once fingerlings are stocked, NOAA Fisheries Service, in coordination with the USDA, could order the removal of those cultured organisms upon a determination by an aquatic animal health expert that a suspected pathogen(s) exist and poses a threat to the health of wild aquatic organisms (Action 8, Preferred Alternative 2(d)).

Alternative 3(b)(4) would require permittees to have one properly functioning locating device on each net pen or cage used for aquaculture. Locating devices should be monitored (batteries, etc.) to ensure their function after storm events. In the event that the net pen or cage breaks free of its mooring and becomes located away from the original permitting site, the locating device could be used to find it and either remove it from the water or return it to the permitted site. This alternative will help to prevent long-term damage to habitat and increase navigational safety.

Alternatives 3(b)(5) through **3(b)(8)** specify monitoring requirements that a permittee would have to abide by when operating an aquaculture facility. Effluent and monitoring requirements are required by the EPA and specified in NPDES permits issued by the EPA. These requirements are intended to monitor water quality, including benthic and organic loading. EPA regulations at 40 CFR 451.21 include feed monitoring and management practices. Permittees would be required to abide by these existing EPA feed monitoring and management practices. Aquatic animal production facilities that produce 100,000 pounds or more per year of aquatic animals must employ efficient feed management and feeding strategies that limit feed input to the minimum amount reasonably necessary to achieve production goals and sustain targeted rates of aquatic animal growth (40 CFR 451.21(a)). These strategies must minimize the accumulation of uneaten food beneath the net pens/cages through the use of active feed monitoring and management practices. These practices may include devices such as video cameras, digital scanning sonar, and upweller systems; monitoring of sediment quality beneath the pens; monitoring of benthic community quality beneath the pens; capture of waste feeds and feces; or other good husbandry practices approved by the permitted authority. Permittees would also have to abide by monitoring and reporting requirements specified by the ACOE and EPA in Section 10 and NPDES permits (Preferred Alternative 3(b)(6). Requirements in ACOE and EPA permits previously issued for aquaculture operations in the Gulf of Mexico include: baseline assessment of a site before operation, effluent limitations and restrictions, an environmental monitoring plan, and several other restrictions and prohibitions. NOAA Fisheries Service would require permittees to regularly inspect allowable aquaculture systems for entanglements and interactions with marine mammals, protected species, and migratory birds. The EPA has a similar regulatory requirement for inspecting net pens/cages for damage (40 CFR 451.21(f)). Regular inspection will help ensure allowable aquaculture systems are properly maintained and repaired. Regular inspections will also allow for rapid diagnose of entanglements or interactions, in the event that they occur. If an entanglement or interaction occurs, then permittees would be required to report this information to NOAA Fisheries Service. The FDA, EPA, and USDA regulate drugs, pesticides, and biologics. Permittees would be required to comply with the existing regulations of these agencies (Food, Drug and Cosmetic Act, 21 USC 321; Clean Water Act, 40 CFR 122; 9 CFR 101-124; 21 CFR 500-599; and 40 CFR 150-189). FDA drugs approved for use in aquaculture can be found at: http://www.fda.gov/cvm/drugsuseaqua.htm.

Alternatives 3(b)(9-12) are all intended to assist in enforcement of aquaculture. Cultured fish would have to be maintained with heads and fins intact until landed on shore to allow proper identification of cultured species. Possession of wild fish or invertebrates at a facility would be prohibited (with the exception of permitted broodstock) to prevent wild fish or invertebrates from being harvested and sold as "cultured" species. Permittees would be required to provide NOAA Fisheries Service access to their facility and equipment to conduct sampling and determine compliance with aquaculture regulations. NOAA Fisheries Service would also conduct at least one on-site inspection each year. The intent of the inspection would be to determine compliance with applicable regulations related to aquaculture.

Alternative 3(b)(13) would require aquaculture facilities to obtain species for grow-out only from a U.S. hatchery. Allowing organisms to be obtained from non-U.S. hatcheries for grow-out would reduce the effectiveness of enforcement and make it difficult to enforce other regulatory provisions contained in this FMP (e.g., species cannot be genetically-modified or transgenic, cultured species must be certified as pathogen-free before stocking in an allowable aquaculture system, etc.).

Alternative 3(b)(14) would restrict the landing of cultured species between the hours of 6 a.m. and 6 p.m. This restriction is consistent with the Red Snapper IFQ program and proposed Grouper-Tilefish IFQ program, and is intended to aid enforcement. In conjunction with the notification requirements in Action 8, this alternative will allow law enforcement the opportunity to meet aquaculture vessels dockside when landing cultured species.

Alternative 3(b)(15) requires vessels transporting cultured organisms to meet various stowage requirements depending on the type of gear onboard. These requirements are similar to existing gear stowage requirements for various Gulf area closures (e.g., Madison-Swanson and Steamboat Lumps closed areas). Similar to **Alternatives 3(b)(13)** and **3(b)(14)**, this requirement is intended to aid enforcement by reducing the potential for illegal harvest of wild fish that may be later sold as "cultured" fish.

<u>Summary Comparison of Socioeconomic and Administrative Consequences</u>
Alternative 1 is the status quo alternative. This alternative would not specify application requirements, operational requirements or restrictions for aquaculture in the Gulf EEZ. Without additional restrictions, offshore aquaculture firms could produce negative externalities, such as genetically modified or transgenic species (if authorized by the FDA), abandon equipment, introduce disease to wild stocks, and engage in other environmentally damaging activities that are not regulated by other federal agencies. The resulting economic and social costs to fishermen, their families and communities would be substantial if native stocks, livelihoods, and fishing communities were permanently lost and essential habitats destroyed.

Alternative 1 would allow an offshore aquaculture operation to place cages, pens and platforms anywhere it wanted in the Gulf EEZ and occupy an area of the EEZ indefinitely, thereby enclosing it. That would leave the possibility that offshore aquaculture operations could site themselves in historical and increasing fishing areas, which would displace fishermen from use of some or all of those areas and cause economic losses of some to all landings and fishing and fishing-related incomes and employment. Those losses of fishing grounds could be economically and socially devastating to fishermen, their families and fishing communities.

Alternative 1 would be economically beneficial to offshore aquaculture and hatchery operations as they would not be required to incur costs to reduce the negative externalities of unrestricted aquaculture placement and management.

Alternative 2 would impose the same restrictions as those required by the application and issuance requirements of an EFP; however, these restrictions are intended for temporary research operations and would not explicitly establish restrictions to address potential negative externalities that could be caused by long-term commercial offshore aquaculture operations if left unregulated. See Section 6.2.4.2 for more information on the application requirements and terms and conditions of an EFP. With no specified preclusions, under **Alternative 2**, aquaculture operators would not necessarily have to incur economic costs to reduce the magnitude of negative externalities they produce. However, based on a 2003 EFP considered by NOAA Fisheries Service and the Council, numerous conditions and restrictions would likely be established by NOAA Fisheries Service prior to permit issuance or as a condition of permit use. These included notifying NOAA Fisheries Service prior to changes in hatcheries, certifying fingerlings as disease-free prior to stocking, using only chemotherapeutants approvded by the FDA and prescribed by a qualified veterinarian, prohibiting the use of toxic chemicals as defined in 50 CFR 622.2, immediately notifying NOAA Fisheries Service of damage to cages, escapement, disease outbreaks, and entanglements, quarterly reporting requirements, recordkeeping requirements, retaining fish with heads and fins intact, notifying NOAA Fisheries Service Law Enforcement at least 24 hours prior to harvest, and periodic inspections by NOAA Fisheries Service. See Section 5.3.3.2 for more information about this particular EFP. Many of the conditions and restrictions described above are similar to those summarized in **Preferred Alternative 3** or in Action 8, **Preferred Alternative 2**. Consequently, **Alternative 2** may impose similar or slightly smaller economic costs on aquaculture and hatchery operations and similar or slighter larger social costs on fishermen, their families and fishing communities when compared to **Preferred Alternative 3**.

Preferred Alternative 3 would establish specific application requirements and operational requirements and restrictions. Overall, these requirements and restrictions are expected to reduce the magnitude of negative externalities that would be produced by an unrestricted offshore aquaculture industry. **Preferred Alternative 3** is the most transparent of the three alternatives because it specifies what the application requirements and operational requirements and restrictions would be. This alternative would also give NOAA Fisheries Service more of the information that is required to adequately estimate the impacts that a proposed offshore operation would be expected to have on the human and biological environment. Although **Preferred Alternative 3** would likely be the most burdensome alternative on a prospective and operating offshore aquaculture business, these requirements are expected to be the most effective among the alternatives considered in reducing the incidence and severity of the potential negative impacts of an offshore aquaculture industry on the biological environment, wild-harvest fisheries, and associated communities.

With regard to the administrative environment, **Alternative 1** would not require any conditions to be met or maintained by an aquaculture facility. This would limit the oversight to administrators of an aquaculture facility's operations, which would in the long-term, require more effort by NOAA Fisheries Service staff to ensure that a facility was operating in the intended manner of this FMP. **Alternative 2** would maintain the status quo of using conditions specified in an EFP; however, as stated above, neither an EFP nor its terms and conditions are intended to support and regulate long-term commercial aquaculture. **Alternative 2** would potentially result in variable permit conditions and restrictions from one permit application to another making it burdensome on NOAA Fisheries Service administrators to assess a facility's operations and its potential impact on the various environments. **Preferred Alternative 3** would create a consistent set of conditions, which would provide the necessary information to administrators, thereby allowing them to more efficiently and consistently evaluate permits. Therefore, **Preferred Alternative 3** would benefit the administrative environment more than either **Alternative 1** or **2**.

4.3 Action 3: Duration of the Permit

Alternative 1: No Action, Exempted Fishing Permits are effective for no longer than one year unless otherwise specified in the EFP or a superseding notice or regulation (50 CFR 600.745(b)(4)).

Preferred Alternative 2: Aquaculture permits are effective for:

- **a) 5 years**
- **b) 10 years and may be renewed in 5 year increments (Preferred)**
- **c) 20 years**
- **d) Indefinitely.**

A Gulf Aquaculture Permit remains valid for the period indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulatory requirements or the aquaculture facility is sold and the permit has not been transferred.

Discussion and Rationale

Alternative 1 would retain the current effective period of an EFP, which is one year unless otherwise specified. **Preferred Alternative 2** would establish a different effective period ranging from 5 years (**Alternative 2(a)**) to indefinitely (**Alternative 2(d)**).

The time period a permit is effective is primarily an economic consideration, although it could have ramifications to the physical and biological environments if a permit is not regularly reviewed for compliance with governing regulations. Under all of the subalternatives in **Preferred Alternative 2**, a permit would remain valid for the period indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulatory requirements or the aquaculture facility is sold and the permit is not transferred. Actions 2 and 8 in this FMP require operations comply with several operational, recordkeeping, and reporting requirements. These requirements will alert NOAA Fisheries Service of potential problems occurring at a facility and provide them with a basis for modifying, suspending, or revoking a permit in accordance with subpart D of 15 CFR part 904. Additionally, Action 2 specifies that NOAA Fisheries Service staff will conduct on-site visits, at least annually, to review operations at aquaculture facilities. Site visits will allow NOAA Fisheries Service an opportunity to determine compliance with applicable regulations.

Short permit durations (less than ten years) would make it: 1) difficult to obtain financing for aquaculture operations and 2) undesirable for investors to commit money to such operations. Offshore aquaculture entrepreneurs will, in many instances, need to finance their operations. Lenders will provide financing only if there is sufficient certainty that the aquaculture operation can pay principal and interest on any loans. Obtaining capital has been a problem for offshore aquaculture entrepreneurs. Longer permit durations are expected to reduce risk costs associated with short-term output fluctuations and/or market fluctuations, which would increase the likelihood of entrepreneurs obtaining financing. Even if financing is available, costs will accrue each time a permit is renewed, so longer renewal periods will minimize costs. The choice of ten years is believed to strike the best balance between providing adequate time to establish operations and funding, while not granting excessively long permit duration.

Summary Comparison of Physical, Biological, and Ecological Consequences

The time period of permit issuance will not have any direct effects on the physical, biological, or ecological environments. However, Action 2 will have indirect effects on these environments. As discussed above, the duration of the permit is of primary importance for business planning purposes and not for monitoring effects on the physical, biological, and ecological environments. Regardless of the effective time period of the permit, NOAA Fisheries Service will regularly (at minimum annually) review operations for compliance with governing regulations. Aquaculture facilities will be required to meet operational requirements specified in Action 2 and recordkeeping and reporting requirements specified in Action 8, as well as other requirements specified in Actions 4, 5, and 6. NOAA Fisheries Service staff will also conduct site visits at facilities to ensure facilities are operating properly and not causing unacceptable impacts to the physical, biological, and ecological environments (Alternative 3(b)(12) in Action 2). The effects on these environments are expected to be similar for all alternatives. However, **Alternative 1** would provide the shortest time period for permit issuance of any of the alternatives, and would allow NOAA Fisheries Service to deny renewing a permit, rather than revoke a permit, if an operation was causing negative environmental impacts to the physical and biological environments. **Alternatives 2(a)** through **2(d)** would allow permits for 5, 10, or 20 years, or indefinitely. If NOAA Fisheries Service encountered problems with revoking, suspending, or modifying a permit before it expired, then shorter permit durations would be more beneficial to the physical and biological environments, than longer permit durations, because after expiration a permit may not be renewed.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative. The duration of an aquaculture permit under the status quo would be of the same duration as an EFP, which is one year unless otherwise specified. The financial commitments of an aquaculture operation are expected to be sufficiently large enough that it is unlikely that an operation would be willing to commit their resources to a project permitted for one year or the short-term. As a result, **Alternative 1** would not be expected to be conducive to the development of an offshore aquaculture industry in the Gulf EEZ.

Preferred Alternative 2 considers alternative permit durations from 5 years to indefinitely. The potential impacts of the development of an aquaculture industry have been previously discussed, such as displacement from historical and increasing fishing areas, and the following discussion focuses only on nuances to these impacts that would be expected to result from the duration of the aquaculture permit. Under each of the alternatives, the permit would remain valid for the specified period of time unless revoked, suspended, or modified.

Alternatives 2(a) and **2(c)** would make the aquaculture permits effective for 5 years and 20 years, respectively. Neither alternative would allow the permit to be renewed. If not renewable, a permit of short duration may have little to no market value. Whether the duration of a permit is of sufficient length or not to generate revenues greater than the fixed and variable costs, the value of a non-renewable permit would fall precipitously towards the end of its useful life, and there is little incentive to preserve the value of a soon-to-be invalid transferable permit. The overall potential limitations of the permit duration and non-renewal condition could effectively reduce the number of operations that are expected to enter the fishery within the next 10 years, thereby reducing both the potential costs and potential benefits of an offshore aquaculture industry. The cessation of aquaculture operations when their permits expire would open the aquaculture sites to alternative uses. This would include access to normal fishing activities, and the associated social and economic benefits that might have existed prior to the use of the site by an aquaculture or hatchery operation.

Preferred Alternative 2(b) would make the aquaculture permit effective for 10 years with renewal opportunity in 5-year increments. The process for renewing a permit is specified in Table 4.1.1. Renewal would require completion and submission of a renewal application form to the NOAA Fisheries Service RA. Unlike **Alternative 2(d)**, **Preferred Alternative 2(b)** would require additional time and costs associated with permit renewal. Additionally, because this alternative offers renewal that **Alternative 2(c)** does not, it offers the possibility of a permit life greater than 20 years, which would be more attractive to those offshore aquaculture interests seeking longer or permanent operations. **Preferred Alternative 2(b)** does not preclude the possibility of unlimited renewals of a permit, and therefore, it could result in fishermen and other resource users from being displaced from areas of the EEZ indefinitely. Conversely, failure to satisfy current renewal requirements or renewal requirements implemented subsequent to the approval of this proposed FMP, could limit the ultimate life of a permit.

Alternative 2(d) would allow the offshore aquaculture permit to be effective indefinitely. Consequently, an offshore aquaculture operation would never require renewal of a permit to continue operations. A permit of this duration would give the permit holder exclusive use of a particular site for an indefinite amount of time, which would prevent others from benefiting from use of that site for an indefinite amount of time. While this alternative would be expected to be the most attractive and economically beneficial to aquaculture businesses, the converse would be true for existing and alternative future users of the sites.

The administrative burden of reviewing applications for permit renewals decreases as the length of time between renewals increases. Therefore, **Alternative 1** has a greater negative impact than **Alternative 2** on the administrative environment. **Alternative 2(d)** has the least impact on the administrative environment, followed by **Alternatives 2(c)**, **2(b)**, and **2(a)**.

4.4 Action 4: Species Allowed for Aquaculture and included in the Aquaculture Fishery Management Unit[3].

Alternative 1: No Action, do not specify species allowed for aquaculture and do not develop an Aquaculture Fishery Management Unit.

Alternative 2: Allow the aquaculture of all finfish species native to the Gulf of Mexico in the reef fish, red drum, and coastal migratory pelagics FMPs and include these species in the Aquaculture Fishery Management Unit[3].

Alternative 3: Allow the aquaculture of all species native to the Gulf of Mexico that are managed by the Council and included in a FMP management unit, except goliath grouper, Nassau grouper, and those species in the shrimp and coral[3] fishery management units, and include these species in the Aquaculture Fishery Management Unit.

Preferred Alternative 4: Allow the aquaculture of all species native to the Gulf of Mexico that are managed by the Council and included in a Council FMP management unit, except those species in the shrimp and coral[3] FMP management units, and include these species in the Aquaculture Fishery Management Unit. The Council will send a letter to NOAA Fisheries Service requesting development of concurrent rulemaking to allow aquaculture of highly migratory species.

<u>Discussion and Rationale</u>

---

[3] Live rock will continue to be regulated by management measures approved in Amendments 2 and 3 to the Coral and Coral Reefs FMP.

Action 4 considers species that would be allowed for aquaculture in the Gulf. **Alternatives 2-4** would also include allowable species in the Aquaculture FMP's fishery management unit (FMU). Alternatives range from no action, not specifying species allowed for aquaculture **(Alternative 1)**, to allowing only native finfish in the Gulf (**Alternative 2**), to allowing culture of all species native to the Gulf that are managed by the Council, except shrimp, corals, and grouper species currently prohibited from harvest (**Alternative 3**). The action and proposed alternatives would not affect the aquaculture of live rock, which will continue to be regulated by management measures approved in Amendments 2 and 3 to the Coral and Coral Reefs FMP.

Endangered and threatened species under the Endangered Species Act (ESA) in the Southeast Region cannot be used for commercial aquaculture. Section 9 of the ESA makes it unlawful for any person to take any endangered species of fish or wildlife. Take, as defined in the statute and regulations at 50 CFR Part 222.102, means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct. Under Section 4 of the ESA, the take prohibition may be extended to species listed as threatened if deemed necessary and advisable for the conservation of the species. NOAA Fisheries Service has issued regulations extending the prohibition of take, with limited exceptions, for all threatened species listed in the Southeast Regions. None of the take exceptions allow for the commercial aquaculture of any Southeast Region endangered or threatened species.

A "Species of Concern" (SOC) is a species or vertebrate population for which there is concern or great uncertainty about its status. Species of Concern are not listed under or protected by the ESA. No specific protections would be afforded SOC with regard to commercial aquaculture. Rather, the purpose of the SOC list is to: 1) increase public awareness about these species, 2) identify those species potentially at risk and in need of protective measures before listing under the ESA becomes necessary, 3) identify data deficiencies and uncertainties associated with the status of the species, 4) work cooperatively with regional co-managers and interest groups to obtain the information necessary to evaluate species status and threats, 5) identify conservation opportunities, and 6) work proactively with federal and state agencies, Native American tribes, and the public to conserve the species.

Alternative 1, the no action alternative, would not specify which species would be allowed for aquaculture and would not establish an Aquaculture FMU. If **Alternative 1** were chosen, a permit applicant could request permission to culture any species, whether it was native to the Gulf or not, managed by the Council, vertebrate or invertebrate, or already protected from fishing in the Gulf EEZ. NOAA Fisheries Service would then determine whether culture of a particular species was acceptable, rather than the Council making that determination through this FMP. Under **Alternative 1**, NOAA Fisheries Service, in consultation with the U.S. Fish and Wildlife Service (USFWS) could determine if culture of a particular species was acceptable, including non-native species. The Lacey Act Amendments of 1981 (16 U.S.C. §§ 3371-3378) provide the USFWS with authority to regulate the import, transport, and possession of non-native species. Regulations at 50 CFR 16.13 state that no live fish, mollusks, crustaceans, or any progeny or eggs of these organisms may be released into the wild except by a state wildlife agency having jurisdiction over the area of release or by persons having prior written permission from such agency. However, such approval of non-native species is unlikely because the USFWS and NOAA co-chair the federal Aquatic Nuisance Species Task Force, whose task is to prevent and control aquatic nuisance species, and implement the Non-indigenous Aquatic Nuisance Prevention and Control Act (NANPCA) of 1990. Further, the Council's Ad Hoc Aquaculture Advisory Panel has also indicated opposition to the use of any non-native species for aquaculture.

Alternatives 2 and **3** and **Preferred Alternative 4** would limit culture to species managed by the Council that are native to the Gulf. All of these alternatives would include allowable aquaculture species in the fishery management plan's FMU. These species could not be genetically modified or transgenic (Action 2). **Alternative 2** would further limit culture to only managed finfish, while **Alternative 3** would allow culture of Council managed finfish and invertebrates, but would prohibit culture of shrimp, corals, and goliath and Nassau grouper. **Preferred Alternative 4** would allow culture of all species managed by the Council, except shrimp and corals, and would include a request to NOAA Fisheries Service to develop concurrent regulations to allow aquaculture of HMS. Shrimp are currently raised in onshore ponds and it is expected that offshore aquaculture of this species will not be cost effective. The market for shrimp is already dominated by imports, which are not limited except through anti-dumping regulations. Corals are currently prohibited from harvest and high demand for culturing corals for commercial purposes is not expected. Additionally, the culture of live rock is covered under existing permit regulations at 50 CFR 622.4.

There is some evidence of the detrimental effects of non-native species on ecosystems. If non-native species were allowed to be cultured in the Gulf EEZ and some escaped, it could have negative impacts on the biological, physical, and ecological environments (see discussion in section 6.1). Potential negative effects caused by the introduction of non-native species include: competition with wild stocks, changes to community structure and food web dynamics, and modification of genetic structure if mating occurred with wild stock. In the most extreme cases in which non-native species become established, fundamental changes in ecosystem function may result in habitat degradation, transmission of pathogens, and loss of other species. Allowing only species native to the Gulf and managed by the Council will ensure that any species being cultured are under an FMP and managed according to the National Standards, including National Standard 3 which requires that a stock be managed as a unit throughout its range, to the extent practicable. Action 2 requires all broodstock used to produce juveniles for aquaculture should be harvested from U.S. waters of the Gulf and be from the same population or sub-population where the aquaculture facility is located.

From the perspective of aquaculture companies, **Alternative 1** would be the least restrictive and allow culture of any species if NOAA Fisheries Service approved it. **Preferred Alternative 4** would be the second least restrictive as it would only prohibit culture of non-native species, shrimp, and corals. **Alternative 2** would allow aquaculture of all finfish managed by the Council. These species are likely to include all or most of those selected by the aquaculture industry initially for culture in the Gulf (see discussion in Section 5.2.2). Red drum, cobia, and mutton snapper have already been cultured successfully. Many of the species in the Council's Reef Fish FMU have been successfully spawned in captivity; therefore fingerlings of these species could be produced for commercial culture. Spiny lobster and stone crab stocks are prohibited from being cultured under **Alternative 2**. **Alternative 3** would allow culture of all species managed by the Council, except shrimp, coral, goliath and Nassau grouper (Appendix E for a list of all species included in the Council's FMPs).

Preferred Alternative 4 would allow for culture of all managed species listed in Appendix E, except corals and shrimp. Species overfished or undergoing overfishing would be allowed to be cultured. As such, culture of those species would increase optimum yield for those stocks and may reduce fishing mortality consistent with National Standard 1, if demand for wild caught fish is reduced.

Given the domestic and international aspects of fisheries for Atlantic HMS, including tunas, swordfish, sharks, and billfish, these fisheries are managed under the dual statutory authorities of the Magnuson-Stevens Act and the Atlantic Tunas Convention Act. The Fishery Conservation Amendments of 1990 (Public Law 101-627), vested managerial authority for Atlantic HMS in the U.S. Exclusive Economic Zone with the Secretary. Acknowledging this management structure, as well as the interest and expertise of the Council on aquaculture issues, the Council is requesting NOAA Fisheries Service develop concurrent rulemaking pertaining to aquaculture activities for Atlantic HMS in the Gulf (**Preferred Alternative 4**).

Summary Comparison of Physical, Biological, and Ecological Consequences

An indirect effect of culturing native fishes is the harvest of wild broodstock for use in aquaculture. If harvest is significant, this could result in increased fishing pressures and mortality on wild stocks. Harvest of native wild fish to support aquaculture activities could have negative indirect effects on the biological, physical, and ecological environments. The extent of these negative effects would depend on the extent of broodstock harvest allowed. Action 8 would provide NOAA Fisheries Service authority to regulate broodstock collection activities, including the quantity of fish harvested.

Introduction of non-native species through aquaculture could cause negative effects to the physical, biological, and ecological environments. Allowing the culture of non-native species by NOAA Fisheries Service is unlikely, because the intent of this FMP is to allow the culture of species already managed by the Council and those regulated by the HMS division of NOAA Fisheries Service. Additionally, the USFWS and NOAA co-chair a federal Aquatic Nuisance Species Task Force that oversees the potential introduction of aquatic nuisance species, suggesting both agencies would advocate a very precautionary approach to introduction of non-native species.

Wild harvest of some species (i.e., Nassau grouper, goliath grouper, red drum, and corals) is currently prohibited in the Gulf EEZ. If a legitimate "cultured" source of these species developed, it could provide a means to sell illegally harvested fish, by marking them as "cultured." Numerous law enforcement requirements in Actions 2 and 8 are intended to diminish the potential for illegal harvest. **Alternative 3** would prohibit culture of goliath and Nassau grouper. **Alternatives 2-4** would prohibit culture of corals. **Alternative 1** would allow culture of all these species, potentially causing poaching. **Preferred Alternative 4** would allow culture of Nassau and goliath grouper and red drum. By allowing culture of these species, poaching of wild stocks might occur, negatively impacting the biological and ecological environments by increasing fishing mortality on these species. However, recent developments in forensic methodology would allow law enforcement to analyze the origin of individuals to determine if fish were wild or cultured. Numerous operational requirements, such as recordkeeping, and reporting specified in Actions 2 and 8 would help NOAA Fisheries Service enforce aquaculture regulations to ensure poaching of wild stocks does not occur.

Another concern with allowable species for aquaculture is the use of GMOs and transgenic animals. The Council has made it clear that GMOs and transgenic animals will not be allowed in the Gulf EZZ aquaculture industry (Action 2). Therefore, it is unlikely any alternative will cause negative effects to the physical, biological, and ecological environments due to the Council's and other agencies restrictions on the use of non-native, GMOs, and transgenic animals in the aquaculture industry. Instead, the range of alternatives merely provides a range of flexibility for aquaculture facilities in choosing species used for production. **Alternative 1** potentially could have the greatest effect on the physical, biological, and ecological environment of the Gulf by not prohibiting the use of non-native species for aquaculture.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative, which would allow an aquaculture applicant to request to culture any species native to the Gulf of Mexico, such as shrimp. (See Actions 1 and 8 which restricts harvesting of wild broodstock and aquaculture of species to those native to the Gulf). Under this alternative, all Gulf fishermen could be adversely affected by direct competition with Gulf offshore fish farms. **Alternative 1** would have the greatest adverse economic and social impacts on fishermen, their families and communities caused by direct competition.

If the restriction on native species specified in **Preferred Alternative 2** of **Action 1** were not accepted, then the status quo alternative could allow the culture of any species, native or non-native to the Gulf (unless prohibited or restricted by other federal laws and agencies), thereby creating the greatest social and economic threat to fishermen, their families, and associated industries and communities. While the flexibility to potentially culture any species may create the best business opportunity for the aquaculture sector, it would have the greatest adverse economic and social impacts of the alternatives.

Alternative 2 would restrict the set of allowable species to finfish that are native to the Gulf and in the reef fish, red drum and coastal migratory pelagics FMPs. These species would be included in the Aquaculture FMU. It would be expected to reduce the number of Gulf fishermen, fishing families and communities that could be economically and socially harmed by Gulf offshore aquaculture operations that directly compete with fishermen. For example, Gulf shrimpers, stone crabbers and lobstermen would not be in direct competition with offshore aquaculture producers, although they would still compete with foreign imports. By restricting the set of native species that can be cultured, **Alternative 2** could reduce the potential economic benefits to offshore aquaculture operations and associated businesses.

Alternative 3 would set the number of allowable native species between the number allowed by **Alternative 1** and the number allowed by **Alternative 2**. Consequently, **Alternative 3** would, similar to **Alternative 2**, reduce the potential costs to Gulf fishermen, fishing families, and communities that could be economically and socially harmed by the development of a Gulf offshore aquaculture industry, but not as much as **Alternative 2** because more species could potentially be cultured. Similarly, by not reducing the set of allowable species as much as **Alternative 2**, **Alternative 3** would not be expected to reduce the potential economic benefits to offshore aquaculture operations and associated businesses as great as **Alternative 2**.

Preferred Alternative 4 would set the number of allowable species between the number allowed by **Alternative 1** and **Alternative 3**, meaning it would allow the second greatest number of native species that could potentially be cultured. Consequently, the economic and social impacts of **Preferred Alternative 4** would be expected to be less than those of **Alternative 3** and greater than those of **Alternative 1**. In effect, the potential social and economic harm to the wild-harvest industry under **Preferred Alternative 4** would be expected to be greater than under **Alternative 3**, but less than under **Alternative 1**, while the potential reduction in economic benefits to the aquaculture industry under **Preferred Alternative 4** would be expected to be less under **Alternative 3**, but greater under **Alternative 1**.

The administrative burden of restricting allowable species would be expected to increase in proportion to the range of cultured species. Although **Alternative 1** would impose no enforcement burden on NOAA Fisheries Service, especially if it allowed the culture of any species, the administrative burden incurred to respond to human and biological harm caused by the potential introduction of non-native species could be substantial. **Alternatives 2** through **4** reduce the risk of such environmental damages and associated burden.

4.5 Action 5: Allowable Marine Aquaculture Systems

Alternative 1: No Action, do not specify allowable systems for offshore marine aquaculture in the Gulf EEZ.

Alternative 2: Allow only cages and net pens for offshore marine aquaculture in the Gulf EEZ.

Preferred Alternative 3: The NOAA Fisheries Service RA will evaluate each proposed aquaculture system on a case-by-case basis and approve or deny use of the proposed system for offshore marine aquaculture in the Gulf EEZ.

To assist the RA in evaluating the structural integrity of a proposed aquaculture system, an applicant would be required to submit to the RA documentation (e.g., engineering analyses, computer and physical oceanographic model results) sufficient to evaluate the ability of the aquaculture system(s) (including moorings) to withstand physical stresses associated with major storm events, e.g. hurricanes, storm surge. The NOAA Fisheries Service RA will also evaluate the proposed aquaculture system and its operations based on potential risks to essential fish habitat, endangered or threatened marine species, marine mammals, wild fish or invertebrate stocks, public health, or safety. The RA may deny use of a proposed aquaculture system or specify conditions for using an aquaculture system based on a determination of such significant risks. The RA's evaluation will be based on information provided by the applicant as well as consultations with NOAA Fisheries Service and NOAA offices/programs. If the RA denies use of a proposed aquaculture system or specifies conditions for its use, the RA shall provide the determination and the basis for it, in writing to the applicant.

<u>Discussion and Rationale</u>

Any aquaculture system must be robust enough to withstand open ocean conditions, prevent fish escapes, and effectively disperse wastes. The biological, physical, and ecological impacts of the alternatives under consideration differ primarily in the types of systems allowed for aquaculture. **Alternative 1** would not specify allowable systems for marine aquaculture in the Gulf EEZ. Presumably, permittees could use any type of system regardless of whether it was capable of withstanding the physical stresses of the marine environment. However, such a system would still need to be reviewed to ensure it does not violate other federal laws (e.g., ESA or EFH requirements under the MSFCMA). **Alternative 2** would allow only cages and net pens to be used for offshore aquaculture. This alternative would essentially be adequate for culturing all allowable species preferred by the Council in Action 4. **Preferred Alternative 3** would provide NOAA Fisheries Service with authority to conduct case-by-case reviews of allowable aquaculture systems. In research on how other countries and states permitted systems allowed for aquaculture, it was apparent that no single set of standards existed for permitting aquaculture grow-out systems. Because there is a wide variety of cage and net pen sizes and shapes, as well as other allowable systems, flexibility in allowing a system is necessary. This will ensure systems have sufficient structural integrity and will allow for innovation as aquaculture system technology develops.

The main purpose of **Preferred Alternative 3** is to allow NOAA Fisheries Service to review each system to ensure maximum environmental safeguards are being used while at the same time allowing operations to use the most recent technology developed for aquaculture systems. Permit applicants would be required to submit documentation, such as computer model results, sufficient to evaluate the ability of the aquaculture system to withstand physical stresses associated with major storm events. This information is considered necessary for NOAA Fisheries Service to make a meaningful evaluation of the proposed system. NOAA Fisheries Service would further evaluate the proposed aquaculture system based on potential risks to EFH, endangered or threatened marine species, marine mammals, wild fish stocks, public health, or safety. Use of a system could be denied or modified if significant risks are determined by the RA.

Summary Comparison of Physical, Biological, and Ecological Consequences

The alternatives under consideration differ in the extent to which they would limit environmental impacts and the use of novel fish culture systems. Those that limit use of novel systems may have negative effects on biological, ecological, socioeconomic, and administrative environments. **Alternative 1** would not specify allowable systems for marine aquaculture. An applicant could use any system imaginable to conduct aquaculture. No standards or requirements would be specified for NOAA Fisheries Service to approve or disapprove a proposed system. However, such a system would be reviewed by various NOAA Fisheries Service programs to ensure it does not pose a threat or risk to EFH or protected resources, as required by the MSFCMA and ESA.

Alternative 2 would only allow the use of cages and net pens. This alternative would not allow the use of future aquaculture system designs, which do not meet the definition of a cage or net pen. As technology evolves, future designs that are not cages or net pens may be developed that reduce impacts to the biological, physical, or ecological environments. If this occurs, then the Council would need to amend their FMP for aquaculture to allow these systems.

Alternative 2 would allow any type of cage or net pen proposed by an applicant, regardless of structural integrity. NOAA Fisheries Service would not have authority to limit use of such systems, unless the system was not a cage or net pen. As a result, the risk of harm to habitat and marine resources could be increased if these systems are more easily damaged by storms and other weather events. Additionally, no standards or requirements would be specified for NOAA Fisheries Service to approve or disapprove systems proposed under **Alternative 2**.

Preferred Alternative 3 would allow case-by-case review of proposed systems. Allowable aquaculture systems could include cages and net pens, as well as other types of systems that may be used to grow finfish, spiny lobster, and stone crabs. This alternative would allow for new and innovative systems to be used as technology evolves. Any proposed system would have to be approved by NOAA Fisheries Service and determined to be reliable and environmentally sound. Factors that would be used to determine the reliability of a system would include risks to essential fish habitat, endangered or threatened marine species, marine mammals, wild fish stocks, public health, and safety. Other important factors to consider when evaluating allowable aquaculture systems include:

1) Potential for habitat degradation;
2) Types of materials comprising the system;
3) Efficiency of mechanisms used for feeding;
4) Ability of the system to disperse wastes; and,
5) Accessibility of system for maintenance and repair.

Because **Preferred Alternative 3** would require NOAA Fisheries Service review, it would allow unreliable systems to be disapproved that otherwise may have been used if **Alternatives 1** or **2** were selected.

Alternative 2 would not require NOAA Fisheries Service to review a cage or net pen design before it was deployed. **Preferred Alternative 3** would require such a review. The alternatives in order from least to most likely to adversely affect the physical, biological, and ecological environments due to lack of detection of a faulty marine aquaculture system design are as follows: **Preferred Alternative 3**, **Alternative 2,** and **Alternative 1**. The alternatives in order from least to most likely to adversely affect the physical, biological, and ecological environments due to not using new innovative fish culture system designs are as follows: **Preferred Alternative 3**, **Alternative 1**, and **Alternative 2**. Therefore, the more restrictive the review process is for approving aquaculture systems, such as allowing an array of gear types, the less potential for negative effects on the physical, biological, and ecological environments.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative and would not specify and explicitly restrict the types of systems used in Gulf offshore aquaculture. However, NOAA Fisheries Service would still have the authority to approve or disapprove specific systems despite unspecified evaluation criteria and determination of appropriateness. **Alternative 1** increases the possibility that the review criteria would not be as stringent as the other alternatives and that an inappropriate system may be allowed, increasing the likelihood that negative externalities created by such a system, with associated adverse social and economic effects, would occur. Absent specific process and criteria requirements, aquaculture operations may be able to reduce their costs by avoiding more detailed and careful consideration of systems capable of reducing these externalities.

Alternative 2 would restrict the types of systems used to cages and net pens. This is the most restrictive of the alternatives and may offer the greatest benefit in terms of reducing the negative externalities of inadequate or inappropriate systems and economic and social costs associated with these externalities. From the aquaculture industry perspective, however, a restriction on the types of systems that can be used could reduce the potential economic viability and returns from the operation because it may disallow the use of a system that best meets the operation's production goals. Adequate reduction of the likelihood of the incidence and/or magnitude of negative externalities may be possible using a system other than cages or net pens.

Preferred Alternative 3 would not specify allowable systems, but would specify the process and criteria that would be employed for system approval. **Preferred Alternative 3** would not be as restrictive as **Alternative 2,** but would be more specific than **Alternative 1**. Consequently, **Preferred Alternative 3** has the potential flexibility to allow the use of a system that best or better meets the operation's production goals, while addressing the need to reduce potential negative externalities and associated economic and social costs associated with those externalities. Because the evaluation process is more clearly stated in **Preferred Alternative 3** than under **Alternative 1**, the likelihood of the use of inappropriate systems would be reduced under **Preferred Alternative 3**. However, the cost to the prospective aquaculture operator to satisfy the evaluation process may be greater under **Preferred Alternative 3** than under **Alternative 1.**

In terms of the administrative burden, **Preferred Alternative 3** is expected to have the largest burden in terms of reviewing a proposed system; however, the burden caused by negative externalities due to use of inappropriate systems is expected to be the least among the alternatives.

4.6 Action 6: Marine Aquaculture Siting Requirements and Conditions

Alternative 1: No Action, do not designate areas in the Gulf of Mexico EEZ where aquaculture would be allowed. The ACOE would permit sites for aquaculture. NOAA Fisheries Service and the Council would continue to review and comment on ACOE siting permits.

Alternative 2: Establish marine aquaculture zones within which individual sites would be permitted. Marine aquaculture facilities may only be sited in the zones specified in Figure 4.6.1. Coordinates for these areas are specified in Table 4.6.1.

Preferred Alternative 3: Establish the following criteria for siting marine aquaculture facilities:

- **(a) Prohibit marine aquaculture in Gulf EEZ marine protected areas and marine reserves, Habitat Areas of Particular Concern, Special Management Zones, and permitted artificial reef areas as specified in 50 CFR 622, and coral reef areas as defined in 50 CFR 622.2.**
- **(b) No offshore aquaculture facility may be sited within 1.6 nautical miles (3 km) of another offshore aquaculture facility.**
- **(c) To allow fallowing and rotation of allowable aquaculture systems within a site permitted by the ACOE and approved by NOAA Fisheries Service, the permitted site must be at least twice as large as the combined area encompassed by the allowable aquaculture systems (e.g., cages and net pens).**
- **(d) Applicants for a Gulf Aquaculture Permit must conduct and submit a baseline environmental assessment of the proposed aquaculture site to NOAA Fisheries Service with their application packet. Data, results, and analyses from the baseline environmental assessment must be provided to NOAA Fisheries Service for consideration during review of a permit application. The baseline environmental assessment must be conducted, and analyses, data, and results must be summarized, based on guidance and procedures specified by NOAA Fisheries Service. If a permit is approved, applicants must also monitor the site in accordance with NOAA Fisheries Service guidance and procedures.**

Baseline environmental assessment and monitoring guidance and procedures will be developed in consultation with the ACOE, EPA, and other federal agencies having authority to regulate offshore aquaculture. Guidance will include, but will not be limited to, procedures and methods for: 1) conducting diver and video surveys, 2) measuring hydrographic conditions, 3) collecting and analyzing benthic sediments and infauna, and 4) measuring water quality characteristics. The guidance and procedures will be available from the RA and on the NOAA Fisheries Service aquaculture website.

(e) The NOAA Fisheries Service RA will evaluate siting criteria in addition to those preferred criteria selected by the Council in Alternative 3(a-d) on a case-by-case basis. Criteria considered by the NOAA Fisheries Service RA during case-by-case review would include, but would not be limited to, depth of the site, current speeds, substrate type, the frequency of harmful algal blooms (HAB) or hypoxia at the proposed site, marine mammal migratory pathways, and the location of the site relative to commercial and recreational fishing grounds and important natural fishery habitats (e.g., seagrasses). The NOAA Fisheries Service RA may deny use of a proposed aquaculture site based on a determination that such a site poses significant risks to essential fish habitat, endangered species, or threatened marine species, will result in user conflicts with commercial or recreational fishermen or other marine resource users, the depth of the site is not sufficient for the allowable aquaculture system(s), substrate and currents at the site will inhibit the dispersal of wastes and effluents, the site poses significant risks of mortality to the cultured species due to low dissolved oxygen or HAB, or other grounds inconsistent with FMP objectives or applicable federal laws. The information used by NOAA Fisheries Service for siting a facility with regard to proximity to commercial and recreational fishing grounds would include, but is not limited to, electronic logbooks from the shrimp industry, logbook reported fishing locations, siting information from previously proposed or permitted aquaculture facilities, and other data that would provide information regarding how the site would interact with other fisheries. Such a determination by the RA shall be based on consultations with NOAA Fisheries Service offices and programs and siting and other information submitted by the permit applicant. If a proposed site is denied, the RA shall provide the determination and the basis for it, in writing to the permit applicant.

Discussion and Rationale

Action 6 would establish either broad zones for aquaculture activities or criteria that would be used to site a marine aquaculture facility. **Alternative 1** would allow NOAA Fisheries Service to evaluate potential aquaculture sites only through commenting on ACOE Section 10 permit applications. However, these applications may not provide all the information NOAA Fisheries Service would need, and would require NOAA Fisheries Service to abide by the final ACOE decision when authorizing a permit. **Alternative 2** and **Preferred Alternative 3** would allow NOAA Fisheries Service to conduct its own evaluation of the proposed areas. **Alternative 2** would establish 13 zones for conducting marine aquaculture (Figure 4.6.1). These zones would encompass 10,392 nm^2 of the Gulf, or approximately 5 percent of the entire Gulf EEZ (209,226 nm^2). The zones are based on GIS maps developed by the Gulf States Marine Fisheries Commission (GSMFC), which identify suitable areas for aquaculture (see pink area in Figure 4.6.1). The zones represent approximately 36 percent of the total area considered to be suitable for conducting offshore marine aquaculture in the Gulf EEZ. Areas not considered suitable for aquaculture included: navigational fairways, lightering zones, platform safety zones, permitted artificial reef areas, HAPCs, coral areas, marine reserves, MPAs, areas of high shrimp fishing effort based on electronic logbooks, hypoxic areas (< 2 mg/l), areas with current speeds of 0.1 m/s or less, depths less than 25 m (82 feet), and depths greater than 100 m (328 feet). Under **Alternative 2**, additional authority would still likely need to be provided to NOAA Fisheries Service to evaluate specific sites within a pre-authorized zone.

Preferred Alternative 3 would establish specific criteria for siting, but would not establish predefined zones. Based on the criteria summarized in sub-alternatives 3(a) and 3(e), approximately 28,719 nm^2 would be suitable for offshore aquaculture in the Gulf (see pink area in Figure 4.6.1). This area would represent approximately 13.7 percent of the entire Gulf EEZ. In order to protect unique areas that are more sensitive to adverse environmental effects, aquaculture would be prohibited in marine protected areas and marine reserves, HAPCs, special management zones (SMZs), permitted artificial reef areas, and coral reef areas (**Alternative 3(a)**). Operations would also be required to be sited at least 1.6 nm from each other (**Alternative 3(b)**) and the permitted site would need to be twice as large as the area encompassed by allowable aquaculture systems to allow fallowing and rotation of cages, net pens, and other allowable systems (**Alternative 3(c)**). Additionally, permit applicants would be required to conduct a baseline assessment (and subsequent environmental monitoring) at the proposed site in accordance with NOAA Fisheries Service guidance and procedures (**Alternative 3(d)**). NOAA Fisheries Service would coordinate the development of guidance and procedures with the EPA, ACOE, and other federal agencies with regulatory authority over marine aquaculture. A baseline assessment is necessary for NOAA Fisheries Service to ensure siting would not unacceptably affect EFH, important benthic habitat, and marine resources. Follow-up environmental monitoring will allow NOAA Fisheries Service and other federal agencies to assess changes at the site resulting from aquaculture operation. Both the National Offshore Aquaculture Act of 2007 (Appendix B) and the California Sustainable Oceans Act of 2006 include baseline assessment and monitoring requirements. NOAA Fisheries Service would also be provided authority to conduct case-by-case reviews of specific sites (**Alternative 3(e)**). The case-by-case approach of **Preferred Alternative 3** would provide for a more comprehensive review process for specific sites that is not provided by **Alternative 2**.

Summary Comparison of Physical, Biological, and Ecological Consequences

Proper siting of an aquaculture facility is critical to both an operation's success and the protection of the surrounding physical, biological, and ecological environments. Offshore aquaculture is often mentioned as an environmentally safer alternative to inshore or onshore aquaculture because facilities are often sited in deep water with sufficient current flow to disperse wastes. However, if a facility is not properly sited, there is potential for significant environmental impacts to occur. These could range from habitat degradation of surrounding benthos to changes in water quality (e.g., low dissolved oxygen or increased nutrients). To prevent impacts to the biological and physical environments, Action 6 proposes either developing siting criteria for facilities (**Preferred Alternative 3**) or developing aquaculture zones for siting marine aquaculture facilities (**Alternative 2**).

Recent environmental monitoring studies conducted off Puerto Rico, New Hampshire, and Hawaii indicate benthic and organic loading tends to be fairly localized around open-ocean aquaculture cages (Alston et al. 2005; Lee et al. 2006; Rapp 2006; UNH 2006). Alston et al. (2005) conducted bimonthly chemical and macroinvertebrate sampling at a control site and sites 0, 20 (65 feet), and 40 meters (131 feet) away from two cages off the coast of Puerto Rico in 2002 and 2003. There were no significant differences detected among control and sampling sites around cages in ammonia-N, nitrate-N, nitrite-N, phosphate concentrations, organic matter, including nitrogen in the sediments, nitrogen beneath the cages, and total carbon beneath the cages (Alston et al. 2005). Lee et al. (2006) sampled oxidation reduction potential (ORP) near two Pacific threadfin cages off Hawaii. ORP was measured at two sites near the cages and at two control sites. ORP measurements were consistently lower at sites near the cages when compared with control sites and ORP measurements increased after the initial sampling event (Lee et al. 2006). Rapp (2006) conducted environmental monitoring in 2004 and 2005 at one of the same cages used in the Alston et al. (2005) study. No organic loading in the benthic water was observed for the first seven months of the study. In the eighth month of the study and thereafter an increase in benthic water organic loading was observed due to a change in the composition and integrity of the fish feed (Rapp 2006). The study reported no increase in organic loading in the sediment for the duration of the project. Lastly, environmental monitoring off New Hampshire (UNH Marine Aquaculture Center 2006) found no evidence of aquaculture activities affecting water quality parameters (e.g., suspended sediments, chlorophyll, and dissolved oxygen). However, the study did indicate that lower total community taxa in areas or zones surrounding the cages may be early signs of increased organic loading.

Alternative 1 would maintain status quo regulations and would not provide NOAA Fisheries Service with the authority to site aquaculture facilities. NOAA Fisheries Service would continue to work with the ACOE when providing comments on proposed aquaculture facility sites. **Alternative 1** would not place any further limits on where aquaculture facilities could be located; therefore allowing maximum flexibility for aquaculture companies. The ACOE could potentially approve a site despite NOAA Fisheries Service' objection; however, the ACOE would have to consider any comments and conservation measures provided by NOAA Fisheries Service. Because criteria for approving a site likely will differ between these two agencies, there is potential for a site to be approved that results in negative effects to the physical and biological environments, such as habitat degradation and diminished water quality.

Alternatives 2 and **3** would provide NOAA Fisheries Service with authority to evaluate a proposed aquaculture site, rather than relying on the review and comment procedures of another agency (**Alternative 1**). This would allow NOAA Fisheries Service to disapprove aquaculture sites proposed for aquaculture, which may have been previously approved by the ACOE. **Alternative 2** would establish 13 predefined aquaculture zones. A benefit to this approach would potentially include the reduced time for approving a facility's location. However, a negative effect would include establishing broad zones that may not include sufficient detail to prevent or minimize localized, small-scale impacts associated with a particular site. If this alternative is selected by the Council as the preferred, then additional authority would likely need to be provided to NOAA Fisheries Service to evaluate specific sites within each of the predefined zones.

Table 4.6.1 Latitude and longitude coordinates for Alternative 2 aquaculture zones shown in Figure 4.6.1.

Zone	Coordinate	Latitude	Longitude	Area(nm)
1	A	25.46	-83.41	2233
	B	24.85	-83.41	
	C	24.85	-82.32	
	D	25.46	-82.25	
2	A	25.97	-83.43	526
	B	25.94	-83.43	
	C	26.02	-82.62	
	D	26.43	-82.62	
3	A	27.48	-84	2503
	B	26.17	-83.57	
	C	26.34	-83.04	
	D	27.48	-83.36	
4	A	28.1	-84.39	911
	B	27.69	-84.39	
	C	27.69	-83.68	
	D	28.1	-83.68	
5	A	29.33	-85.23	854
	B	28.54	-84.84	
	C	28.54	-84.69	
	D	29.33	-84.69	
6	A	30.01	-86.35	310
	B	29.74	-86.35	
	C	29.51	-86.08	
	D	30.01	-86.08	
7	A	29.98	-87.52	207
	B	29.58	-87.52	
	C	29.58	-87.35	
	D	29.98	-87.35	
8	A	29.82	-88.37	350
	B	29.38	-88.37	
	C	29.38	-88.04	
	D	29.6	-88.04	
9	A	28.39	-91.33	729
	B	28.19	-91.33	
	C	28.19	-90.48	
	D	28.56	-90.02	
	E	28.56	-90.29	
	F	28.39	-90.55	
10	A	28.8	-92.49	514
	B	28.49	-92.49	
	C	28.35	-92.04	
	D	28.8	-92.04	
11	A	28.18	-95.96	644
	B	27.99	-95.86	
	C	28.49	-94.96	
	D	28.63	-95.13	
12	A	27.47	-96.84	304
	B	27.12	-96.84	
	C	27.12	-96.58	
	D	27.35	-96.5	
13	A	26.32	-96.82	307
	B	26.09	-96.82	
	C	26.09	-96.38	
	D	26.32	-96.38	

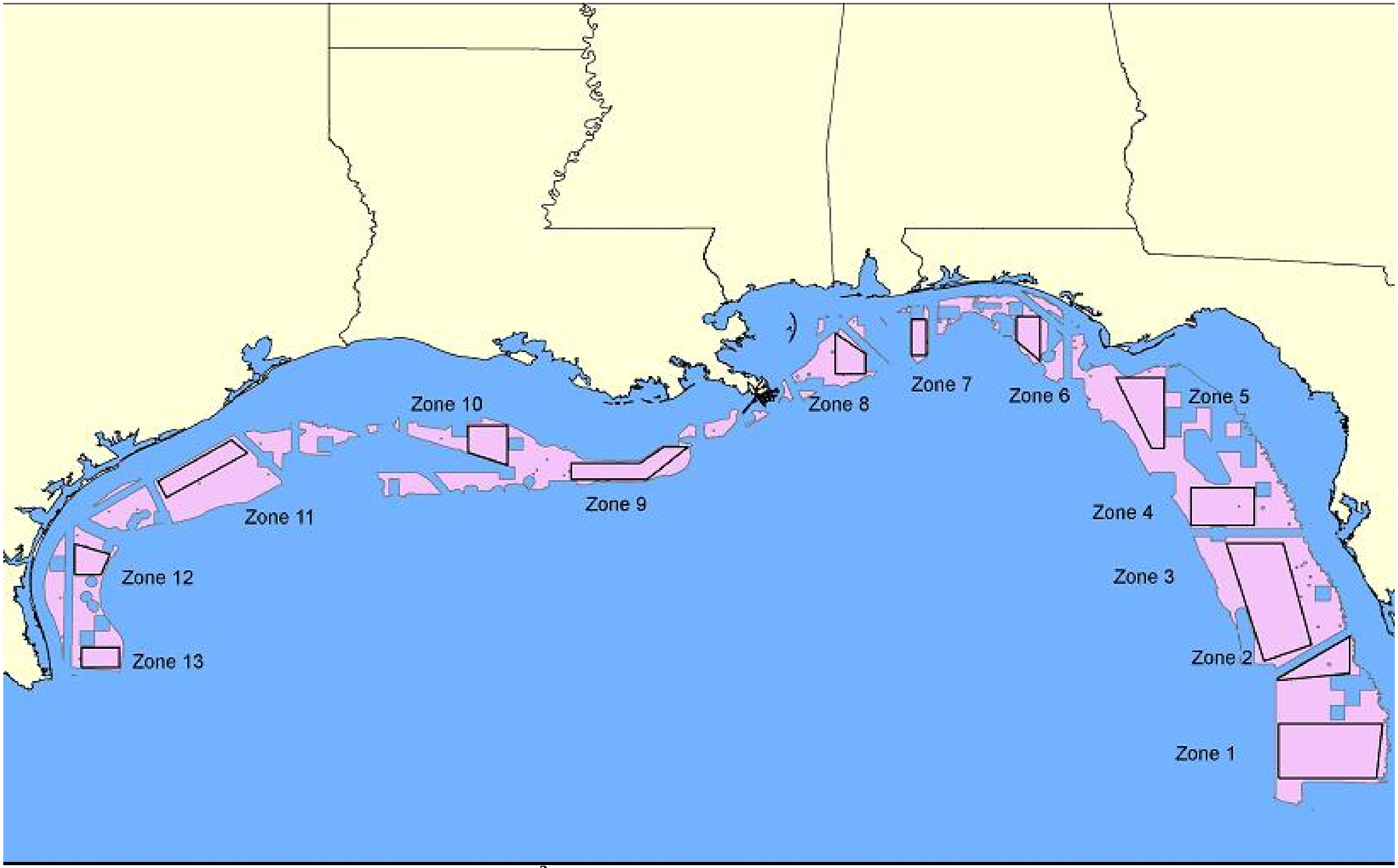

Figure 4.6.1 Aquaculture zones 1-13 (10,392 nm^2) developed for Action 6, Alternative 2. Pink represents all areas considered suitable for aquaculture in the Gulf EEZ (28,719 nm^2).

Preferred Alternative 3 would prohibit aquaculture operations from being sited in certain areas and would allow NOAA Fisheries Service to review proposed aquaculture sites on a case-by-case basis. Explicitly prohibiting aquaculture in sensitive areas, such as coral reefs and HAPCs, will afford protection to those habitats and prevent, or minimize to the extent practicable, any impacts from occurring (e.g., nutrient loading) that are associated with aquaculture operation. The requirement to conduct a baseline assessment (and subsequent environmental monitoring) at a site will ensure that facilities are not sited in sensitive areas that are vulnerable to impact and damage. If a permit is issued, assessment data will also provide managers and scientists with a baseline to assess impacts of an aquaculture facility once operation begins. Requiring facilities to be sited at least 1.6 nm (3 km) from one another might limit transmission of pathogens between facilities. Siting aquaculture facilities close to one another allows for transmission of diseases due to contaminated water from nearby facilities. British Columbia and Chile currently require salmon farms to be separated at least 3 km apart, while Scotland requires salmon farms to be separated 8 km apart (http://www.agf.gov.bc.ca/fisheries/Finfish/cabinet/Summary_Table_BC-World_Aqua_Regs.pdf). Nova Scotia, Newfoundland, Maine, and New Brunswick require salmon farms to be separated by 1 km or less. There is no widely accepted standard for how far apart facilities should be sited, but estimates range from 300 m to 8 km depending on the species being cultured and the country or state responsible for management (Levings et al. 1995). The farther apart facilities are sited, the lower the likelihood of water from one facility contaminating water at another facility. Lastly, requiring a site to be twice as large as the area encompassed by allowable aquaculture systems will allow permittees to rotate allow systems. This is analogous to terrestrial farming and crop rotation practices, and will diminish the build-up of wastes and organic matter below cages, net pens, and other allowable systems, thereby benefiting the physical environment.

Overall, **Preferred Alternative 3** would include the most thorough review of a proposed site, and therefore would provide the greatest net benefits to the physical and biological environments. **Alternative 2** would provide benefits to the physical and biological environment on a broad scale by prohibiting aquaculture in areas not suitable for aquaculture, but this alternative may not adequately address small scale siting considerations within broader aquaculture zones. **Alternative 1** would not provide NOAA Fisheries Service with authority to regulate siting of aquaculture facilities. NOAA Fisheries Service would continue to comment on ACOE siting permits to ensure proper siting of facilities. This alternative would relegate NOAA Fisheries Service role to only commenting on permits under the authority of other federal agencies, potentially providing the least protection to the physical and biological environments.

<u>Summary Comparison of Socioeconomic and Administrative Consequences</u>

Alternative 1 is the status quo alternative and would not designate areas where aquaculture would be allowed. Consequently, without such restriction, an offshore aquaculture could place cages, pens and platforms anywhere it wanted in the Gulf EEZ, subject to ACOE siting permits. As a result, **Alternative 1** would have the greatest possibility among the alternatives considered that offshore aquaculture operations could site themselves in historical and increasing fishing areas, and displace fishermen from the use of some or all of these areas, which could cause the economic loss of some or all landings, incomes and employment, which could be economically and socially significant to fishermen, their families and communities. From the aquaculture industry perspective, **Alternative 1** would give the largest flexibility in siting offshore aquaculture operations and, among the alternatives, offer the largest economic benefits and lowest costs associated with siting an operation. For example, an operation could select a site for its proximity to shoreside support facilities and markets in order to reduce operating costs. Unlike **Preferred Alternative 3**, additional costs associated with selection of a site (e.g., baseline assessment) may also be avoided if not required by other federal agencies.

Alternative 2 would restrict the areas where aquaculture could occur by establishing marine aquaculture zones. By restricting the areas where aquaculture operations could be located, this alternative would be expected to reduce the likelihood of sites placed in historical and increasing fishing areas, thereby reducing the potential adverse economic and social impacts on fishermen, their families, and communities caused by the loss of fishing areas to offshore aquaculture. Restricting site placement may also reduce the magnitude of negative externalities that are created by site location, although zones could create density issues that could exacerbate environmental externalities. Under **Alternative 2**, aquaculture businesses may have to incur higher set-up costs, operational costs, and productivity effects as a result of the siting restrictions, particularly if the zones are located farther offshore than economically optimal or operation densities within zones increase environmental externalities that adversely affect operations.

Preferred Alternative 3 would restrict the areas where offshore aquaculture can occur, the distance between sites, and the total area of each site. While **Preferred Alternative 3** would restrict site placement, sites would not be limited to marine aquaculture zones. Site placement restriction would be expected to reduce the magnitude of the negative externalities that may be created by unrestricted site location. **Preferred Alternative 3** would reduce and may eliminate offshore aquaculture operations from being sited within historical and increasing fishing areas, thus reducing the costs to fishermen, their families and communities associated with reduced harvests and/or higher operating expenses. The restriction on the distance between aquaculture sites would be expected to reduce the density of offshore aquaculture. While this restriction would increase the costs of transiting from one affiliated facility to another, reducing the density of sites reduces the potential for cumulative external effects, such as combined effluent flows, larger exclusion areas that would need to be transited around, etc. The site size requirement would be expected to reduce the environmental problems, and associated social and economic costs, of production concentration by allowing systems to be rotated within the area of the site. As with any restrictions on site locations, aquaculture businesses may face higher set-up and operating expenses relative to **Alternative 1**, but there should be greater flexibility under **Preferred Alternative 3** than under **Alternative 2**.

With regard to the administrative environment, **Alternative 2** would require establishment of aquaculture zones, which would be evaluated before any permit applications are received. If an applicant proposed to place a system in such an area, their permit application would likely be processed more quickly, reducing the burden on the administrative environment. Although **Preferred Alternative 3** would have higher administrative costs than simply commenting on an ACOE Section 10 permit, a thorough review of a proposed site would prevent higher administrative costs later from failure of a system. Similarly, review of baseline assessments and other siting criteria in **Preferred Alternative 3** would take more staff time than would **Alternative 1** and **Alternative 2**.

4.7 Action 7: Restricted Access Zones for Marine Aquaculture Facilities

Alternative 1: No Action, Do not establish restricted access zones around marine aquaculture facilities.

Preferred Alternative 2: Create a restricted access zone for each aquaculture facility. The boundaries of an aquaculture facility's restricted access zone shall correspond with the coordinates on the approved ACOE Section 10 permit. No recreational and no commercial fishing other than offshore aquaculture may occur in the restricted access zone. No fishing vessels may operate in or transit through the restricted access zone unless the vessel has on board a signed copy (i.e., a permit with an original signature and not a copy of the signature) of the facilities' aquaculture permit onboard. The permittee must mark the restricted access zone with a floating device such as a buoy at each corner of the zone. Each floating device must clearly display the aquaculture facility's permit number and the words "RESTRICTED ACCESS" in block letters at least 6 inches in height and in a color that contrasts with the color of the floating device.

Alternative 3: Prohibit recreational and commercial fishing and the operation or transit of federally permitted fishing vessels within:
- **(a) 100 feet (30 meters) of allowable marine aquaculture systems.**
- **(b) 500 feet (152 meters) of allowable marine aquacultures systems.**
- **(c) 1,640 feet (500 meters) of allowable marine aquaculture systems.**

Discussion and Rationale
Section 6.8 examines the effects of the various Action 7 alternatives relative to each other within the biological, physical, ecological, economic, social, and administrative environments.

The MSFCMA provides the Council with authority to create zones that exclude fishing or the operation of fishing vessels. Section 303(b)(1) of the MSFCMA states that any FMP prepared by the Council may "designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear". Examples are zones where fishing with certain gear is prohibited and marine reserves where fishing and possession of fish is prohibited. Restricting access around aquaculture facilities would afford some protection to an operation's equipment and the product being cultured as well as increase safety by reducing encounters between vessels and aquaculture equipment (National Standard 10). While limiting usage near these sites could be seen as a user conflict by denying the public from accessing these areas, this measure will likely reduce user conflicts by not allowing competing uses in the same area. The most prudent way to overcome this issue is for an aquaculture facility to request a large enough area to afford protection from potential user conflict problems (e.g. a vessel accidentally cutting a mooring line while passing the facility), while at the same time maximizing other user groups' access to the open ocean. The Council's preferred alternative best achieves this balance.

Summary Comparison of Physical, Biological, and Ecological Consequences

Establishing restricted access zones around aquaculture facilities is primarily administrative, but does indirectly affect the physical, biological, and ecological environments. **Alternative 1** would not restrict access around a marine aquaculture facility. Fishing vessels could fish close to allowable aquaculture systems and vessels could transit in or through permitted aquaculture sites. These activities could result in damage to allowable aquaculture systems, including escapement of cultured fish. To minimize the risks of allowable aquaculture systems being damaged, **Preferred Alternative 2** and **Alternative 3** propose establishing restricted access zones for marine aquaculture facilities.

The zone for **Preferred Alternative 2** would correspond to the coordinates on the ACOE siting permit, which should be an area at least twice as large as the total area encompassed by the allowable aquaculture systems (e.g., cages and net pens) as required in the siting criteria of Action 6. The ACOE permit will determine the appropriateness of the siting permit based on "the extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited" (33 CFR 320.4(a)(2)(iii)). The USCG requires structures be marked with lights and signals to ensure compliance with private aids to navigation (33 C.F.R. 66.01). Title 33 C.F.R. 64 also requires the marking of structures, sunken vessels, and other obstructions for the protection of maritime navigation. Types of structures and their marking requirements can be found at 33 CFR 67. The restricted access zone would need to be marked with a floating device such as a buoy at each corner of the zone. The buoy or other floating device must display the facility's permit number and the words "restricted access" in block letters at least 6 inches in height, in contrasting color to the float so that boaters and fishers are aware of the restricted access zone. These marking requirements are consistent with USCG marking requirements and are believed to provide adequate visibility.

Alternative 3 is similar to **Preferred Alternative 2** in that it would restrict and prohibit recreational and commercial fishing, and the operation or transit access around allowable aquaculture systems. Fishermen and vessels would be prohibited within 100, 500, or 1,640 feet of allowable aquaculture systems **(Alternative 3)**. This latter distance corresponds to the specified distance for MMS safety zones established for some oil and gas platforms in the Gulf (33 CFR 147.15).

Restricting access around a facility may protect species known to aggregate around structure. Aquaculture facilities have been shown as aggregation sites for many wild species. For example, Alston et al. (2005) found species abundance and richness significantly increased around an aquaculture cage off the coast of Puerto Rico after it was deployed. Additionally, the lack of anchoring or any other interactions that may occur with the physical environment will benefit the benthos of these restricted sites. Also, preventing access around a facility will reduce the likelihood of damage to a facility, particularly cages and net pens, thereby reducing any potential impacts associated with fish escapement. Overall, **Preferred Alternative 2** or **Alternative 3** would benefit the physical, biological, and ecological environments more than **Alternative 1**.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative and would not restrict access near offshore aquaculture facilities in the EEZ. A potential cost of unrestricted access near an aquaculture facility is that operation of a fishing vessel close to an aquaculture facility could result in accidental damage to the facility, vessel and/or personnel caused by use of fishing gear or other equipment or a vessel strike. The possibility for such may actually increase as aquaculture operations are known to aggregate wild fish, which are attracted to the structures, feed, waste products, or prey from the facility. Thus, while the incidence of accidental damage and associated costs may increase, the quality of wild fishing experiences at the sites could result in increased social and economic benefits for fishermen.

Preferred Alternative 2 would create a restricted access area around each aquaculture facility, based on the ACOE siting permit, and require a facility to mark its borders. No fishing could occur within the zone/area. This alternative would reduce the risk of damages, and associated costs, caused by use of fishing gear or other equipment or a vessel strike. The prohibition on fishing in the restricted access zone would apply to fishermen, both commercial and recreational, as well as the aquaculture facility owner, employees, and contracted personnel. Thus, while the costs associated with accidental gear, vessel, or system damage would be reduced, the prohibition on all fishing would be expected to reduce the potential social and economic benefits of fishing in these areas. As noted for **Alternative 1**, this could represent foregone increased benefits from fishing in areas surrounding a facility if the systems become fish attractants. Any reduction in economic or social benefits to commercial or recreational fishermen would be expected to have spill-over consequences to their families, communities, and associated fishing businesses. The restricted access zones may provide additional benefits by further assisting in reducing density-related externalities. Site operators would be required to incur the cost of marking their restricted access zones and maintaining these markings.

Alternative 3 considers buffer zones for fishing vessels of at least 100 feet (**Alternative 3a**), 500 feet (**Alternative 3b**) or 1,640 feet (**Alternative 3c**) away from a marine aquaculture system. Other than the specific distances, the primary difference between **Alternative 3** and **Preferred Alternative 2** is that **Alternative 3** would establish uniform restricted zones whereas the zones under **Preferred Alternative 2** would be based on

ACOE siting coordinates. Thus, **Alternative 3** may reduce the risks and associated damages and costs to vessels, fishing gear, or aquaculture systems somewhat better than **Preferred Alternative 3** if the fixed distances make it easier to know when fishing gear, other equipment or vessel is approaching a facility's borders. Risk reduction would be expected to increase as the minimum distance increases. However, the absence of mandatory zone marking may reduce some of this protection, especially if visual detection of a facility is severely impaired by existing weather conditions. Also, while a larger zone would be expected to result in less unintended damages, the larger the zone, the greater the potential loss of fishing access, with associated reductions in harvests and associated social and economic benefits.

In terms of the administrative burden, **Preferred Alternative 2** may impose the largest burden on enforcement because it would result in the largest restricted access zones being established; however, it may also have the smallest burden from responses and investigations of accidental damages to facilities, vessels, other property and/or personnel caused by use of fishing gear or other equipment or a vessel strike.

4.8 Action 8: Recordkeeping and Reporting

Alternative 1: No Action, the Regional Administrator has authority to specify recordkeeping and reporting requirements in an EFP (50 CFR 600.745).

Preferred Alternative 2: Establish the following reporting and recordkeeping requirements for aquaculture permittees:

- **(a) On a continuing basis, provide NOAA Fisheries Service currently valid copies of all state and federal permits (e.g., ACOE Section 10 permit, EPA NPDES permit) required for conducting offshore aquaculture. Maintain and make available upon request monitoring reports required by each of these permits for the most recent three years;**
- **(b) Notify NOAA Fisheries Service via phone or an electronic web-based form within 24 hours of discovery of any of the following events:**
  - **(1) Major escapement. Major escapement is defined as the escape of 10 percent of the cultured organisms from a single allowable aquaculture system (e.g., one cage or one net pen) within a 24 hour period or the cumulative escape within a 24 hour period from all allowable aquaculture systems (e.g., all cages or net pens) at an aquaculture facility representing 5 percent or more of the total cultured organisms or the cumulative escape of 10 percent or more of the cultured organisms from all allowable aquaculture systems at an aquaculture facility in any 30-day consecutive period. A permittee shall provide NOAA Fisheries Service with the following information if major escapement occurs or is suspected of having occurred: Gulf Aquaculture Permit number, contact person name and phone number, specific location of escapement, cause(s) for**

escapement and the number, type of species, size, and percent of cultured organisms that escaped, and actions being taken to address the escapement. If no major escapement occurs during a given year, then the permittee shall provide the NOAA Fisheries Service RA with an annual report via an electronic web-based form on or before January 31 each year indicating no major escapement occurred.

(2) Entanglements or interactions with marine mammals, endangered species, and migratory birds. A permittee shall provide the NOAA Fisheries Service RA with the following information if entanglements or interactions with marine mammals, endangered species, or migratory birds occur: 1) Date, time, and location of entanglement or interaction, 2) Species entangled or involved in interactions and number of individuals affected; 3) number of mortalities and acute injuries observed, 4) cause of entanglement or interaction, and 5) actions being taken to prevent future entanglements or interactions. If no entanglement or interaction occurs during a given year, then the permittee shall provide the NOAA Fisheries Service RA with an annual report via an electronic web-based form on or before January 31 each year indicating no entanglement or interaction occurred.

(c) Report via phone or an electronic web-based form all findings or suspected findings of any OIE-reportable pathogen episodes or additional pathogens that are subsequently identified as reportable pathogens in the National Aquatic Animal Health Plan as implemented by the USDA, or U.S. Departments of Commerce or Interior that are known to infect the cultured species within 24 hours of diagnosis to NOAA Fisheries Service. Information reported must include: OIE-reportable pathogen, percent of cultured organisms infected, findings of the aquatic animal health expert, plans for submission of specimens for confirmatory testing (as required by the USDA), testing results (when available), and actions being taken to address the reportable pathogen episode. NOAA Fisheries Service, in cooperation with USDA/APHIS, may order the removal of all cultured organisms from an allowable aquaculture system upon confirmation by an USDA/APHIS-approved reference laboratory that an OIE-reportable pathogen exists and USDA/APHIS and NOAA Fisheries find that the event poses a significant risk to the health of wild or farmed aquatic organisms (Note: the Animal Health Protection Act of 2002 provides the Secretary of Agriculture authority to carry out operations and measures to detect, control, or eradicate any pest or disease of livestock, including animals at a slaughterhouse, stockyard, or other point of concentration. NOAA Fisheries Service would coordinate with the USDA in ordering the removal of cultured organisms). If no finding or suspected finding of an OIE suspected pathogen episode occurs during a given year, then the permittee shall

provide the NOAA Fisheries Service RA with an annual report via an electronic web-based form on or before January 31 each year indicating no finding or suspected finding of an OIE suspected pathogen episode.

(d) Notify NOAA Fisheries Service within 30 days of any changes in hatcheries used for providing fingerlings or other juvenile organisms and provide updated names and addresses/locations for the applicable hatcheries;

(e) Keep original purchase invoices or copies of purchase invoices for feed on file for three years from the date of purchase and make available to NOAA Fisheries Service or authorized officers during inspection or upon request;

(f) Submit sale records electronically using a web-based form and maintain and make available to NOAA Fisheries Service personnel or authorized officers during inspection(s) or upon request, sale records for the most recent three years. Sale records must include the species and quantity of cultured organisms sold in pounds whole weight, the estimated average weight of cultured organisms sold to the nearest tenth of a pound, the date of sale, and the names of companies or individuals to whom fish were sold;

(g) Notify NOAA Fisheries Service via phone or electronically using a web-based form of the intended time, date, species and number of fingerlings or other juvenile organisms that will be transported from a hatchery, other than a hatchery that is integrated within the aquaculture facility, to an aquaculture facility at least 72 hours prior to transport.

(h) Notify NOAA Fisheries Service via phone or electronically using a web-based form of the intended time, date and estimated amount in pounds whole weight by species of fish to be harvested from the aquaculture facility at least 72 hours prior to harvest.

(i) Notify NOAA Fisheries Service via phone or electronically using a web-based form of the intended time, date, and port of landing for any vessel landing cultured organisms harvested from an aquaculture facility at least 72 hours prior to landing.

(j) Any cultured organisms harvested from an offshore aquaculture facility and being transported for landing ashore or sale must be accompanied by the applicable bill of lading through the first point of sale. The bill of lading must include species name, quantity in numbers or pounds, Gulf Aquaculture Permit number of the aquaculture facility from which the fish were harvested, and name and address of purchaser.

(k) Maintain and make available to NOAA Fisheries Service personnel or authorized officers upon request a written or electronic daily record of the number of cultured animals introduced into and number or pounds and average weight of fish removed from each allowable

aquaculture system, including mortalities, for the most recent three years.

(l) Permittee must provide NOAA Fisheries Service current information (i.e. updates if changed since application) regarding names, addresses, and phone numbers of captains, pilots, aircraft owners, and vessel owners, along with documentation or identification numbers for project vessels and aircraft.

(m) Permit applicants must provide NOAA Fisheries Service copies of valid state and federal aquaculture permits for each hatchery they obtain fingerlings from;

(n) At least 30 days prior to each time a permittee or their designee intends to harvest broodstock from the EEZ or state waters, that would be used to produce juvenile fish for an aquaculture facility in the Gulf EEZ, submit a request electronically via a web-based form to the NOAA Fisheries Service RA, including the following information: the number of animals, species, and size, the methods, gears, and vessels (including USCG documentation or state registration) to be used for capturing, holding, and transporting broodstock, the date and specific location of intended harvest, and the location to which broodstock will be delivered. Allowable methods or gears used for broodstock capture include those identified for each respective fishery in 50 CFR 600.725, except red drum, which may be harvested only with handline or rod and reel. The NOAA Fisheries Service RA may deny or modify a request for broodstock collection if allowable methods or gears are not proposed for use, the number of fish harvested for broodstock is more than necessary for purposes of spawning and rearing activities, or other grounds inconsistent with FMP objectives or other federal laws. If a broodstock collection request is denied or modified, the RA shall provide the determination and the basis for it, in writing to the permittee. If a broodstock collection request is approved, the permittee shall submit a report to the RA including the number and species of broodstock collected, their size (length and weight), and the geographic location where the broodstock were captured. The report must be submitted on a web-based form to the NOAA Fisheries Service RA no later than 15 days after the date of harvest.

(o) During catastrophic conditions only, the RA may authorize use of paper-based components for basic required functions as a backup to what would normally be reported electronically. The RA will determine when catastrophic conditions exist, the duration of the catastrophic conditions, and which participants or geographic areas are deemed affected by the catastrophic conditions. The RA will provide timely notice to affected participants via publication of notification in the *Federal Register* and other appropriate means and will authorize the affected participants' use of paper-based components for the duration of the catastrophic conditions NOAA

Fisheries Service will provide each aquaculture permit holder the necessary paper forms, sequentially coded, and instructions for submission of the forms to the RA. The paper forms will also be available upon request from the RA. The program functions available to participants or geographic areas deemed affected by catastrophic conditions may be limited under the paper-based system. Assistance in complying with the requirements of the paper-based system will be available via Customer Service Monday through Friday between 8 a.m. and 4:30 p.m. eastern time.

(p) Any other appropriate recordkeeping and reporting requirements necessary for evaluating and assessing the environmental impacts of an aquaculture operation.

Discussion and Rationale

Section 6.9 examines the effects of the various Action 8 alternatives relative to each other within the biological, physical, ecological, economic, social, and administrative environments. The following is a brief summary of the environmental consequences associated with each of these alternatives.

Recordkeeping and reporting requirements are intended to allow both aquaculture facilities and NOAA Fisheries Service to examine the aquaculture operation and its impacts to the physical, biological, and ecological environments. Records and reports will aid enforcement and act as the check and balance system in the time periods between permit issuance and renewal. These requirements will also help mitigate impacts associated with marine aquaculture and alert managers to potential problems. If potential problems arise, these requirements will allow NOAA Fisheries Service to work with a permittee to resolve potential problems and environmental impacts, or revoke an aquaculture permit if problems and impacts persist.

Action 8 considers two alternatives. Many additional alternatives were considered for this action, but have been moved to the considered, but rejected section in Appendix D. **Alternative 1** would not establish recordkeeping and reporting requirements, while 17 recordkeeping and reporting requirements are specified by **Preferred Alternative 2**. Under either alternative, aquaculture operations would still have to abide by any recordkeeping and reporting requirements specified by other federal agency permits (e.g., EPA NPDES permit, ACOE siting permit, etc.).

Additionally, the following text describes requirements that would be implemented as part of the aquaculture regulatory program. These requirements would be in addition to those described in the range of alternatives for Action 8. Additional requirements for dealer reporting are summarized in Action 1.

The administrative functions associated with the aquaculture program (e.g., registration and account setup, landing transactions and most reporting requirements) are intended to be accomplished online via the aquaculture website; therefore, a participant must have access to a computer and Internet access and must set up an appropriate online aquaculture account to participate. Assistance with online functions will be available from Customer Service by calling Monday through Friday between 8 a.m. and 4:30 p.m. eastern time. If some online reporting functions are not available at the time of initial implementation of the aquaculture program, participants may comply by submitting the required information via email using the appropriate forms that are available on the website. Once online functions are available, participants must comply by using the online system unless alternative methods are specified.

Landings and transactions of cultured species harvested from allowable aquaculture systems in the Gulf EEZ would be tracked using an electronic reporting system developed by NOAA Fisheries Service. Transactions would be initiated by the Gulf aquaculture dealer (Action 1). Aquaculture permit holders would verify landings transactions before reporting is complete. If aquaculture permit holders indicate an error occurred during completion of a landing transaction, NOAA Fisheries Service may require participants to complete a landing transaction correction form.

The electronic reporting process would also be used to collect and monitor the following data and information. In some instances, reporting by phone would also be an option.

- Landing transactions (i.e. when an aquaculture permit holder sells cultured species to a permitted dealer), including the following information:

    - Date, time, and location of transaction;
    - The actual ex-vessel value of cultured species sold;
    - The weight of the catch sold by species; and,
    - Information necessary to identify the fisherman, vessel, and dealer involved in the transaction.

- Discovery of major escapement, entanglements, or interactions.
- Findings or suspected findings of pathogen episodes.
- Changes in hatcheries used for providing fingerlings.
- Harvest and landing notifications.
- Current documentation or identification numbers for project vessels and aircraft.
- Requests for broodstock collection.
- Any other appropriate recordkeeping and reporting requirements necessary for evaluating and assessing the environmental impacts of an aquaculture operation.

For some information, it will not likely be practical to provide reports and records electronically. For the following information, hard copies may be mailed to NOAA Fisheries Service if this information cannot be provided electronically:

- Current valid copies of state and federal permits pertaining to aquaculture.
- Copies of valid state and federal aquaculture permits for each hatchery supplying fingerlings to a permitted aquaculture operation.

Summary Comparison of Physical, Biological, and Ecological Consequences

Alternative 1 does not specify recordkeeping and reporting requirements, but would continue to allow the RA authority to specify EFP recordkeeping and reporting requirements if Action 1, **Alternative 1** (Exempted Fishing Permit) had been selected as the preferred alternative. Because Action 1, **Alternative 2** (NOAA Fisheries Service permit to operate a facility) was selected by the Council as the preferred, only **Alternative 2** can be selected for Action 8.

The greatest impacts to the biological and physical environments would occur if the Council had selected **Alternative 1** as the preferred. **Alternative 1** would not provide a standardized set of requirements for monitoring environmental impacts. If the RA does not specify an adequate range of recordkeeping and reporting requirements under the EFP, then environmental impacts to the physical and biological environments could occur over the short and long term resulting in increased potential for habitat degradation, escapement, and disease outbreaks.

Preferred Alternative 2 will require aquaculture facilities to meet multiple recordkeeping and reporting requirements. Four of the 17 subalternatives in **Preferred Alternative 2** pertain to recordkeeping (**Alternatives 2(e), 2(f), 2(j), and 2(k)**). Permittees would be required to maintain purchase invoices for feed, harvest and sale records, a record of the number of fish stocked for culture, and possess a bill of lading through the first point of sale. These recordkeeping requirements are intended to assist law enforcement in determining compliance with applicable regulations. Additionally, feed invoices will assist NOAA Fisheries Service and the EPA in the event that water quality problems arise as a result of the type of feed being used. As discussed in Section 6.1.3.1, the composition and integrity of feed can negatively affect organic loading (Rapp 2006). Permittees are required to abide by feed management regulations established by the EPA in 40 CFR 451. Harvest and sale records will be used to ensure that production does not exceed the maximum level allowed by Action 9. Harvest and sale records may also be used for auditing purposes to verify that more fish are not being harvested than originally stocked and/or produced. Permittees will also be required to maintain a daily record of the number of cultured animals introduced into and removed from (including mortalities) each allowable aquaculture system for the most recent 3 years. Additional guidance on the removal and disposal of animal mortalities prevent discharge to waters of the U.S. is provided by the EPA (40 CFR 451.11(a)(3)).

The remaining alternatives would all require permittees to report to NOAA Fisheries Service. **Alternative 2(a)** would require permittees to submit copies of valid state and federal aquaculture permits on a continuing basis. This information will allow NOAA Fisheries Service to determine if a permittee possesses other necessary permits for operation. Permittees would also be required to maintain and make available monitoring reports required by other federal agencies for a period of three years. This information would alert NOAA Fisheries Service if monitoring requirements of other agencies identify impacts to the physical or biological environment, and would be used to supplement any additional baseline assessment and monitoring data required by NOAA Fisheries Service in Action 6. NOAA Fisheries Service would work cooperatively with the ACOE, the EPA, and other federal agencies to correct or mitigate any problems caused by the operation, or if necessary, revoke the permit.

Alternative 2(b) would require permittees to report major escapement events or entanglements and interactions with marine mammals, endangered species, or migratory birds (http://www.fws.gov/migratorybirds/intrnltr/mbta/mbtandx.html) within 24 hours of discovery to NOAA Fisheries Service. This reporting requirement will allow NOAA Fisheries Service to assess the severity of the problem and identify solutions for addressing and preventing future escapements, entanglements, or interactions. There is no standard definition used for escapement in the aquaculture industry. The Council's definition for escapement is a modification of the State of Maine's definition, which requires permittees to report any known or suspected escape of 25 percent or more of a cage population and/or more than 50 fish with an average weight of two kg each or more within 24 hours (http://www.maine.gov/dmr/aquaculture/documents/StandardFinfishApplication07.pdf). The State of Washington also has escape reporting and recapture requirements, as well as an escape prevention plan, but does not have a definition for escapement (WAC 220-76-110 and WAC 220-76-120). The Council's definition for escapement would be more conservative (10 vs. 25 percent for an individual aquaculture system) than Maine's definition and would expand the definition to include 5 percent or more of the cultured organisms within all allowable aquaculture systems at a site. Major escapement would also include escape of 10 percent or more of cultured organisms from all allowable aquaculture systems in a 30-day consecutive period. During development of this alternative, the Council also considered, but rejected many additional definitions for escapement. The amounts preferred for determining escapement (5 and 10 percent) should allow operations to effectively quantify whether or not loses have occurred. Specifying lower percentages would make it difficult for permittees to quantify when and if escapement has occurred. Permittees would be required to specify the cause of the escapement, entanglement, or interaction and the quantity and type of species affected when reporting information to NOAA Fisheries Service. For marine mammals, endangered species, and migratory birds, permittees would also be required to provide information on the number of interactions, mortalities, and acute injuries, the date, time, and location of the entanglement or interaction, and actions being taken to prevent future entanglements or interactions.

To minimize the spread of pathogens, **Alternative 2(c)** would require cultured organisms to be inspected prior to stocking in allowable systems. Cultured organisms would have to be certified as free of OIE-reportable pathogens or other NOAA-designated pathogens by an aquatic animal health expert. Stocking specific pathogen-free organisms will be in the best interest of the operation, which wants to maintain healthy product, and not spread pathogens to wild stock. By not stocking organisms containing certain pathogens, the risk of disease spreading to other organisms within and outside an allowable aquaculture system will be reduced.

If OIE reportable pathogens are determined to exist, NOAA Fisheries Service, in cooperation with the Secretary of Agriculture, may order the removal of all cultured organisms from an allowable aquaculture system if the OIE-reportable pathogens pose a significant threat to the health of other cultured organisms or wild aquatic organisms (7 U.S.C. 8301 et seq.). Eradication is the most severe response and involves total depopulation of an affected population and potentially any populations linked to the diseased animals as identified through an epidemiologic trace. The Department of Agriculture must work with the affected parties and subject matter experts to determine the most effective means to undertake the eradication and must be responsible for effectively depopulating and then cleaning and disinfecting the affected premises.

Permittees would be required to report escapements, entanglements or interactions, and pathogen episodes within 24 hours of discovery. Twenty-four hours is considered a reasonable time frame for response and will allow NOAA Fisheries Service and other agencies to more quickly and efficiently respond to these events.

Alternatives 2(d), **2(g)**, **2(h)**, and **2(i)** all specify notification requirements for permittees. NOAA Fisheries Service would need to be notified prior to any changes in hatcheries, prior to juvenile organisms being transported from a hatchery, prior to the time and date of harvest of cultured organisms, and prior to landing. Permittees would be required to notify NOAA Fisheries Service 72 hours in advance of transport, harvest, or landing of cultured organisms. A 72-hour notification window will aid enforcement and NOAA Fisheries Service staff and allow them the opportunity to be present at a facility or landing location when these events occur. Permittees would also be required to notify NOAA Fisheries Service within 30 days of changes in hatcheries. This will allow NOAA Fisheries Service to update permit records and ensure compliance with operational restrictions contained in Action 2 (e.g., marking and tagging requirements for hatchery fish, no GMOs or transgenic species). These alternatives will all benefit the biological environment by improving enforcement and ensuring wild species are not harvested or landed and reported as cultured products. By providing NOAA Fisheries Service prior notification for transport, harvest, and landing, law enforcement officers and other personnel can be present at a facility or landing location to determine compliance with regulations.

Alternatives 2(l) and **2(m)** would also be used for enforcement purposes to ensure records are kept up to date. Permittees would be required to provide current contact information for captains, pilots, aircraft owners, and vessel owners used to support aquaculture activities and operations, along with documentation or identification numbers for project vessels and aircraft. Similarly, contact information would need to be provided for hatcheries used to obtain fingerlings. This information will allow NOAA Fisheries Service to better enforce aquaculture regulations.

Alternative 2(n) would specify requirements for harvesting broodstock. Action 1, Preferred Alternative 2, authorizes permittees to harvest or designate hatchery personnel or other entities to harvest wild broodstock of an allowable aquaculture species native to the Gulf for aquaculture purposes. Prior to harvesting broodstock, permittees would need to submit a request to NOAA Fisheries Service that would include the species, number of animals, and the size of those animals they intend to harvest. This request would need to be submitted to NOAA Fisheries Service at least 30 days prior to the expected date of harvest to allow for enough time to review and process the request. The permittee would also need to identify the gears and methods used for harvest and transport. NOAA Fisheries Service would then be responsible for reviewing this information and approving, modifying, or denying the permittee's request. If broodstock harvest is approved, then the permittee would be required to report to NOAA Fisheries Service once broodstock have been harvested. The harvest of broodstock could negatively affect wild stocks if the amount harvested is significant and results in increased fishing mortality on the wild stock. NOAA Fisheries Service will be able to limit the amount of fish harvested for broodstock. Harvest of broodstock in most instances is expected to be small and insignificant when compared to landings by commercial and recreational fishermen. Additionally, restrictions on allowable gears and methods used for broodstock harvest will help minimize detrimental effects on the physical environment.

Alternative 2(o) would provide for modifications to recordkeeping and reporting requirements by the NOAA Fisheries Service RA in the event of a catastrophic event (e.g., hurricane). The RA would determine when catastrophic conditions exist and which permittees or geographic areas are affected by these conditions. The RA would then provide timely notice to those affected by the catastrophic conditions and may modify or suspend time schedules and reporting methods for the duration of the catastrophic conditions. If records and reports cannot be submitted electronically, then the RA would provide necessary paper-based forms for submission of records and reports. This provision is similar to regulations adopted for the Gulf Council's red snapper IFQ program and is intended to ensure NOAA Fisheries Service continues to receive reports and records in the event of a catastrophe.

Alternative 2(p) is a "catch-all" alternative and would allow other appropriate recordkeeping and reporting requirements to be established that are necessary for evaluating and assessing the environmental impacts of an aquaculture operation.

<u>Summary Comparison of Socioeconomic and Administrative Consequences</u>

Alternative 1 is the status quo alternative and would not specify recordkeeping and reporting requirements. Although the NOAA Fisheries Service RA has the authority to specify recordkeeping and reporting requirements in the terms and conditions for an EFP, the absence of systematic recordkeeping and reporting requirements under **Alternative 1** increases the possibility that important information would not be collected or not become available in a sufficient manner to ensure adverse events do not occur or are minimized to the extent practical. As a result, under **Alternative 1**, the potential incidence and magnitude of negative externalities created by no reporting and recordkeeping or under-reporting and recordkeeping is highest. Thus, the potential for adverse social and economic effects would be higher for **Alternative 1** than **Preferred Alternative 2**.

Preferred Alternative 2 would establish 17 recordkeeping and reporting requirements that are important to reducing the incidence and severity of events that could adversely affect the human and biological environments. Consequently, **Preferred Alternative 2** would be expected to reduce the adverse social and economic effects of these events.

Although these recordkeeping and reporting requirements likely would constitute general business practices, their requirement could impose an additional expense on the aquaculture operation.

NOAA Fisheries Service will also incur costs associated with collecting, storing, and reviewing data provided by permitteees. The additional costs associated with collection and review of this data is expected to provide social and economic benefits due to greater oversight and review of aquaculture operations. If environmental impacts arise, these recordkeeping and reporting requirements would inform NOAA Fisheries Service of those impacts. As a result, management action could be taken to modify a permit and/or address environmental impacts.

4.9 Action 9: Biological Reference Points and Status Determination Criteria.

Alternative 1. No Action. Do not establish biological reference points (maximum sustainable yield [MSY], optimum yield [OY]) or status determination criteria (maximum fishing mortality threshold [MFMT], minimum stock size threshold [MSST]) specific to aquaculture in the Gulf of Mexico EEZ.

Preferred Alternative 2. Establish the following new biological reference points and status determination criteria for aquaculture in the Gulf of Mexico EEZ:

The proxy for MSY is:
(a) the total yield harvested by all aquaculture operations in a given year within the management regime established in this FMP.
(b) 16 million pounds whole weight (mp ww).
(c) 32 mp ww.
(d) 36 mp ww.
(e) 64 mp ww (Preferred).
(f) 190 mp ww.

The proxy for OY is the total yield harvested by all permitted aquaculture operations annually, but not to exceed:
(a) 16 mp ww.
(b) 32 mp ww.
(c) 36 mp ww.
(d) 64 mp ww; Equal to MSY (Preferred).
(e) 190 mp ww.

No individual, corporation, or other entity can be permitted to produce more than:
(a) 5 percent of the maximum level of OY.
(b) 10 percent of the maximum level of OY.
(c) 20 percent of the maximum level of OY (Preferred).

Production of juvenile fish by a hatchery in the Gulf EEZ will not be counted toward optimum yield or the 20-percent production restriction because those fish would be accounted for subsequently via reported harvest at the aquaculture facility where grow-out occurs.

If planned aquaculture production exceeds the preferred OY specified in Alternative 2 than the Council would initiate review of the OY proxy and aquaculture program, and NOAA Fisheries Service would publish a control date, after which entry into the aquaculture industry may be limited or restricted.

Overfished (i.e., MSST) and overfishing (i.e., MFMT) definitions contained in the various FMPs to manage wild stocks will be used as proxies for assessing the status of those wild stocks potentially affected by excessive production in aquaculture operations.

Discussion and Rationale

The MSFCMA was written in part to establish the legal framework for managing wild fisheries resources of the United States, and was not explicitly written for managing at sea fish farming or aquaculture operations. Many of the principles and concepts that guide wild stock management under the MSFCMA are either of little utility or are not generally applicable to the management of aquaculture operations. Despite this lack of conceptual similarity, offshore aquaculture falls within the realm of activities subject to regulatory control under the MSFCMA and therefore must be accommodated within the existing legal framework. Many MSFCMA legal requirements do not fit well or are difficult to satisfy with respect to aquaculture, thereby making them seem less useful or even unnecessary. This is particularly true for yield targets and stock status parameters around which management of wild fisheries is based. Regardless, they are legal requirements, and until additional legal authority specifically suited for management of at sea aquaculture operations is established, all such requirements must be satisfied.

Summary Comparison of Physical, Biological, and Ecological Consequences

Alternative 1 would not establish biological reference points or status determination criteria for aquaculture in the Gulf. Biological reference points and status criteria would continue to be specified for wild species managed by the Council, but similar criteria and reference points would not be established for aquaculture. This alternative would not satisfy MSFCMA legal requirements and would require the Council to specify reference points and criteria in a subsequent amendment to this FMP.

Preferred Alternative 2 would establish biological reference points and status determination criteria for aquaculture in the Gulf. MSY would either be equivalent to the total annual production capacity of all aquaculture operations in the Gulf EEZ, or set equal to 16, 32, 36, 64, or 190 million pounds (mp) whole weight. Setting MSY equivalent to the annual production capacity of all aquaculture operations in the Gulf

EEZ will involve some uncertainty. Theoretically, there will be some maximum capacity of the Gulf to produce cultured fish that does not adversely affect wild stocks or the marine environment (e.g., water quality, habitat). In contrast, setting MSY equal to a specific annual poundage allows the Council to take a more precautionary approach until more is known about the impacts of aquaculture in the Gulf. The MSY specification, as with other fisheries, may be modified based on new information developed as this component of the fishery proceeds. The Council's preferred alternative for MSY is 64 mp whole weight.

The proxies for MSY are based on either the productivity of wild stocks (suboptions 2(c) or 2(e)) or expected production capacity (suboptions 2(a), 2(b), and 2(d)). The OY proxies summarized in suboptions 2(a-e) are likely substantially less than the yield that can be achieved by aquaculture operations over the long-term. Suboption 2(a), suboption 2(b), and preferred suboption 2(d) proxies are based on an estimated 5-20 operations starting business in the Gulf over the next ten years and are considered reasonable estimates for future demand of aquaculture permits (Table 4.9.1). The OY proxies also assume the operations will use 6 to 12 cages approximately 3,000 to 6,000 m^3 in size and that the production capacity of each cage is 22 to 44 pounds per m^3. The OY proxies specified for suboptions 2(c) and 2(e) represent average commercial harvest levels of marine species from the Gulf during 2000-2006. Suboption 2(c) represents wild stock landings of all Council managed species proposed for culture in this FMP (i.e., reef fish, coastal migratory pelagics, stone crabs, spiny lobster, and red drum). Suboption 2(e) represents the average landings of all marine species in the Gulf, except menhaden and shrimp, during 2000-2006. If menhaden and shrimp are included, landings would total 1.53 billion pounds. Basing MSY on the harvest of wild stocks can be useful when assessing risks (both environmental and economic/social) to domestic fisheries. These MSY estimates are considered short-term proxies (next 10 years or until MSY/OY estimates are reviewed by the Council) for MSY until more is known about the number and size of operations, potential environmental impacts resulting from aquaculture, economic sustainability of aquaculture, and the production capacity of various marine aquaculture systems.

In addition to establishing a definition for MSY, **Preferred Alternative 2** would also establish a definition for OY. Optimum yield would either remain undefined for aquaculture in the Gulf EEZ (**Alternative 1**) or be set at 16, 32, 36, 64, or 190 mp whole weight. Guidance in 50 CFR 600.310 states OY should be based on MSY, or on MSY as it may be reduced by social, economic, and biological factors. Since aquaculture is essentially a farming operation, all animals cultured are intended for harvest. Unlike wild stock management, there is no need to leave cultured animals in offshore aquaculture grow-out systems to support future generations. Accordingly, there are currently no social, economic, or ecological factors supporting a reduction from MSY; therefore, OY and MSY can be set equal to one another. To the extent that harvesting MSY would result in adverse impacts to resources in the Gulf, OY may be reduced to a level where such adverse impacts do not occur. The Council's preferred option for OY is to set it equal to 64 mp whole weight (OY suboption (d)).

If the planned production level exceeds the preferred OY then the Council would initiate review of the OY proxy and aquaculture program, and determine whether OY should be increased or some other action is appropriate. Any change (increase or decrease) to OY should be based on the extent and magnitude of any adverse environmental and economic impacts that may result from the existing aquaculture management regime. During review of the program and OY proxy, NOAA Fisheries Service would publish a control date in the *Federal Register* after which entry into the aquaculture industry may be limited. Any permits issued after the control date may be subject to revocation. No individual, corporation, or other entity will be issued a permit authorizing the production of more than 20 percent of the maximum OY (i.e., 64 mp; Council preferred). The Council also considered capping planned production for a single operation at 5 or 10 percent of OY. Permit applicants should base their production capacity on the number of allowable aquaculture systems they propose to use, the frequency and size at which cultured species are harvested, and the overall productivity of the species proposed for culture. In reviewing permit applications, NOAA Fisheries Service will determine if planned production amounts are consistent with the permit application. This provision is necessary to ensure entities do not obtain an excessive share of the allowable yield (National Standard 4: 50 CFR 600.325(a)(3)). The level selected by the Council for capping production must ensure against possible anti-competitive effects resulting from a small number of entities accounting for most or all of the aquaculture production.

Aquaculture operations will harvest all cultured fish and invertebrates produced, excluding losses due to natural mortality. Due to cultured versus wild stocks being harvested, it would not be possible to overharvest the animals. Therefore, thresholds for determining overfishing and overfished status are not directly applicable to the cultured fish and invertebrates. However, it is conceivable that some level of aquaculture in the Gulf could result in adverse impacts to wild stocks, which could result in overfishing and depletion of such stocks. Therefore, the most logical way to assess impacts of overharvest in aquaculture operations is not on the cultured fish actually harvested, but the wild stocks remaining in the surrounding environment. Overfishing and overfished thresholds for wild stocks have been approved by the Council for evaluating the status of managed stocks and stock complexes. These thresholds will be used by NOAA Fisheries Service to determine if offshore aquaculture in the Gulf EEZ is adversely affecting wild populations, causing them to become overfished or undergo overfishing.

Preferred Alternative 2, unlike **Alternative 1**, would establish status criteria and reference points. MSY suboption 2(a) would be similar to **Alternative 1** in that it would set MSY at the level aquaculture operations are capable of producing on an annual basis. MSY suboption 2(e) would be considerably more precautionary than Alternative 1 and set MSY equal to 64 mp (**Preferred Alternative**). The Council also considered setting OY equal to or greater than MSY, but their preferred alternative would set OY equal to MSY for the reasons explained above. The lower OY is set, the greater the benefit to the biological and physical environments. By establishing a precautionary OY level, the Council can assess the impacts of aquaculture as the industry grows to determine if the specified OY level is adequately protecting wild stocks and habitat. If impacts are not observed, or are considered to be minimized to the extent practicable and are not resulting in significant negative impacts, than the Council could consider increasing OY/MSY in the future.

Similarly, OY/MSY could be reduced in the future if negative impacts are determined to be occurring and cannot be prevented or mitigated. There is the potential for adverse impacts related to offshore aquaculture to occur, such as those described in Section 6.1. If NOAA Fisheries Service identifies adverse impacts to wild stocks resulting in populations falling below the established thresholds or becoming subject to excessive fishing mortality, as a consequence of aquaculture operations (reduced biomass levels resulting in increased F), the appropriate overfished or overfishing determination will be triggered. Adverse environmental impacts to the aquaculture operations will be based on data collected via the ongoing monitoring (including monitoring by other federal agencies) of permitted operations. If there is a reasonable basis to tie aquaculture operations to adverse environmental impacts, which are in turn resulting in reduced abundance (depletion) of wild stocks, action will be taken by the Council and NOAA Fisheries Service. Such action could include, but is not limited to, reducing aquaculture production levels, removing cultured organisms containing pathogens, removing cultured organisms that are transgenic or that have been genetically modified, and reevaluating facility siting locations to avoid habitat degradation.

Table 4.9.1 Maximum sustainable yield estimates for offshore aquaculture in the Gulf of Mexico based on 5-20 aquaculture operations, different amounts of cage productivity (22 vs. 44 pounds per m^3), different size cages (3,000 vs. 6,000 m^3) and different amounts of cages used per aquaculture operation (6 vs. 12 cages).

Productivity	# operations	# of cages[1]	cage size[2] (m^3)	production/cage (lbs)	total production (mp)
low productivity 22 lbs/m^3	5	6	3,000	66139	2
	5	6	6,000	132277	4
	5	12	3,000	66139	4
	5	12	6,000	132277	8
	10	6	3,000	66139	4
	10	6	6,000	132277	8
	10	12	3,000	66139	8
	10	12	6,000	132277	16
	20	6	3,000	66139	8
	20	6	6,000	132277	16
	20	12	3,000	66139	16
	20	12	6,000	132277	32
high productivity[1] 44 lbs/m^3	5	6	3,000	132277	4
	5	6	6,000	264554	8
	5	12	3,000	132277	8
	5	12	6,000	264554	16
	10	6	3,000	132277	8
	10	6	6,000	264554	16
	10	12	3,000	132277	16
	10	12	6,000	264554	32
	20	6	3,000	132277	16
	20	6	6,000	264554	32
	20	12	3,000	132277	32
	20	12	6,000	264554	64

[1] Posadas and Bridger 2004

[2] cage size based on two different sized SeaStation™ aquaculture cages

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1 is the status quo alternative. This alternative would not establish biological reference points or status determination criteria specific to aquaculture in the Gulf EEZ. Biological reference points and status determination criteria are required components of an FMP. As a result, **Alternative 1** would not support the approval and implementation of this proposed FMP. While such would eliminate any potential social and economic costs associated with this proposed FMP, any potential benefits would similarly not be realized. Subsequent approval of the FMP would require additional work and expenditures to support the plan development process. In the absence of these specifications, assuming the proposed FMP could be implemented and the aquaculture industry allowed to develop, offshore aquaculture operations could produce an unlimited amount of product, subject only to financing, production, and market constraints. The economic benefit of this unconstrained production would be a potentially very large quantity of cultured seafood produced in the Gulf EEZ with corresponding economic benefits to the producers and general consuming public. However, such unconstrained production could have substantial adverse economic and social consequences for wild-caught fishermen if they are in direct competition with the offshore aquaculture producers where the same or closely related species are harvested or just generally in competition as producers of generic seafood products. Moreover, increasing the numbers of aquaculture facilities decreases the total area where fishermen can operate in the EEZ, which can have additional and substantial economic and social impacts to fishermen, their families and communities.

Preferred Alternative 2 would establish biological reference points and status determination criteria for aquaculture in the Gulf. MSY and OY proxies under this alternative would range from the total yield produced by all operations in a given year to 190 mp. **Preferred Alternative 2** would also establish a cap on the production by an individual company, which would range from 5 percent to 20 percent of OY. Finally, **Preferred Alternative 2** would require NOAA Fisheries Service to publish a control date if aquaculture production exceeds the OY, after which entry into the fishery may be limited or restricted. The preferred specifications in **Preferred Alternative 2** are an MSY and OY of 64 mp (MSY sub-option **2(e)** and OY suboption **2(d)**, respectively), and an individual production cap of 20 percent (sub-option **2(c)**).

Alternative 2(a) for MSY would allow aquaculture operators to establish an MSY benchmark based on actual production. The other alternatives would establish specific levels of MSY and OY, two of which, 16 mp and 32 mp, respectively, would be less than the preferred values of 64 mp (MSY and OY), while the last alternative would establish values approximately three times the preferred values, or 190 mp. While both the MSY and OY represent target capacities, the OY level itself is the reference point that would place the operational restriction on the industry. In general, OY values less than the preferred value would be expected to result in lower social and economic benefits to the aquaculture operations and associated industries than the preferred value, and lower potential social and economic costs to the fishermen and associated industries and communities relative to the OY that would be established by **Preferred Alternative 2(d)**. The opposite results would be expected to occur under the 190-million pound values of **Alternative 2(e)** (higher benefits to producers and associated industries and higher potential costs to fishermen and associated industries and communities).

The 20-percent individual, corporation, or other entity production cap of the preferred alternative offers the greatest social and economic benefit to aquaculture facility owners and those who benefit from their production because it would allow aquaculture producers to increase their scale of production, produce larger quantities, and potentially experience greater economies of scale than the other two alternatives. Lower cap values would produce lower benefits of this nature. The higher the cap, however, the lower the number of potential operators, the lower the competition, increased risk of economic and social harm from anti-competitive behavior, and the greater the potential for spread of aquaculture activities, and associated costs and benefits, across the Gulf.

The administrative burden of the **Preferred Alternative 2** arises primarily from establishment of biological reference points and status determination criteria. However, without such criteria, the burden caused by an unmanaged aquaculture fishery could be substantially greater.

4.10 Action 10: Framework Procedures

Alternative 1: No action (status quo), do not specify framework procedures for modifying aquaculture management measures or biological reference points.

Alternative 2: Specify the following framework procedures for modifying biological reference points (MSY, OY) for offshore marine aquaculture in the Gulf EEZ.

A. The Council will appoint an Aquaculture Advisory Panel (AP) to meet at least bi-annually to evaluate the aquaculture management program proposed in this FMP (and as amended by subsequent Council actions). The group shall be composed of Council staff, NOAA Fisheries Service biologists and social scientists, Scientific and Statistical Committee (SSC) members, Socioeconomic Panel (SEP) members, and other state, university, or private scientists with expertise related to aquaculture. The AP will address and review the following:

1. Annual planned aquaculture production levels relative to MSY and OY.

2. Whether or not the condition and status of wild stocks, marine mammals, protected resources, EFH, and other resources managed by the Council and NOAA Fisheries Service are adversely affected by aquaculture through:

a. OIE reportable pathogens;
b. organic and benthic loading and changes in water quality;
c. entanglements and interactions;
d. escapement of cultured fish;
e. other factors.

3. Economic and social considerations of aquaculture in the EEZ as they relate to Gulf of Mexico fishing communities.

B. The AP will prepare a written report with its recommendations for submission to the Council. The report will provide the scientific basis for their recommendations, and may include, but is not limited to:

a. a summary of annual aquaculture landings and planned production;
b. a summary of whether or not Council and NOAA Fisheries Service managed resources have been adversely affected by aquaculture;

c. a summary of ongoing research activities related to aquaculture in the Gulf of Mexico EEZ, including important findings and results; and,
d. recommendations for revising MSY or OY.

C. If the AP determines aquaculture is adversely affecting wild stocks, stock complexes, marine mammals, protected resources, essential and critical habitat, fishing communities, or other resources managed by the Council or NOAA Fisheries Service, they may recommend MSY and OY be reduced. Any decrease in MSY or OY shall include the scientific basis for the recommendation.

D. If the AP determines aquaculture is not adversely affecting wild stocks, stock complexes, marine mammals, protected resources, essential and critical habitat, fishing communities, or other resources managed by the Council and NOAA Fisheries Service, they may recommend to the Council that MSY and OY be increased. Any increase in MSY or OY shall include the scientific basis for the recommendation.

E. The Council will review and consider the AP's recommendations and hold a public hearing to obtain comments on the AP's report. The Council may convene the SEP or SSC to provide additional advice prior to taking final action. After public input, the Council will make findings on the need for changes.

F. If changes are needed to MSY or OY, the Council will advise the RA in writing of their recommendations, accompanied by the AP's report, relevant background material, and public comments.

G. The RA will review the Council's recommendations for consistency with the goals and objectives of the Aquaculture FMP, national standards, the MSFCMA, and other applicable laws. If the RA concurs with the recommendations, regulations will be drafted and implemented through notice in the *Federal Register*. If the RA rejects the recommendations, the RA shall notify the Council in writing of the reasons for rejection and existing regulations would remain in effect.

Regulatory changes that may be established or modified by the RA by notice in the *Federal Register* include:
a. adjustments to MSY; and,
b. adjustments to OY

Preferred Alternative 3: Specify the following framework procedures for modifying biological reference points (MSY, OY), and management measures for offshore marine aquaculture in the Gulf of Mexico EEZ.

A. The Council will appoint an Aquaculture AP to meet at least bi-annually to evaluate the aquaculture management program proposed in this FMP (and as amended by subsequent Council actions). The group shall be composed of Council staff, NOAA Fisheries Service biologists and social scientists, Scientific and Statistical Committee (SSC) members, Socioeconomic Panel (SEP) members, and other state, university, or private scientists with expertise related to aquaculture. The AP will address and review the following:

1. Annual planned aquaculture production levels relative to MSY and OY.

2. Whether or not the condition and status of wild stocks, marine mammals, protected resources, EFH, and other resources managed by the Council and NOAA Fisheries Service are adversely affected by aquaculture through:

a. OIE reportable pathogens;
b. organic and benthic loading and changes in water quality;
c. entanglements and interactions;
d. escapement of cultured fish;
e. other factors.

3. Economic and social considerations of aquaculture in the EEZ as they relate to Gulf of Mexico fishing communities.

4. Management measures for regulating aquaculture, including:

a. permit application requirements (Action 2);
b. aquaculture operational requirements and restrictions, including monitoring (Action 2);
c. allowable aquaculture system requirements (Action 5);
d. siting requirements (Action 6); and,
e. recordkeeping and reporting requirements (Action 8).

B. The AP will prepare a written report with its recommendations for submission to the Council. The report will provide the scientific basis for their recommendations, and may include, but is not limited to:

a. a summary of annual aquaculture landings and planned production;
b. a summary of whether or not Council and NOAA Fisheries Service managed resources have been adversely affected by aquaculture;
c. recommended changes to permit application requirements, operational requirements and restrictions, allowable aquaculture system requirements, siting requirements, and recordkeeping and reporting requirements; and

d. a summary of ongoing research activities related to aquaculture in the Gulf of Mexico EEZ, including important findings and results; and,
e. recommendations for revising MSY or OY.

C. If the AP determines aquaculture is adversely affecting wild stocks, stock complexes, marine mammals, protected resources, essential and critical habitat, fishing communities, or other resources managed by the Council or NOAA Fisheries Service, they may recommend MSY and OY be reduced. Any decrease in MSY or OY shall include the scientific basis for the recommendation.

D. If the AP determines aquaculture is not adversely affecting wild stocks, stock complexes, marine mammals, protected resources, essential and critical habitat, fishing communities, or other resources managed by the Council or NOAA Fisheries Service, they may recommend to the Council that MSY and OY be increased. Any increase in MSY or OY shall include the scientific basis for the recommendation.

E. If the AP determines changes to permit application requirements, operational requirements and restrictions, allowable aquaculture system requirements, siting requirements, and recordkeeping and reporting requirements are warranted, they shall provide the Council with recommended changes, including rationale for such changes.

F. The Council will review and consider the AP's recommendations and hold a public hearing to obtain comments on the AP's report. After public input, the Council will determine if changes to aquaculture management measures or MSY/OY are warranted. If changes are warranted, then the Council will develop a regulatory amendment. The Council may convene the SEP or SSC to provide additional advice prior to taking final action on the regulatory amendment. The Council will provide an opportunity for public input when taking final action.

G. If changes are needed to MSY, OY, or management measures listed above, the Council will submit to the RA a regulatory amendment, accompanied by the AP's report and any relevant public comments.

H. The RA will review the Council's regulatory amendment for consistency with the goals and objectives of the Aquaculture FMP, national standards, the MSFCMA, and other applicable law. If the RA concurs with the recommendations, regulations will be drafted and implemented through regulatory amendment in the *Federal Register*. If the RA rejects the recommendations, the RA shall notify the Council in writing of the reasons for rejection and existing regulations would remain in effect.

Regulatory changes that may be established or modified by the RA through regulatory amendment in the *Federal Register* include:

- **a. adjustments to MSY;**
- **b. adjustments to OY;**
- **c. permit application requirements;**
- **d. aquaculture operational requirements and restrictions, including monitoring requirements;**
- **e. allowable aquaculture system requirements;**
- **f. siting requirements for aquaculture facilities; and,**
- **g. recordkeeping and reporting requirements.**

<u>Discussion and Rationale</u>

Action 10 includes three alternatives and proposes framework procedures to allow for timelier implementation of some aquaculture regulatory measures. **Alternative 1** would not specify framework procedures for aquaculture. Any time the Council needed to modify aquaculture regulations, a plan amendment would need to be developed. Development of a plan amendment could take considerable time and slow the implementation of various management measures in the event that negative impacts are occurring on the physical, biological, social, or economic environments. **Alternative 2** and **Preferred Alternative 3** propose framework procedures for modifying biological benchmarks (MSY/OY) and some aquaculture regulatory measures (**Preferred Alternative 3 only**). Both **Alternatives 2** and **3** would rely on an Aquaculture AP that would meet at least bi-annually to provide recommendations to the Council. The AP would be composed of Council staff, NOAA Fisheries Service biologists and social scientists, SSC and SEP members, and other state, university, or private scientists with expertise related to aquaculture. The authority of the AP would be much more limited under **Alternative 2**; they could only recommend changes to MSY and OY. Under **Preferred Alternative 3**, the AP would have broader authority, which would include recommending changes to: MSY and OY, application and operating requirements, recordkeeping and reporting requirements, siting requirements, and allowable aquaculture system requirements. The main responsibilities of the AP would include: 1) reviewing annual planned aquaculture production levels relative to MSY and OY; 2) evaluating the condition and status of wild stocks and other marine resources and whether their status has or has not been adversely affected by offshore aquaculture; and 3) assessing economic and social considerations of aquaculture in the Gulf EEZ.

Under **Alternative 2**, if the Council supported the AP's recommendations, it could then submit the recommendations to the RA for further consideration. The RA would have the authority to approve or deny the proposed changes to MSY and OY. If the RA approved the changes, then the regulatory measures would be published in the *Federal Register*. **Preferred Alternative 3** is similar to **Alternative 2**, except the Council would need to develop a regulatory amendment for proposed regulatory changes recommended by the Panel. After development and review by the Council the regulatory amendment would then be submitted to the RA for further consideration. The framework procedures described in **Alternative 2** and **3** are both intended to allow timelier implementation of regulatory measures necessary to prevent or mitigate impacts to the physical, biological, social, economic, and administrative environments. For both **Alternatives 2** and **3**, several opportunities for public comment and input would be available before any proposed changes to regulatory measures are approved. **Alternative 2** could potentially take considerably less time than **Preferred Alternative 3**, because a regulatory amendment would not have to be developed. However, **Alternative 2** would be much more limiting in that it would only allow biological reference points to be changed.

Summary Comparison of Physical, Biological, and Ecological Consequences

All of the framework procedures proposed in Action 10 are administrative in nature, and therefore would not have any direct effect on the physical, biological, or ecological environments. The proposed framework procedures may result in some indirect effects to these environments. Indirect effects would include adjustments to OY/MSY based on biological considerations and the timeliness of regulatory measures that could be implemented to address adverse impacts related to aquaculture.

As discussed in Action 9, the Gulf has some maximum production capacity for aquaculture beyond which adverse impacts will result. The Council's preferred alternative in Action 9 would set OY equal to 64 mp. This value is considered relatively conservative in comparison to the Gulf's ultimate production capacity, which is currently unknown. However, rather than establish MSY/OY at higher levels the Council is taking a precautionary approach to setting these values until more is known. **Alternatives 2** and **3** in Action 10 would provide procedures for modifying MSY/OY. Any changes would be based on recommendations by an Aquaculture AP, as approved by the Council, after assessing whether or not adverse effects from aquaculture are impacting wild marine resources. If adverse impacts are occurring, then **Alternatives 2** and **3** would indirectly benefit the physical and biological environments by allowing more timely reductions in OY/MSY and adjustments to regulatory measures (**Preferred Alternative 3 only**). Similarly, if adverse impacts are determined to not be occurring, or have been minimized to the extent practicable, then both **Alternatives 2** and **3** would provide for timelier implementation of increased OY/MSY levels. **Preferred Alternative 3** has the added benefit of allowing regulatory adjustments through development of a regulatory amendment. Although development of a regulatory amendment would take longer than publication of regulations in the *Federal Register* (as proposed in **Alternative 2**), it would still be faster than implementation of a plan amendment. Timely implementation of regulatory measures will ensure NOAA Fisheries Service has appropriate operational, siting, recordkeeping, and reporting requirements for issuing, monitoring, and reviewing aquaculture permits.

Summary Comparison of Socioeconomic and Administrative Consequences

Alternative 1, the status quo alternative, would not establish framework procedures for modifying aquaculture regulations or biological reference points. Each time the Council amended their regulations, a full plan amendment would have to be developed, which would take considerably more time than development of a regulatory amendment or *Federal Register* notice. This alternative would therefore result in the greatest economic costs to the Council and NOAA Fisheries Service of any of the alternatives considered in this action. Additionally, not being able to implement regulations in a timely manner may have negative social and economic consequences. Lack of a bi-annual review process would also result in negative economic and social effects, especially for persons concerned about the potential negative environmental impacts that may result from offshore aquaculture. Of the alternatives considered in this action, **Alternative 1** is expected to result in the greatest economic and social costs and least economic and social benefits.

Alternative 2 would establish an organizational framework for the Council and NOAA Fisheries Service to effectively manage the aquaculture fishery; however, it provides only limited authority for the Council and NOAA Fisheries Service to make regulatory changes. The Council, upon recommendation by its Aquaculture AP could recommend to NOAA Fisheries Service changes to MSY/OY. Changes in the offshore aquaculture industry, such as technological change, that should necessitate other regulatory changes, such as reporting and/or operational requirements, would not be possible under this alternative. Hence, it would not establish a mechanism for NOAA Fisheries Service to respond to developing industrial practices while potentially decreasing negative externalities and increasing support of offshore aquaculture. Costs incurred by NOAA Fisheries Service under **Alternative 2** would include participating in AP meetings, review of AP and Council recommendations, and preparation of a *Federal Register* notice.

Preferred Alternative 3 would also establish an organizational framework for the Council and NOAA Fisheries Service to effectively manage the aquaculture fishery. **Preferred Alternative 3** would also include an Aquaculture Advisory Panel. The panel could recommend to the Council changes to MSY or OY, permit application requirements, operational requirements and restrictions, and monitoring requirements. **Preferred Alternative 3** would provide the Council with broader authority to make regulatory changes than **Alternative 2. Preferred Alternative 3** would establish a more flexible regulatory process that could adapt to ongoing changes in the offshore aquaculture industry, which could both support the developing industry and reduce negative externalities and associated economic and social costs caused by the industry. **Preferred Alternative 3** is expected to result in greater economic costs to the Council and NOAA Fisheries Service than **Alternative 2,** but less economic costs than **Alternative 1.** Costs incurred by NOAA Fisheries Service under **Alternative 2** would include participating in AP meetings, review of AP and Council recommendations, and preparation of a *Federal Register* notice. **Preferred Alternative 3** would include the same costs as **Alternative 2,** plus there would be additional economic costs for preparing a regulatory amendment. Overall, **Preferred Alternative 3** is expected to provide the best balance between timely review of the aquaculture program, timely implementation of regulatory measures, and public opportunities for proposed regulatory changes.

In terms of the administrative burden, the greater flexibility of **Preferred Alternative 3** is expected to generate a smaller burden over the long run.

5.0 Affected Environment

Both the physical environment and biological environment for Gulf fisheries are described in detail in the Environmental Impact Statement (EIS) for the Generic Essential Fish Habitat Amendment, which is incorporated here by reference (GMFMC 2004). Summaries of that information are presented in the following subsections.

5.1 Physical Environment

The Gulf is bounded by Cuba, Mexico, and the U.S., and has a surface area of 1.51 million km^2 (Wiseman and Sturges 1999). It is a semi-enclosed, oceanic basin connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatan Channel. Conditions in the Gulf are primarily affected by the Loop Current, the discharge of freshwater into the northern Gulf, and a semi-permanent, anti-cyclonic gyre in the western Gulf.

5.1.1 Geological Features

The Gulf can be divided into two major sediment provinces (Figure. 5.1.1-1). East of DeSoto Canyon and southward along the west Florida coast, sediments are primarily carbonates. Coarse surface deposits include quartz sand, carbonate sand, and mixtures of the two.
To the west of DeSoto Canyon, sediments are terrigenous. Coarse sediments make up the very shallow near shore bottoms from the Texas/Mexican border to off central Louisiana from the shore to the central third of the shelf. Beyond depths of 80 m, fine sediments are also strongly represented. Fine sediments are limited to the northern shelf under the influence of the Mississippi and Atchafalaya Rivers.

The west Florida shelf provides a large area of hard bottom habitat. It is comprised of low relief hard bottoms that are relict reefs or erosional structures. Some high relief can be found along the shelf edge in waters 130 to 300 m deep. Hard bottom provides extensive areas where reef biota, such as corals, can become established. These hard bottom areas have become important reef fish fishing areas and some, such as the Tortugas North and South closed areas, the Florida Middle Grounds HAPC, the Steamboat Lumps closed area, and the Madison and Swanson marine reserves limit fishing activities within their boundaries.

Off the Alabama/Mississippi shelf and shelf break, irregular-shaped aggregates of calcareous organic forms called pinnacles are found. These pinnacles average about 9 m in height and are found in waters about 80 to 130 m deep. In addition to the pinnacles, low-relief hard bottom areas can be found in waters less than 40 m adjacent to Florida and Alabama.

While the Louisiana/Texas shelf is dominated by muddy or sandy terrigenous sediments, banks and reefs do occur on the shelf. Rezak et al. (1985) grouped banks into the mid-shelf banks, (defined as those that rise from depths of 80 m of less and have a relief of 4 to 50 m) that are made of relatively bare, bedded tertiary limestones, sandstones, claystones, and siltstones, and relict reefs (defined as those that rise from water depths of 14 to 40 m and have a relief of 1 to 22 m) that are relict carbonate shelf. The Flower Garden Banks National Marine Sanctuary is located about 150 km directly south of the Texas/Louisiana border. This coral reef is perched atop two salt domes rising above the sea floor and ranges from 15 to 40 m deep.

5.1.2 Oceanographic Features

Most of the oceanic water entering the Gulf flows through the Yucatan Channel, a narrow (160 km wide) and deep (1,650-1,900 m) channel. Water leaves the Gulf through the Straits of Florida, which is about as wide as the Yucatan Channel, but not nearly as deep (about 800 m). This pattern of water movement produces the most pronounced circulation feature in the Gulf basin, known as the Loop Current with its associated meanders and intrusions. After passing through the Straits of Florida, the Loop Current, also known as the Florida Current at this stage, merges with the Antilles Current to form the Gulf Stream.

Runoff from precipitation on almost two-thirds of the land area of the U.S. eventually drains into the Gulf via the Mississippi River. The combined discharge of the Mississippi and Atchafalaya Rivers alone accounts for more than half the freshwater flow into the Gulf and is a major influence on salinity levels in coastal waters on the Louisiana/Texas continental shelf. The annual freshwater discharge of the Mississippi/Atchafalaya River system represents approximately 10 percent of the water volume of the entire Louisiana/Texas shelf to a depth of 90 m. The Loop Current and Mississippi/Atchafalaya River system, as well as the semi permanent, anticyclonic gyre in the western Gulf, significantly affect oceanographic conditions throughout the Gulf.

5.1.2.1 Temperature

The physical characteristics of the Gulf have been extensively mapped. Darnell et al. (1983) mapped physical parameters for the northwestern Gulf (the Rio Grande River to the Mississippi River). Bottom temperature was mapped for the coldest and warmest months (January and August). During January, the shallowest waters of the central shelf ranged between 12° C and 14° C. The temperature increased with depth, with a broad band of warmer water, between 17° C and 19° C, across the middle to deeper shelf. However, on the outer shelf off central Louisiana and south Texas, temperatures dropped below 17° C, presumably due to the intrusion of cold deeper waters in both areas.

During August, the shallowest waters of the central shelf reached 29° C, and bottom water temperatures decreased almost regularly with depth, attaining lows of around 17° C to 18° C toward the outer shelf. Thus, bottom temperatures showed a seasonal range of 15° C or more. On the outer shelf the seasonal range was only 2° C or less.

Darnell and Kleypas (1987) mapped the eastern Gulf (Mississippi River to the Florida Keys), following the same protocol as Darnell et al. (1983) in gathering bottom temperature data during January and August. During the month of January, the coldest shelf water (14° C) appeared just off the Mississippi barrier islands. Water colder than 16° C occupied the near shore shelf out to the 25-m isobath from the Chandeleur Islands to Cape San Blas, Florida, and below that point it extended to the 20-m isobath to northern Tampa Bay. West of DeSoto Canyon all bottom shelf waters were below 18° C. However, east of DeSoto Canyon, all outer shelf waters exceeded 18° C, and the 18° C and 20° C isotherms passed diagonally shoreward across the isobaths so that all shelf waters from just above Charlotte Harbor to the Florida Keys were 18° C or above. The maximum January temperature (22° C) was encountered near the southern tip of the Florida shelf at a depth of 60 to 70 m.

During August, the temperature of the near shore bottom water ranged from 26° C near Panama City, Florida, to 30° C around Cedar Key, Florida. Throughout the eastern Gulf shelf, bottom water temperatures decreased with depth. Near the Mississippi River Delta the outer shelf water was 22° C, but temperatures down to 16° C were observed along both the eastern and western rims of DeSoto Canyon and at several localized areas along the outer shelf of Florida. For most of the shelf of the Florida peninsula, bottom isotherms paralleled the isobaths.

Seasonal comparisons reveal that near shore waters for the entire eastern Gulf shelf were 10° C to 15° C warmer in the summer than in the winter. Near the Mississippi River Delta, the bottom waters of the outer shelf were only about 5° C warmer in the summer than during the winter. However around the rim of DeSoto Canyon and along the shelf of Florida, summer temperatures ranged 1° C to 4° C colder in the summer than in the winter. This summer temperature depression is due to the intrusion of colder slope water onto the outer shelf during the summer months.

Figures 5.1.2.1-1 and 5.1.2.1-2 show sea surface temperature (SST) derived using the National Oceanographic Data Center and the University of Miami's Rosenstiel School of Marine and Atmospheric Sciences' Advanced Very High Resolution Radiometer Version 5.0 Pathfinder SST data from 1985-2001. Figure 5.1.2.1-1 depicts the monthly SST average for February, the coldest month, while Figure 5.1.2.1-2 depicts the monthly SST average for August, the warmest month. During February, average surface temperatures ranged from 15° C in the northern Gulf to 26° C between the Yucatan Peninsula and Cuba. During August, surface temperature for most of the Gulf averaged either 29° C or 30° C.

5.1.2.2 Salinity

Surface salinities in the Gulf vary seasonally. During months of low freshwater input, surface salinities near the coastline range between 29 and 32 ppt (MMS 1997). High freshwater input conditions during the spring and summer months result in strong horizontal salinity gradients with salinities less than 20 ppt on the inner shelf in the northern Gulf. The waters in the open Gulf are characterized by salinities between 36.0 and 36.5 ppt (MMS 1997).

5.1.2.3 Hypoxia

Hypoxic waters occur when dissolved oxygen levels drop below 2 mg/L. In the northern Gulf, an major area of hypoxia may occur from late February through early October extending from near the mouth of the Mississippi River to near the mouth of the Sabine River nearly continuously from mid-May through mid-September on an annual basis. The hypoxic area is most widespread, persistent, and severe in June, July, and August (Rabalais et al. 1999). Hypoxic waters in this zone can include 50 to 80 percent of the lower water column between 5 and 30 m water depth, and can extend as far as 130 km offshore to depths of 60 m (Rabalais and Turner 2001). Between 1985 and 1992, hypoxia generally formed two areas west of the Mississippi and Atchafalaya River deltas, with the total area averaging 8,000 to 9,000 km^2. After the Mississippi River flooded in 1993, the size of the hypoxic zone doubled in area forming a single continuous zone across the Louisiana continental shelf (Rabalais et al. 2002). In 2002, the hypoxic zone covered approximately 22,000 km^2 of the Louisiana-Texas shelf. Other smaller hypoxic zones may form in Gulf bays and offshore waters periodically, but less regularly than in the Louisiana offshore area.

5.1.2.4 Turbidity

Riverine inputs, wind, and currents are the primary agents that cause turbidity in Gulf waters. Turbidity levels in the western and northern Gulf are higher than the eastern Gulf, because of more sources of freshwater input. Surface turbidity is limited to areas of riverine inputs with the Mississippi and Atchafalaya Rivers the primary inputs for the Gulf. During the low water periods, the amount of sediment in suspension averages 0.260 g/L. The amount of sediment increases to 0.640 g/L during high water (flood) periods. These turbid waters are delivered to offshore locations by tidal currents and winds.

Another type of turbidity that is found near the bottom is called the nepheloid layer. This is a body of moving, suspended sediment that is formed when the turbulence of bottom waters is high enough to offset the settling (gravity driven) of the sedimentary particles. Along the south Texas continental shelf, Shideler (1981) found that the nepheloid layer thickened offshore to a maximum of 35 m near the shelf break and that the concentration of suspended sediment in the nepheloid layer decreased from a maximum near shore to a minimum at the shelf break.

Rezak et al. (1985) studied the nepheloid layer on the Louisiana/Texas shelf from 1979 to 1982. Inshore of the 10-m isobath the water was turbid from top to bottom. Offshore of the 10-m isobath, the top 2 to 3 m of water was turbid with a layer of clear water between the bottom nepheloid layer and the top layer of turbid water. The nepheloid layer at the base of the water column up to 50 km offshore was heavily laden with suspended sediment. The nepheloid layer extends across the shelf in a well mixed bottom layer 10 to 15 m thick, and spills over onto the continental slope. At the shelf break, the nepheloid layer wells up to more than 25 m in thickness. Rezak et al. (1985) concluded that the sediment in the nepheloid layer is kept in suspension over much of the inner shelf by swift currents.

5.1.3 Aquaculture Sites

5.1.3.1 Areas where aquaculture may be prohibited or should be avoided.

Figure 5.1.3.1-1 Platform safety zones, oil and gass platforms, lightering zones, shipping fairways, marine protected area/marine reserves, and marine sanctuaries in the eastern Gulf of Mexico.
Figure 5.1.3.1-2 Platform safety zones, oil and gas platforms, lightering zones, shipping fairways, and marine sanctuaries in the western Gulf of Mexico.

5.1.3.1.1 Marine reserves and seasonal-area closures

Madison/Swanson and Steamboat Lumps Marine Reserves – These areas are marine reserves intended to protect reef fish, and in particular gag spawning aggregations. Fishing, except for surface trolling during May through October, is prohibited (219 square nautical miles) in these marine reserves. The Madison/Swanson site was also identified as a HAPC by the Council. A new site, the Edges 40-fathom break (390 nm^2), is proposed for implementation as a seasonal area closure in Amendment 30B to the Reef Fish FMP. If approved, this area would prohibit fishing from January through April each year along the 40 fathom break in the northeast Gulf.

Tortugas North and South Ecological Reserves – These areas are no-take marine reserves cooperatively implemented by the state of Florida, NOS, the Council, and the National Park Service (185 square nautical miles). These areas prohibit fishing for any species and bottom anchoring by fishing vessels.

5.1.3.1.2 USCG Lightering areas, safety zones, shipping fairways, and anchorages

The U.S. Coast Guard regulates numerous areas where navigation is restricted or prohibited. These areas include lightering areas (where oil is offloaded from vessels), anchorages, outer continental shelf safety zones, deepwater port safety zones (for the Louisiana Offshore Oil Port and the Gulf Gateway Port), and shipping fairways. Aquaculture facilities sited in these areas would pose hazards to navigation or national security, making these areas unsuitable for offshore aquaculture.

5.1.3.1.3 Areas prohibited by the U.S. Army Corps of Engineers

The ACOE regulations prohibit aquaculture activities from occurring in disposal areas and their vicinity, navigation channels, borrow sites, and federal mitigation areas.

5.1.3.1.4 HAPCs

The Council has established a number of HAPCs. The regulations in these areas vary (Generic EFH Amendment 3 or 50 CFR 622.34), but have been primarily established to protect critical fish habitat from damage due to anchoring and fishing activities.

Individual reef areas and bank HAPCs of the northwestern Gulf include: East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil Bank, 29 Fathom, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank. Bottom anchoring by fishing vessels and the use of trawling gear, bottom longlines, buoy gear, dredge gear, and all traps/pots on coral reefs are prohibited in the East and West Flower Garden Banks, McGrail Bank, and Stetson Bank (263.2 square nautical miles).

Florida Middle Grounds HAPC – This HAPC is located in the northeastern Gulf and includes an area of pristine soft corals (348 square nautical miles). All gear interfacing with the bottom is prohibited in this HAPC.

Pulley Ridge HAPC – A portion of this HAPC (110 square nautical miles) is closed to anchoring of fishing vessels and the use of trawling gear, bottom longlines, buoy gear, dredge gear, and all traps/pots (2,300 square nautical miles) to protect deepwater hermatypic coral reefs.

5.1.3.1.5 Sites designated as "No Activity Zones" by the Mineral Management Service

Several shelf edge, mid-shelf, and low relief banks with coral reef community organisms exist off of Louisiana and Texas. These banks are protected from potential oil and gas development impacts by the MMS through a Topographic Features Stipulation (MMS 2002), which establishes a "No Activity Zone" at each bank. The "No Activity Zone" prohibits any structure, drilling rig, pipeline, or anchoring within the zone.

5.1.3.2 Other environmentally sensitive areas

Figure 5.1.3.2-1 Areas of concern in the eastern Gulf of Mexico.
Figure 5.1.3.2-2 Areas of concern in the western Gulf of Mexico.

5.1.3.2.1 Hypoxic zones

As discussed in Section 5.1.2.3, hypoxia can extend over vast areas of the Louisiana and upper Texas continental shelf. In order to avoid impacts to aquaculture organisms from low dissolved oxygen levels and waste material from aquaculture operations contributing to the hypoxic zone, areas that experience frequent hypoxia should be avoided.

5.1.3.2.2 Areas where harmful algal blooms frequently occur

Harmful algal blooms or red tide are common on the west Florida continental shelf. In order to avoid potential losses of all organisms due to harmful algal blooms, aquaculture facilities should be sited in areas where the history of occurrence of harmful algal blooms is low.

5.1.3.2.3 Ecological areas of concern

Currently, unprotected hard bottom areas exist that should be avoided when siting aquaculture facilities. For example, the Pinnacles area located on the Mississippi and Alabama continental shelf consists of a 1.6 km wide band of shelf-edge features in water depths ranging from 68 to 101 m. These pinnacles have vertical relief of about 9 m with some exceeding 15 m (Continental Shelf Associates, Inc. and Texas A&M Univ. 2001).

Seagrasses are very sensitive to anthropogenic disturbances and have a very low recovery capacity. Effluents from aquaculture operations might also have a negative effect on seagrass. Fish farming releases high organic and nutrient loading into the surrounding water (Beveridge 2004). Organic matter may accumulate in the sediment under and nearby cages, degrading the benthic macrophyte communities, especially seagrass (Perez et al. 2005). Therefore, aquaculture facilities should avoid seagrass areas. Siting criteria specified for Action 6, Preferred Alternative 3 includes NOAA Fisheries Service consideration of important ecological habitats, such as seagrass.

5.1.3.3 Other special management areas

Figure 5.1.3.3-1 Permitted artificial reef sites and zones in the eastern Gulf of Mexico.
Figure 5.1.3.3-2 Permitted artificial reefs and zones in the western Gulf of Mexico.

5.1.3.3.1 Traditionally highly fished areas

One of the many uses of the Gulf is commercial and recreational fishing. Since aquaculture facilities will have some type of physical footprint, facilities should avoid user conflict as much as possible. One way to reduce user conflict with the fishing industries is, to the extent practicable, site aquaculture facilities outside of traditional highly fished areas. Aquaculture facilities should not be sited around artificial reefs, in artificial reef zones, or in highly trawled or fished areas. Siting criteria specified for Action 6, Preferred Alternative 3, includes NOAA Fisheries Service consideration of traditional fishing areas when siting an offshore aquaculture facility.

5.1.3.3.2 Alabama Special Management Zone (SMZ)

In the Alabama SMZ, fishing by a vessel operating as a charter vessel or headboat, a vessel that does not have a commercial permit for Gulf reef fish, or a vessel with such a permit fishing for Gulf reef fish, is limited to hook-and-line gear with no more than 3 hooks. Nonconforming gear is restricted to bag limits, or for reef fish without a bag limit, to 5 percent by weight of all fish aboard.

5.1.3.3.3 Areas of current or future oil and gas activities, dredge disposal, and military warning areas.

Approximately 4,000 oil and gas platforms exist in the Gulf. Thousands of miles of oil and gas pipeline are buried throughout the Gulf. When determining a site location, aquaculture companies and regulators will have to consider current and future oil and gas activities. Several interim and final unconfined dredge material disposal areas exist offshore of the major shipping channels throughout the Gulf. Aquaculture companies and regulators should be aware of the potential problems unconfined dredge material disposal could have on facility operations. Aquaculture companies and regulators should also be aware that boat operations and aircraft use could be affected if facilities are sited in military warning areas.

5.1.3.3.4 Ordnance zones

The U.S. Air Force has released an indeterminable amount of unexploded ordnance in some areas of the Gulf. The exact location of the unexploded ordnance is unknown and drilling or other activities may be potentially hazardous in these areas. Zones where this ordnance may occur have been defined and should be avoided when siting an aquaculture operation.

5.1.4 Possible Environmental Guidelines for Siting of Aquaculture Facilities

Site selection is a key factor in any aquaculture project, affecting both the economic viability and the sustainability of the project. While correct siting is important for economic reasons, it is also important for environmental reasons. Culture of any species must be established in geographical regions having adequate water quality and exchange. Offshore aquaculture cages should be located in areas with a suitable surrounding environment. Variables to consider in site selection include water depth, water quality, currents, and sediment type (Buitrago et al. 2005; Hunter et al. 2006; Kapetsky and Aguilar-Manjarrez 2007; Levings et al. 1995; Perez et al. 2005; Ross et al. 1993).

5.1.4.1 Water Depth

Water depth requires detailed consideration for cage suitability as it has an influence on net size, anchoring system, and anchoring method. Cages may be damaged in shallow water, whereas anchoring systems needed for deeper waters may become limiting, giving a greater risk of losing stock. Cages should be located at sites where the water depth is sufficient to maximize water exchange and to keep cage bottoms well clear of bottom substrates. Conversely, costs and problems associated with cage anchoring increase with depth.

In order to avoid waste accumulation and cage damage during storms, water depths for cage aquaculture should be limited to areas where water depths are greater than one and one half times the cage height (Ross et al. 1993). Therefore, if a cage was 20 m in depth, it would require at least 30 m of water. Kapetsky and Aguilar-Manjarrez (2007) reviewed depth thresholds for cages based on a review of current experimental and commercial installations in the United States. They also examined specifications given by cage manufacturers worldwide. The minimum site depth found was 25 m. Kapetsky and Aguilar-Manjarrez (2007) recommended a minimum depth of 25 m in order to avoid waste accumulation under cages. They established 100 m as the maximum depth for anchored cages since inspection of mooring and anchoring systems in depths greater than 100 m would be difficult.

5.1.4.2 Water Quality

Water quality considerations include temperature, dissolved oxygen, and salinity. As detailed in Section 5.1.2.1, temperature can vary widely between seasons and locations in the Gulf. Water temperature is the environmental parameter which has the most effect on fish (Lawson 1995). Temperatures on either side of the optimum can induce stress in the animal, affecting feeding, growth, reproduction, and disease inhibition. Facilities should be sited so that cultured species are within their optimum temperature range. Low dissolved oxygen can have a variety of physiological effects on cultured organisms, impacting growth and mortality. For most areas of the Gulf, below optimum dissolved oxygen levels are not a problem. Off the coast of Louisiana, hypoxia can affect thousands of square kilometers each summer. While primarily affecting bottom waters between 5 and 30 m off Louisiana, hypoxia can affect 50 to 80 percent of the water column, occur in water depths out to 60 m, and extend onto the upper Texas shelf (Rabalais and Turner 2001). Salinity also varies widely seasonally and across the Gulf.

5.1.4.3 Current speed

The Loop Current enters the Gulf through the Yucatan Channel, turns clockwise and exits through the Straits of Florida. The speed of the Loop Current may exceed 2 m/sec. The intrusion of the Loop Current into the Gulf varies. As the current travels farther north, it tends to shed eddies as large as 400 km or more in diameter that slowly move westward at speeds of approximately 5 cm/s (Wiseman and Sturges 1999). These eddies carry massive amounts of heat, salt, and water into the western Gulf. Currents over the inner continental shelf in the Gulf are strongly wind driven out to depths of approximately 50 to 60 m (Wiseman and Sturges 1999). Current speeds over the inner shelf therefore vary.

Water currents are very important for cage site selection because they are integral to the water exchange rate and help in avoiding waste accumulation underneath cages. Bottom currents should be above 5 cm/s (Ross et al. 1993, Hambrey and James 2005), but water exchange and waste accumulation are a factor of depth and current speed. The recommendation of 5 cm/s was based upon having more than the one and one half times the cage height underneath the cages. As the depth decreases towards the minimum of one and one half times the cage height, currents will need to be faster to avoid waste accumulation. While current offshore cage designs can handle sustained currents of over 100 cm/s, currents faster than this can adversely affect organisms, contribute towards food losses, and make maintaining the cages difficult. Excessive currents can also re-suspend wastes underneath cages. Therefore, areas with sustained currents greater than 100 cm/s should be avoided.

5.1.4.4 Sediment type

In the eastern Gulf, sediments are primarily coarse carbonates. To the west of DeSoto Canyon, sediments are terrigenous with a mixture of coarse and fine sediments. Sediment type can potentially affect the type of anchors or moorings used for cages and can also affect the rate of processing of organic waste from the cages (Figure 5.1.4.4-1).

5.2 Biological Environment

5.2.1 Life History and Biology

The biological environment of the Gulf, including the species addressed in this PEIS, is described in detail in the final EIS for the Generic Essential Fish Habitat amendment and is incorporated here by reference (GMFMC 2004).

5.2.2 Federally Managed Gulf of Mexico Species Suitable for Aquaculture

Most reef fish and coastal migratory pelagic species could be raised in aquaculture systems, but likely only those commanding the highest value or with the highest growth rates will be raised. Cobia have been successfully raised in hatcheries and in net pens off Puerto Rico for commercial production (Benetti et al. 2007; 2008). Additionally, over the last eight years NOAA has funded numerous research studies pertaining to cobia, mutton snapper, and greater amberjack (www.aquaculture.noaa.gov). Hatchery technology, breeding programs, and larval rearing techniques for cobia and mutton snapper have been successfully developed. The Gulf of Mexico Marine Stock Enhancement Program has also conducted research for administering live food to larval red snapper. Red snapper were successfully spawned naturally in captivity and release experiments were conducted to evaluate the post-release survival of red snapper. Research and development activities were also conducted in Puerto Rico to refine culture technology for spiny lobster (http://www.snapperfarm.com/ 2006/ snapperfarmsr&d activities.htm). Lastly, several states, including Florida and Texas, currently operate red drum stock enhancement programs in the Gulf, making this species a viable option for use in offshore aquaculture. The state of Florida’s Stock Enhancement Research Facility (SERF) began raising fingerlings in 1988. Since that time, approximately 6 million redfish have been released statewide. Texas Parks and Wildlife’s marine hatchery annual produces ~25 million red drum and spotted seatrout fingerlings for stock enhancement.

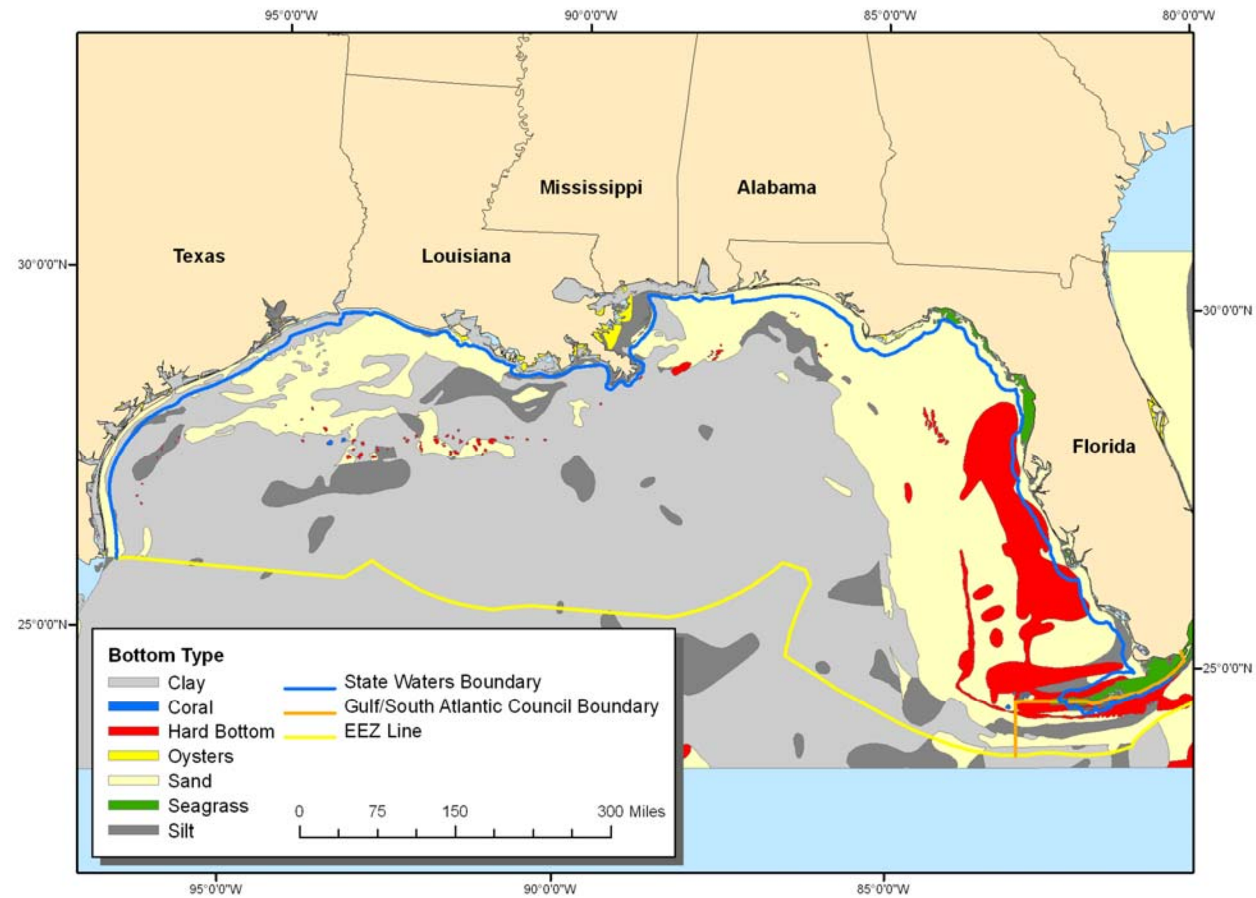

Figure 5.1.1-1. Sediment types throughout the Gulf of Mexico.

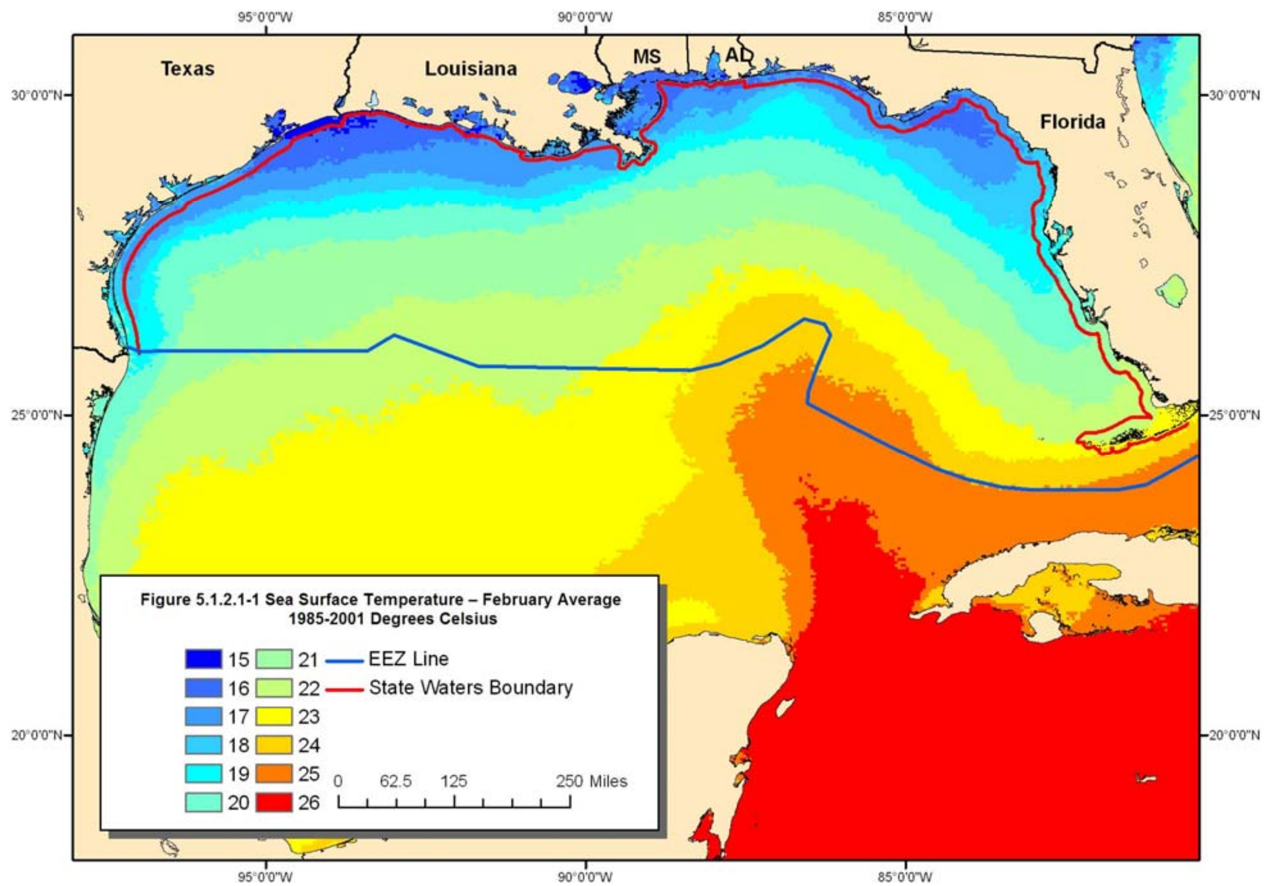

Figure 5.1.2.1-1. Average February sea surface temperatures in the Gulf of Mexico, 1985-2001.

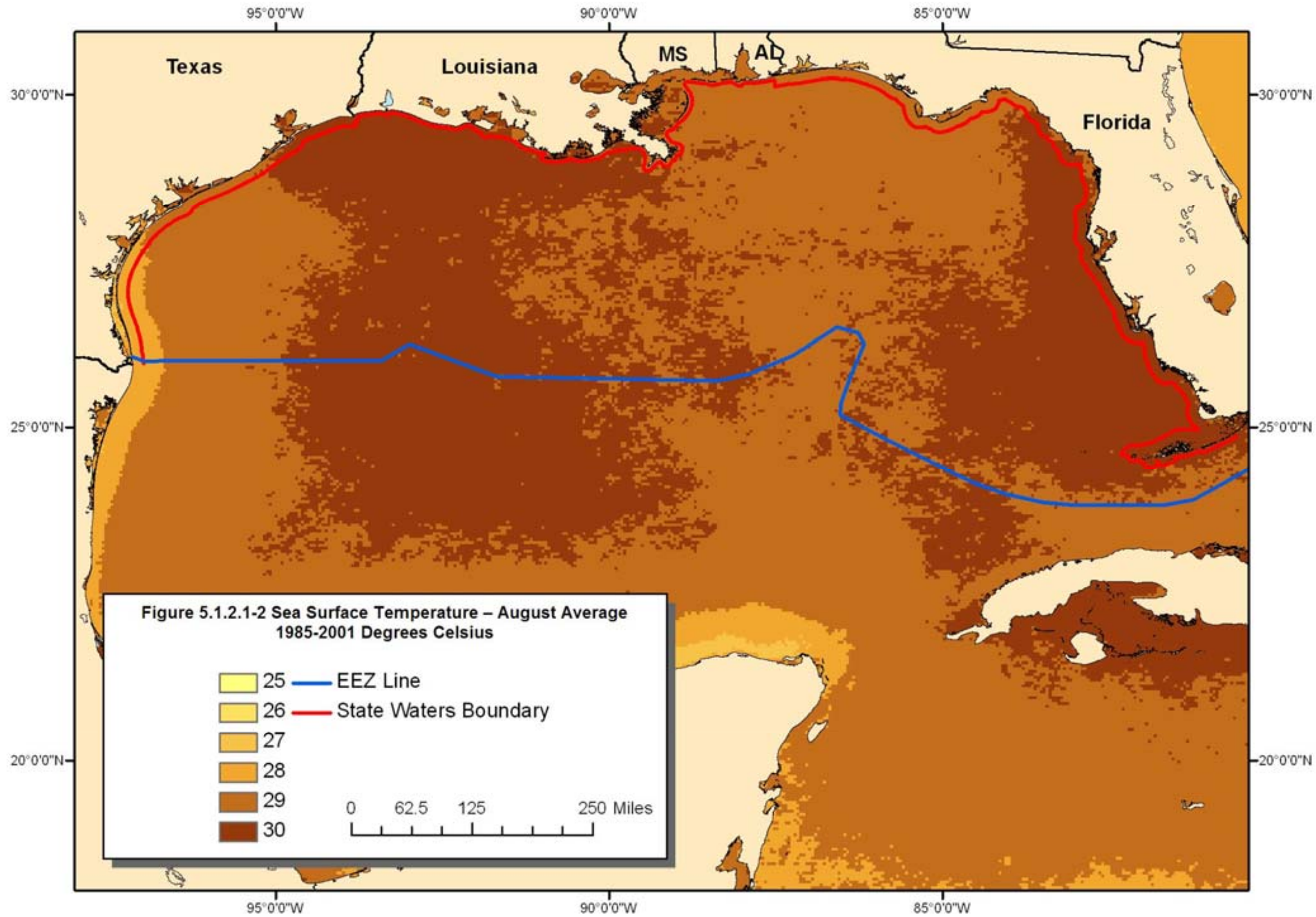

Figure 5.1.2.1-2. Average August sea surface temperatures in the Gulf of Mexico, 1985-2001.

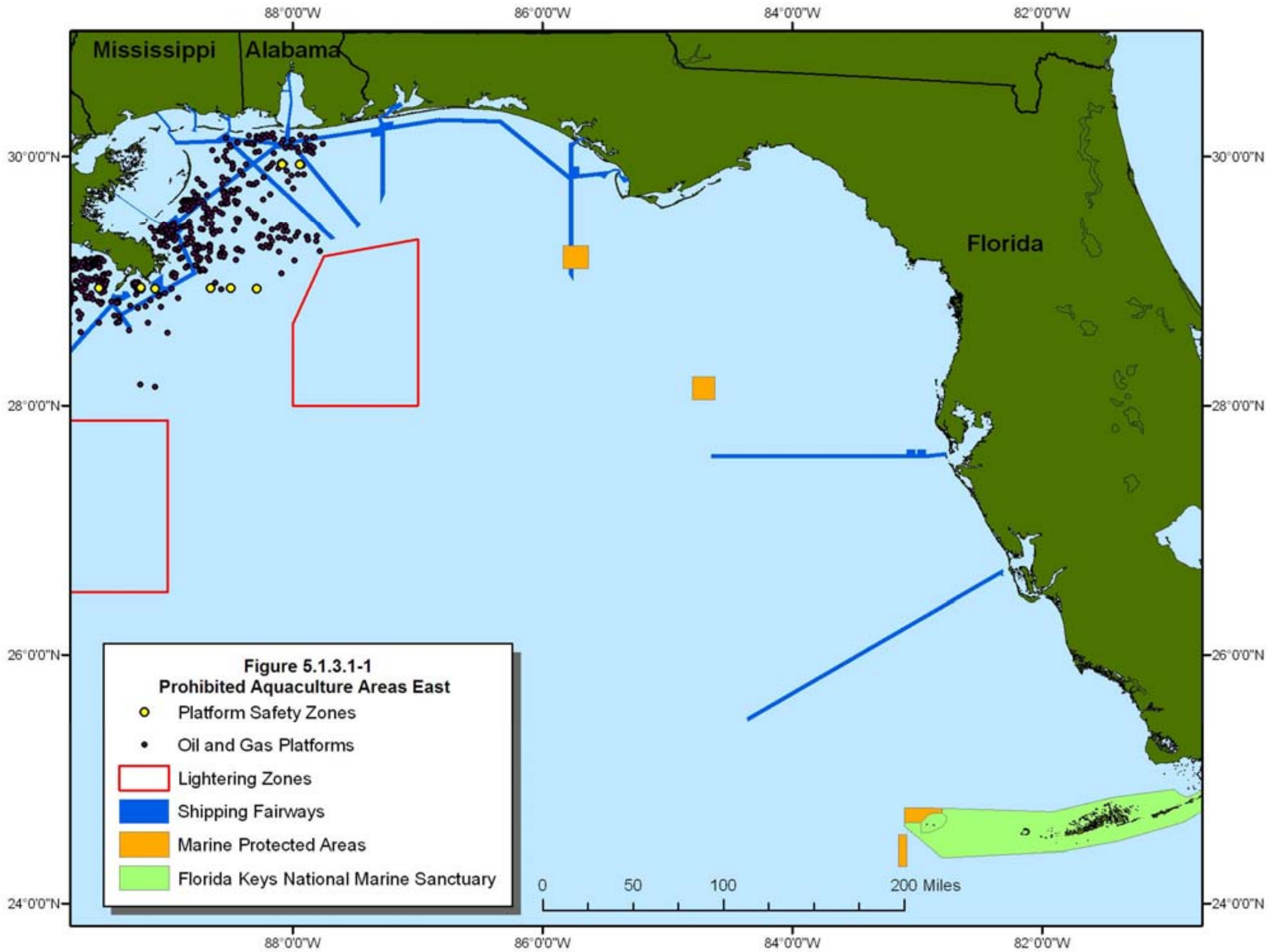

Figure 5.1.3.1-1. Platform safety zones, oil and gas platforms, lightering zones, shipping fairways, marine protected areas/marine reserves, and marine sanctuaries in the eastern Gulf of Mexico.

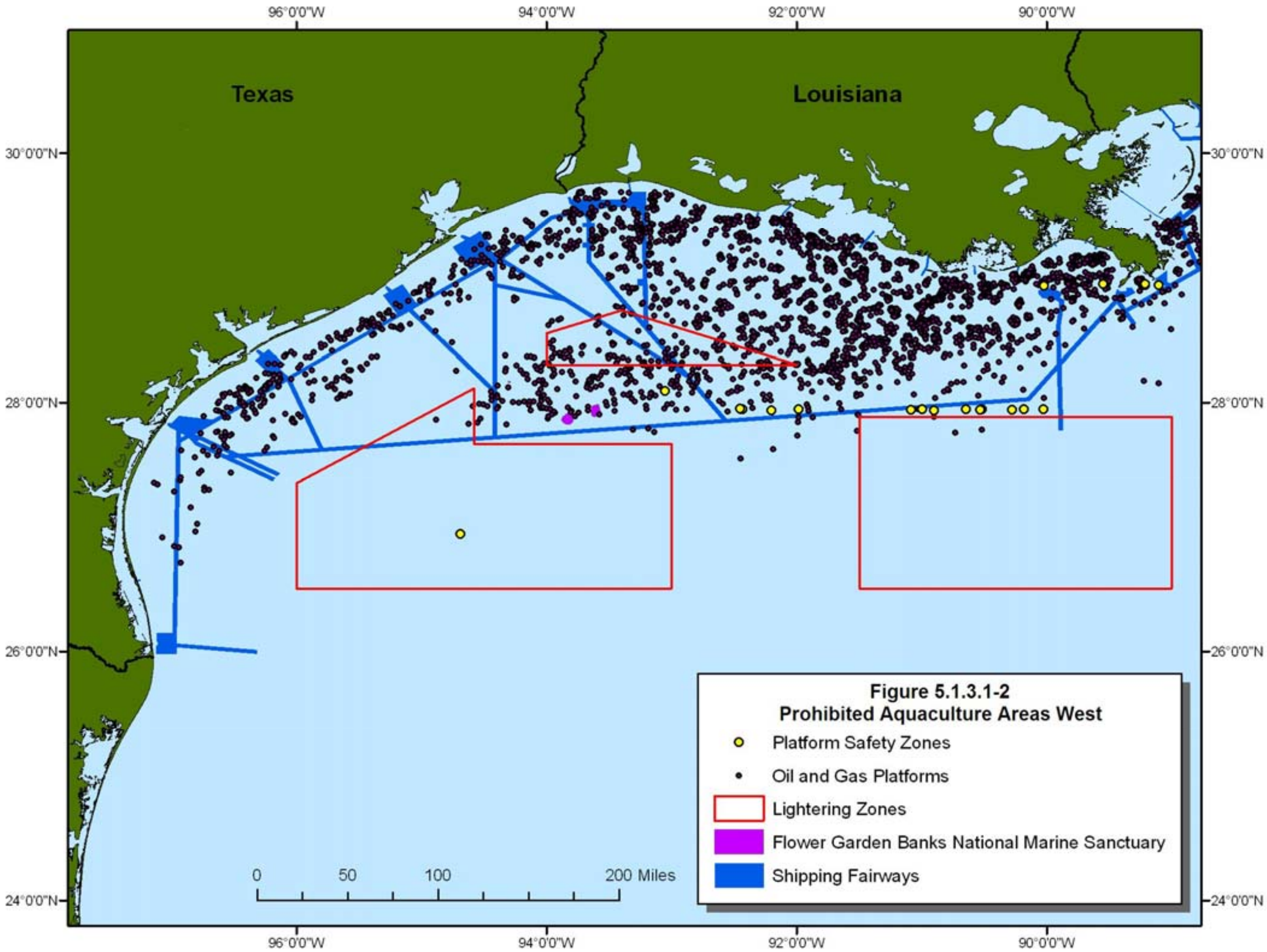

Figure 5.1.3.1-2. Platform safety zones, oil and gas platforms, lightering zones, shipping fairways, and marine sanctuaries in the western Gulf of Mexico.

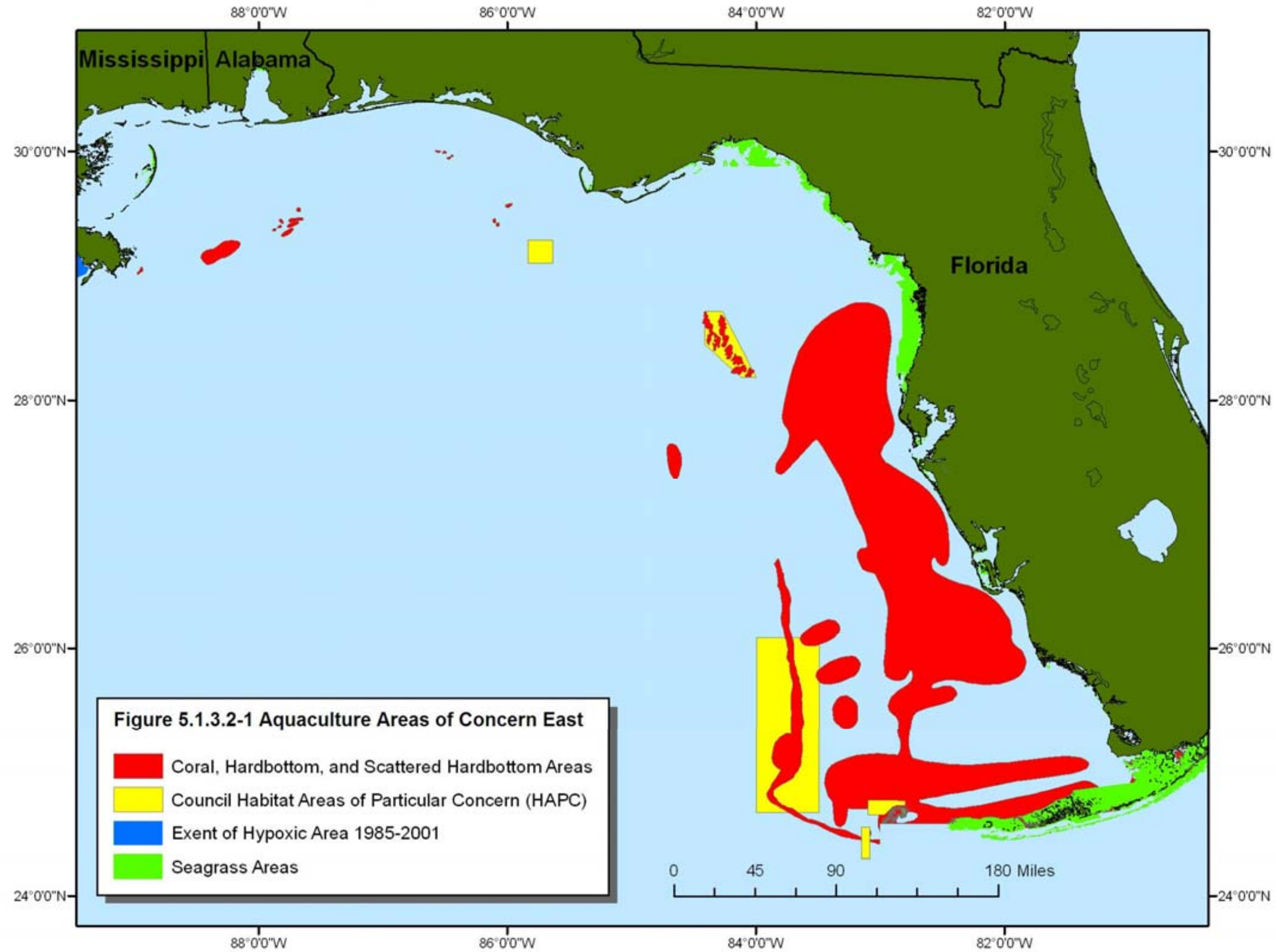

Figure 5.1.3.2-1. Areas of concern in the eastern Gulf of Mexico.

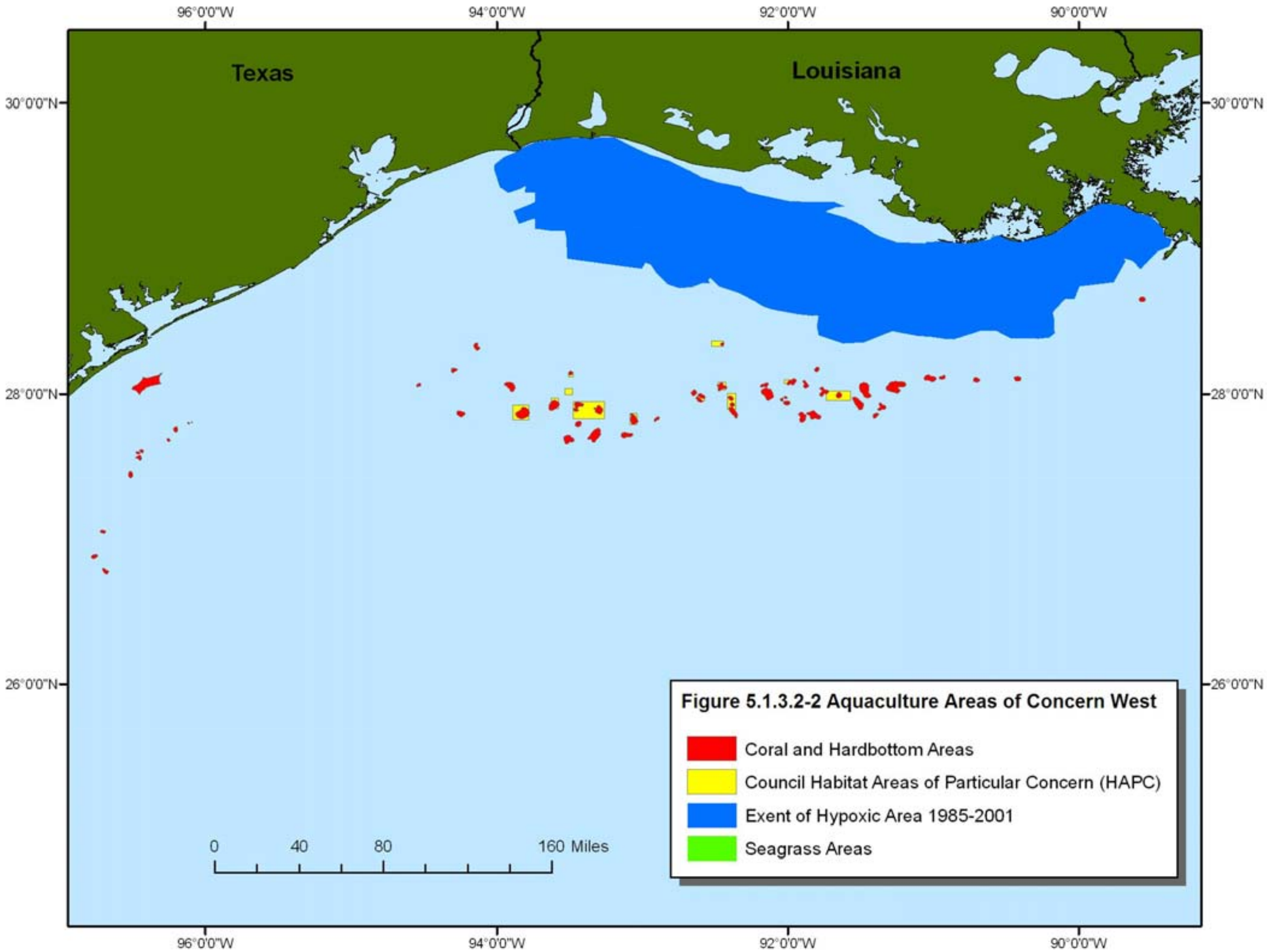

Figure 5.1.3.2-2. Areas of concern in the western Gulf of Mexico.

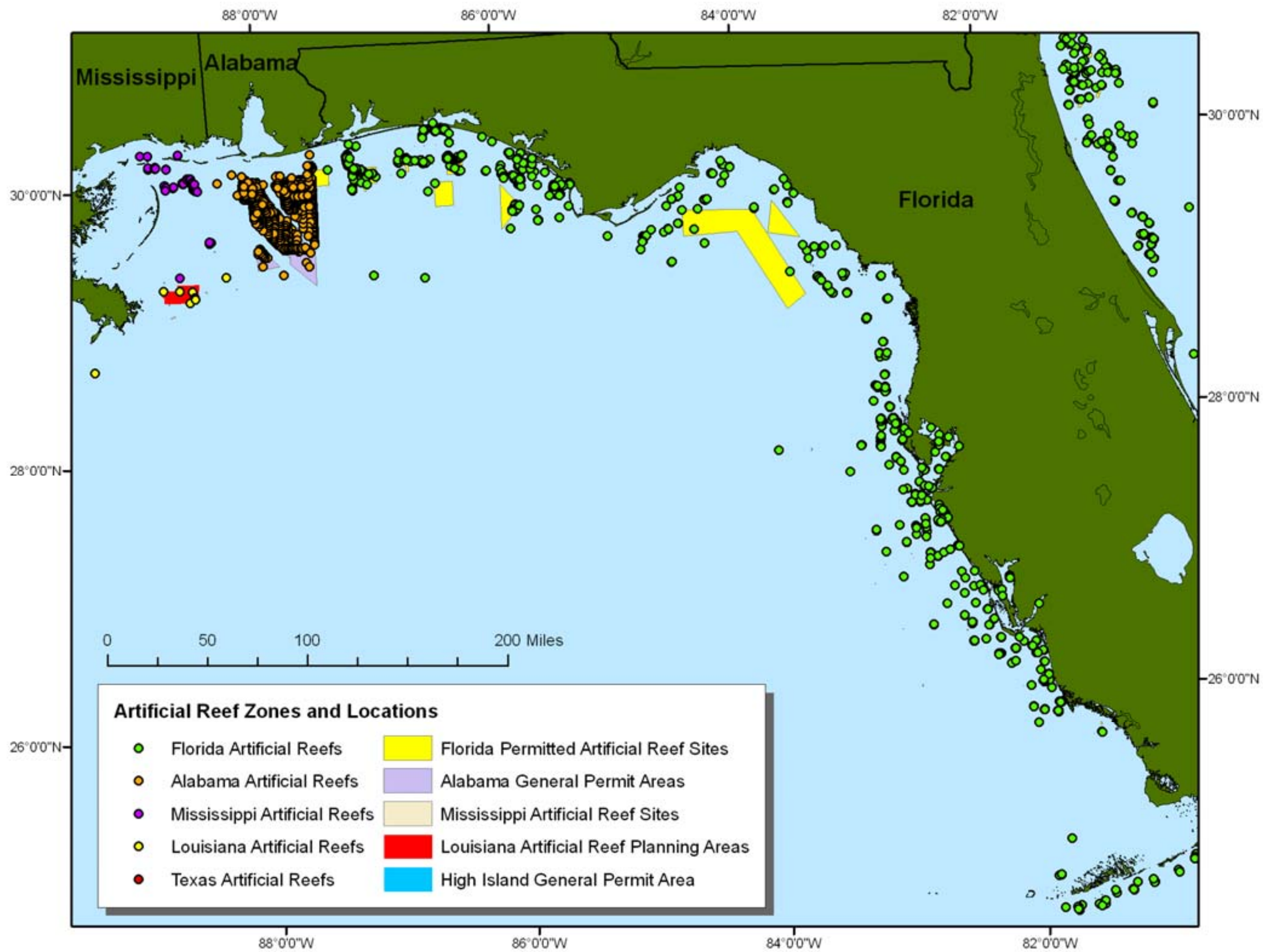

Figure 5.1.3.3-1. Permitted artificial reef sites and zones in the eastern Gulf of Mexico.

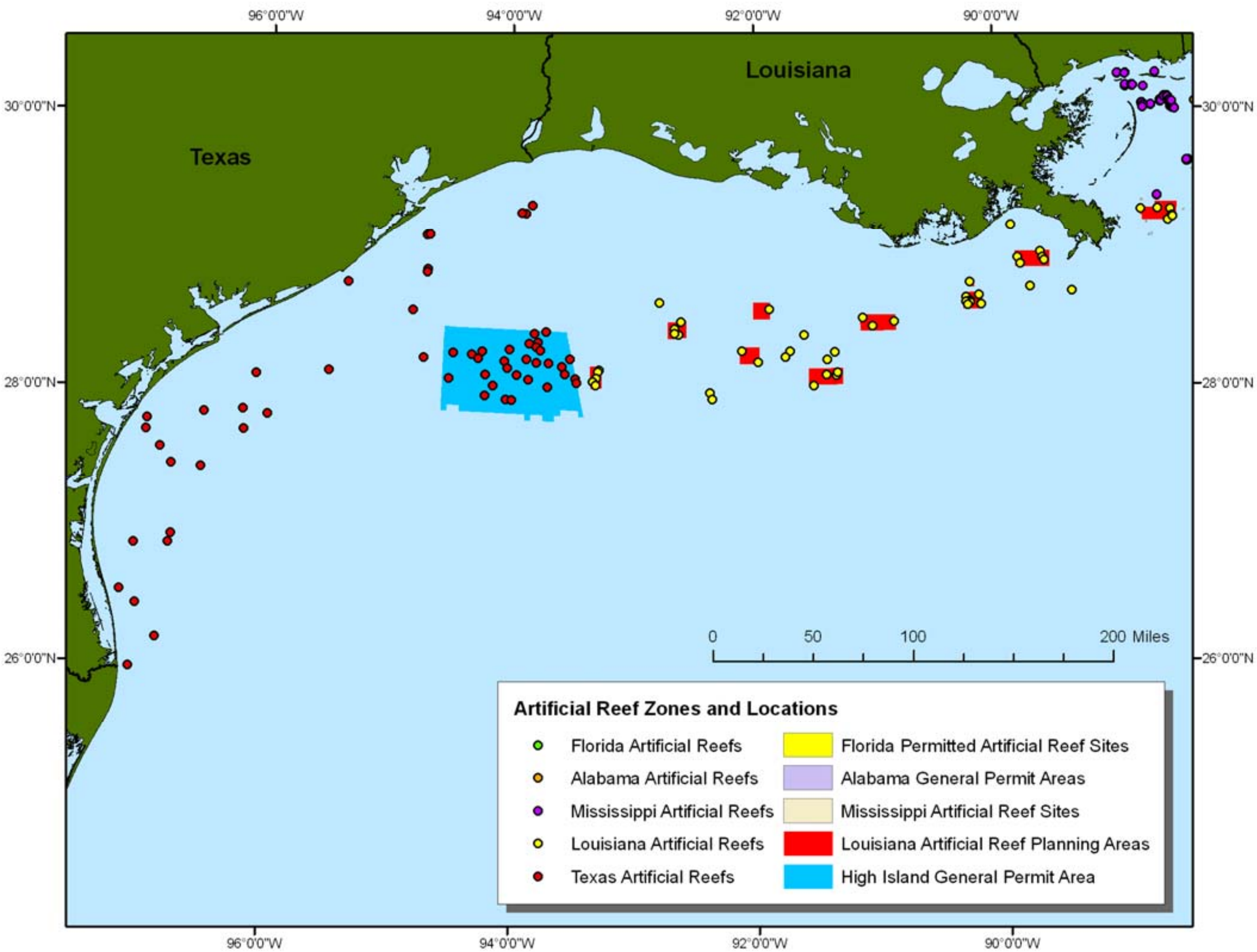

Figure 5.1.3.3-2. Permitted artificial reefs and zones in the western Gulf of Mexico.

5.2.3 Status of Stocks

5.2.3.1 Council Managed Species

The NOS of NOAA collaborated with NOAA Fisheries Service and the Council to develop distributions of reef fish (and other species) in the Gulf (SEA 1998). NOS obtained fishery-independent data sets for the Gulf, including SEAMAP, and state trawl surveys. Data from the Estuarine Living Marine Resources (ELMR) Program contain information on the relative abundance of specific species (highly abundant, abundant, common, rare, not found, and no data) for a series of estuaries, by five life stages (adult, spawning, egg, larvae, and juvenile) and month for five seasonal salinity zones (0-0.5, 0.5-5, 5-15, 15-25, and >25). NOS staff analyzed the data to determine relative abundance of the mapped species by estuary, salinity zone, and month. For some species not in the ELMR database, distribution was classified as only observed or not observed for adult, juvenile, and spawning stages.

In general, reef fish are widely distributed in the Gulf, occupying both pelagic and benthic habitats during their life cycle. Habitat types and life history stages are summarized in Table 5.2.3.1-1 and can be found in more detail in GMFMC (2004). In general, both eggs and larval stages are planktonic. Larvae feed on zooplankton and phytoplankton. Exceptions to these generalizations include the gray triggerfish that lay their eggs in depressions in the sandy bottom, and gray snapper whose larvae are found around submerged aquatic vegetation (SAV). Juvenile and adult reef fish are typically demersal, and are usually associated with bottom topographies on the continental shelf (<100 m) which have high relief, i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. However, several species are found over sand and soft-bottom substrates. Juvenile red snapper are common on mud bottoms in the northern Gulf, particularly off Texas through Alabama. Also, some juvenile snappers (e.g. mutton, gray, red, dog, lane, and yellowtail) and groupers (e.g. goliath grouper, red, gag, and yellowfin) have been documented in inshore seagrass beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC 1981). More detail on hard bottom substrate and coral can be found in the FMP for Corals and Coral Reefs (GMFMC and SAFMC 1982).

5.2.3.1.1 Reef Fish

The Reef Fish FMP currently encompasses 42 species. Stock assessments have been conducted on 12 species: red snapper (SEDAR 7, 2005), vermilion snapper (SEDAR 9 2006a), yellowtail snapper (SEDAR 3 2003), gray triggerfish (SEDAR 9 2006b), greater amberjack (SEDAR 9 2006c), hogfish (SEDAR 6 2004a), red grouper (SEDAR 12 2007), gag (SEDAR 10 2006; SEFSC 2007), yellowedge grouper (Cass-Calay and Bahnick 2002), mutton snapper (SEDAR 15A 2008), and goliath grouper (SEDAR 6, 2004b). A review of the Nassau grouper's stock status was conducted by Eklund (1994), and updated estimates of generation times were developed by Legault and Eklund (1998).

Table 5.2.3.1-1. Summary of habitat utilization by life history stage for most species in the Reef Fish FMP. This table is adapted from Table 3.2.7 in the final draft of the EIS from the Council's EFH generic amendment (GMFMC 2004).

Common name	Eggs	Larvae	Post-larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Red snapper	Pelagic	Pelagic		Hard bottoms, Sand/ shell bottoms, Soft bottoms	Hard bottoms, Sand/ shell bottoms, Soft bottoms	Hard bottoms, Reefs	Sand/ shell bottoms
Queen snapper	Pelagic	Pelagic				Hard bottoms	
Mutton snapper	Reefs	Reefs	Reefs	Mangroves, Reefs, SAV, Emergent marshes	Mangroves, Reefs, SAV, Emergent marshes	Reefs, SAV	Shoals/ Banks, Shelf edge/slope
Schoolmaster	Pelagic	Pelagic		Mangroves, SAV	Hard bottoms, Mangroves, Reefs, SAV, Emergent marshes	Hard bottoms, Reefs, SAV	Reefs
Blackfin snapper	Pelagic			Hard bottoms	Hard bottoms	Hard bottoms, Shelf edge/slope	Hard bottoms, Shelf edge/slope
Cubera snapper	Pelagic			Mangroves, Emergent marshes, SAV	Mangroves, Emergent marshes, SAV	Mangroves, Reefs	Reefs
Gray (mangrove) snapper	Pelagic, Reefs	Pelagic, Reefs	SAV	Mangroves, Emergent marshes, Seagrasses	Mangroves, Emergent marshes, SAV	Emergent marshes, Hard bottoms, Reefs, Sand/ shell bottoms, Soft bottoms	
Dog snapper	Pelagic	Pelagic		SAV	Mangroves, SAV	Reefs, SAV	Reefs
Mahogany snapper	Pelagic	Pelagic		Reefs, Sand/ shell bottoms	Reefs, Sand/ shell bottoms	Hard bottoms, Reefs, Sand/ shell bottoms, SAV	
Lane snapper	Pelagic		Reefs, SAV	Mangroves, Reefs, Sand/ shell bottoms, SAV, Soft bottoms	Mangroves, Reefs, Sand/ shell bottoms, SAV, Soft bottoms	Reefs, Sand/ shell bottoms, Shoals/ Banks	Shelf edge/slope
Silk snapper						Shelf edge	
Yellowtail snapper	Pelagic			Mangroves, SAV, Soft bottoms	Reefs	Hard bottoms, Reefs, Shoals/ Banks	

Common name	Eggs	Larvae	Post-larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Wenchman	Pelagic	Pelagic				Hard bottoms, Shelf edge/slope	Shelf edge/slope
Vermilion snapper	Pelagic			Hard bottoms, Reefs	Hard bottoms, Reefs	Hard bottoms, Reefs	
Gray triggerfish	Reefs	Drift algae	Drift algae	Drift algae	Drift algae, Reefs	Reefs, Sand/ shell bottoms	Reefs, Sand/ shell bottoms
Greater amberjack	Pelagic	Pelagic	Pelagic	Drift algae	Drift algae	Pelagic, Reefs	Pelagic
Lesser amberjack				Drift algae	Drift algae	Hard bottoms	Hard bottoms
Almaco jack	Pelagic			Drift algae	Drift algae	Pelagic	Pelagic
Banded rudderfish		Pelagic		Drift algae	Drift algae	Pelagic	Pelagic
Hogfish				SAV	SAV	Hard bottoms, Reefs	Reefs
Blueline tilefish	Pelagic	Pelagic				Hard bottoms, Sand/ shell bottoms, Shelf edge/slope, Soft bottoms	
Tilefish	Pelagic, Shelf edge/ Slope	Pelagic		Hard bottoms, Shelf edge/slope, Soft bottoms	Hard bottoms, Shelf edge/slope, Soft bottoms	Hard bottoms, Shelf edge/slope, Soft bottoms	
Dwarf sand perch					Hard bottoms	Hard bottoms, Soft bottoms	
Sand perch						Reefs, SAV, Shoals/ Banks, Soft bottoms	
Rock hind	Pelagic	Pelagic				Hard bottoms, Reefs	Hard bottoms, Reefs
Speckled hind	Pelagic	Pelagic				Hard bottoms, Reefs	Shelf edge/slope
Yellowedge grouper	Pelagic	Pelagic			Hard bottoms	Hard bottoms	
Red hind	Pelagic	Pelagic		Reefs	Reefs	Hard bottoms, Reefs, Sand/ shell bottoms	Hard bottoms
Goliath grouper	Pelagic	Pelagic	Man-groves	Mangroves, Reefs, SAV	Hard bottoms, Mangroves, Reefs, SAV	Hard bottoms, Shoals/ Banks, Reefs	Reefs, Hard bottoms
Red grouper	Pelagic	Pelagic		Hard bottoms, Reefs, SAV	Hard bottoms, Reefs	Hard bottoms, Reefs	

Common name	Eggs	Larvae	Post-larvae	Early Juveniles	Late juveniles	Adults	Spawning adults
Misty grouper	Pelagic	Pelagic				Hard bottoms, Shelf edge/slope	Hard bottoms
Warsaw grouper	Pelagic	Pelagic			Reefs	Hard bottoms, Shelf edge/slope	
Snowy grouper	Pelagic	Pelagic		Reefs	Reefs	Hard bottoms, Reefs, Shelf edge/slope	
Nassau grouper		Pelagic		Reefs, SAV		Hard bottoms, Reefs, Sand/ shell bottoms	Hard bottoms, Reefs, Sand/ shell bottoms
Black grouper	Pelagic	Pelagic		SAV	Hard bottoms, Reefs	Hard bottoms, Mangroves, Reefs	
Yellowmouth grouper	Pelagic	Pelagic		Mangroves	Mangroves, Reefs	Hard bottoms, Reefs	
Gag	Pelagic	Pelagic		SAV	Hard bottoms, Reefs, SAV	Hard bottoms, Reefs	
Scamp	Pelagic	Pelagic		Hard bottoms, Mangroves, Reefs	Hard bottoms, Mangroves, Reefs	Hard bottoms, Reefs	Reefs, Shelf edge/slope
Yellowfin grouper				SAV	Hard bottoms, SAV	Hard bottoms, Reefs	Hard bottoms

Of the 12 species for which stock assessments have been conducted, the 2007 Report to Congress on the Status of the U.S. Fisheries (NOAA Fisheries Service 2008) classifies two as overfished (greater amberjack and red snapper), and four as undergoing overfishing (red snapper, gag, gray triggerfish, and greater amberjack). In June 2008, the status for gray triggerfish changed from undefined to overfished after Amendment 30A to the Reef Fish FMP. Recent assessments for vermilion snapper (SEDAR 9 2006a) and red grouper (SEDAR 12 2007) indicate these species are not overfished and are not undergoing overfishing. Recent assessments for greater amberjack (SEDAR 9 2006c), gray triggerfish (SEDAR 9 2006b), and gag (SEFSC 2007) indicate these species are experiencing overfishing, and stock recovery for greater amberjack is occurring slower than anticipated. The overfished status for gag is currently undefined. The Council recently approved Amendment 30B to the Reef Fish FMP to address overfishing for gag. This amendment was submitted in September 2008 to the Secretary for approval. Many of the stock assessments and stock assessment reviews can be found on the Council (www.gulfcouncil.org) and SEDAR (www.sefsc.noaa.gov/sedar) websites.

5.2.3.1.2 Coastal Migratory Pelagics

King Mackerel

The Gulf group king mackerel stock is no longer considered as overfished or undergoing overfishing, the current spawning stock biomass (SSB) is above SSB_{MSY}. Current fishing mortality ($F_{current}$) is below F_{MSY} and the stock is in good health. Although the current total allowable catch (TAC) is set at 10.2 mp, catches in the most recent years have approximated catches at the allowable biological catch (ABC) range for OY (7.0 mp to 8.0 mp). Analyses conducted as part of SEDAR 16 indicate Gulf group king mackerel are fully recovered (SEDAR 16 2008).

Spanish Mackerel

Gulf group Spanish mackerel was assessed in 1999 using data through the 1997 fishing year. Based on the Council's proposed definitions for overfishing and the overfished condition for Gulf group Spanish mackerel, the stock is not considered as either overfished or undergoing overfishing (MSAP 2001a). Recent catch levels are less than half of the recommended TAC under the OY target of $F_{40\%\ SPR}$. Furthermore, $SSB_{current}$ is above SSB_{MSY}.

Dolphin

Prager (2000) assessed the dolphin stocks in the Gulf, South Atlantic, and Caribbean as one stock. He concluded that F_{1997} to F_{msy} was approximately 50 percent, and B_{1998} to B_{MSY} was approximately 156 percent. Consequently, the stock was neither undergoing overfishing nor overfished. Furthermore, MSY was estimated at approximately 27 million pounds per year, and average annual catches for the last 5 years were approximately 16 million pounds. Thus, there was little chance that the stock would become overfished unless fishing mortality drastically increased.

Cobia

MSAP (2001b) and Williams (2001) observed that F_{2000} was estimated at 0.67 and there was a 40 percent chance that F_{2000} was greater than F_{MSY}. Biomass in 2000 was estimated at 1.33 and there was a 30 percent chance that B_{2000} was less than MSST (defined as 70 percent of B_{MSY}). Consequently, under the Council's status determination criteria, cobia would not be considered as overfished or undergoing overfishing. Furthermore, catches in recent years have been approximately 1.1 to 1.2 million pounds and below the estimated MSY of 1.5 million pounds. Additionally, these recent catches have been below the recommended OY catch of 75 percent of MSY. Thus, it is expected that if present catch levels continue the stock will continue to remain healthy.

Table 5.2.3.2-2 Species of the reef fish FMP. Species in bold have had stock assessments. *Deep-water groupers (Note: if the shallow-water grouper quota is filled, then scamp are considered a deep-water grouper) **Protected groupers

Common Name	Scientific Name	Stock Status
	Balistidae—Triggerfishes	
Gray triggerfish	***Balistes capriscus***	**Overfished, overfishing**
	Carangidae—Jacks	
Greater amberjack	***Seriola dumerili***	**Overfished, overfishing**
Lesser amberjack	*Seriola fasciata*	Unknown
Almaco jack	*Seriola rivoliana*	Unknown
Banded rudderfish	*Seriola zonata*	Unknown
	Labridae—Wrasses	
Hogfish	***Lachnolaimus maximus***	**Unknown**
	Lutjanidae—Snappers	
Queen snapper	*Etelis oculatus*	Unknown
Mutton snapper	***Lutjanus analis***	**Not overfished, not overfishing**
Schoolmaster	*Lutjanus apodus*	Unknown
Blackfin snapper	*Lutjanus buccanella*	Unknown
Red snapper	***Lutjanus campechanus***	**Overfished, overfishing**
Cubera snapper	*Lutjanus cyanopterus*	Unknown
Gray (mangrove) snapper	*Lutjanus griseus*	Unknown
Dog snapper	*Lutjanus jocu*	Unknown
Mahogany snapper	*Lutjanus mahogoni*	Unknown
Lane snapper	*Lutjanus synagris*	Unknown
Silk snapper	*Lutjanus vivanus*	Unknown
Yellowtail snapper	***Ocyurus chrysurus***	**Not overfished, not overfishing**
Wenchman	*Pristipomoides aquilonaris*	Unknown
Vermilion snapper	***Rhomboplites aurorubens***	**Not overfished, not overfishing**
	Malacanthidae—Tilefishes	
Goldface tilefish	*Caulolatilus chrysops*	Unknown
Blackline tilefish	*Caulolatilus cyanops*	Unknown
Anchor tilefish	*Caulolatilus intermedius*	Unknown
Blueline tilefish	*Caulolatilus microps*	Unknown
(Golden) Tilefish	*Lopholatilus chamaeleonticeps*	Unknown
	Serranidae—Groupers	
Dwarf sand perch	*Diplectrum bivittatum*	Unknown
Sand perch	*Diplectrum formosum*	Unknown
Rock hind	*Epinephelus adscensionis*	Unknown
Yellowfin grouper	*Mycteroperca venenosa*	Unknown
Scamp	*Mycteroperca phenax*	Unknown
Red hind	*Epinephelus guttatus*	Unknown
****Goliath grouper**	***Epinephelus itajara***	**Unknown, not overfishing**
****Nassau grouper**	***Epinephelus striatus***	**Unknown, not overfishing**
Red grouper	***Epinephelus morio***	**Not overfished, not overfishing**
Gag	***Mycteroperca microlepis***	**Not overfished, overfishing**
Yellowmouth grouper	*Mycteroperca interstitialis*	Unknown
Black grouper	*Mycteroperca bonaci*	Unknown
***Yellowedge grouper**	***Epinephelus flavolimbatus***	**Unknown**
*Snowy grouper	*Epinephelus niveatus*	Unknown
*Warsaw grouper	*Epinephelus nigritus*	Unknown
*Misty grouper	*Epinephelus mystacinus*	Unknown
*Speckled hind	*Epinephelus drummondhayi*	Unknown

Cero, Bluefish, and Little Tunny
The status of these three species was assessed in 2001. The little tunny assessment (Brooks 2002) estimated that there was only a 24 percent chance that the F for 2000/01 was greater than F_{msy}; therefore, little tunny were not undergoing overfishing. The assessment also indicated there was a 78 percent chance that the little tunny stock was not overfished. The MSAP recommended that the catch not exceed 1.55 MP. The assessment for bluefish provided inconsistent results and no recommendations on stock status or management benchmarks were made by the MSAP. The MSAP did note however that CPUE trends had declined since the mid to late 1980s. A preliminary analysis of cero landings was conducted in 2001, but no status determinations were made.

5.2.3.1.3 Stone Crab

Landings, in pounds of claws on a fishing-season basis, have varied without trend since 1989-90. Peak landings were 3.5 million pounds statewide in Florida in the 1997-98 fishing season. Statewide landings for 2004-05 were 3.0 million pounds of claws.

Since the 1962-63 fishing season (the first year with an estimate of the number of traps in the fishery), the number of traps in the fishery has increased more than a hundred-fold – from 15,000 traps in the 1962-63 season to 1.6 million traps in the 2001-02 season. In a physical count of traps conducted in the 1998-99 fishing season, FWC employees found 1.4 million traps, which was twice the number that was estimated in 1992-93. As a response to the rapidly increasing number of traps in the fishery, the legislature in 2000 approved the stone crab trap limitation program, which was implemented in October 2002. The number of commercial trips also increased from 19,000 in the 1985-86 season (the first season with trip information available) to a maximum of 38,000 trips in the 1996-97 season and then declined afterwards.

The status of the stock is best indicated by the stable landings after 1989-90. The three-fold increase in the number of traps since then suggests that the current level of landings is all that can be harvested under current environmental conditions, regulations, and fishery practices and that the fishery is overfishing (Muller et al. 2006). Recruitment does not show any decline over the time series. These conclusions were the same as those from the 1997 and 2001 assessments. The stone crab fishery may be resilient because most female stone crabs spawn one or more times before their claws reach legal size, because some crabs survive declawing, and because the fishing season is closed during the principal spawning season. However, the fishery continues to have too many traps in the water. Further evidence of excess traps is the low catch-per-trap level over a very wide range of numbers of traps. For the past decade (1995-96 to 2004-05 fishing seasons), the Gulf coast fishers have declawed approximately 10.5 million crabs during each seven-month fishing season.

5.2.3.1.4 Spiny Lobster

This section summarizes the "assessment of spiny lobster, *Panulirus argus*, in the Southeast United States" prepared by the Southeast Data Assessment and Review (SEDAR) 8 U.S. Spiny Lobster Stock Assessment Panel.

Two assessment models were chosen during SEDAR 8: a simple, modified DeLury model and a statistical catch-at-age model (Integrated Catch-at-Age). The age-structured model was the base model and the DeLury model was a check for consistency. Recruitment of lobsters one year after settlement has varied over time. The spawning biomass in Florida has increased over time especially in the three most recent fishing years. Fishing mortality rates have varied without trend until the recent drop in fishing mortality after 2000. Older lobsters appear to be less available to the fishery as reflected in the dome-shaped selectivity curve. Both assessment models interpreted the lower landings after the 1990-2000 fishing years as decreased effort. The DeLury model estimated a lower population size with correspondingly higher fishing mortality rates than did the catch-at-age model, but when the DeLury model was adjusted for selectivity, the results were similar.

Amendment 6 of the Spiny Lobster FMP defined overfishing as fishing at a rate in excess of that associated with a static SPR value of 20 percent (F_{2005}). With the current life history values and fishery practices, the fishing mortality rate on fully recruited lobsters (age-3) at a static SPR of 20 percent was 0.49 per year. The spiny lobster fishery in the Southeastern United States has fluctuated at SPR values around the 20 percent objective until the three most recent years and was deemed to not be overfishing because the fishing mortality rate on age-3 in 2003-04 (0.26 per year) was below the Council's F_{MSY} proxy of $F_{20\%\ SPR.}$ Even when the fishing mortality rate was adjusted for retrospective bias (0.36 per year), the fishing mortality rate in 2003-04 was still below the Council's management objective. Without a Caribbean-wide stock assessment, the SEDAR panel was unable to determine the status of the stock with regard to B_{MSY} or the MSST.

5.2.3.1.5 Red Drum

The 1987 Stock Assessment Panel report recommended that ABC be set at zero for the EEZ and that the states increase the escapement rate of red drum from estuaries to 20 percent. The 1989 SEFSC Stock Assessment report indicated the SSBR would likely decline to 13 percent. The 1989 Stock Assessment Panel report recommended ABC for the EEZ be maintained at zero, and that the states increase escapement to 30 percent.

During 1991, the Red Drum Stock Assessment Panel (RDSAP) reviewed stock assessments prepared by NOAA Fisheries Service, the Louisiana Department of Wildlife and Fisheries (LDWF), and the State of Florida. The RDSAP recommendation was that ABC be set at zero. The Council recommended to NOAA Fisheries Service that TAC be zero for 1992, and that a more comprehensive assessment of a SSBR level be provided in 1992.

The most recent stock assessment for red drum is very uncertain, and the RDSAP could not reach a firm conclusion on the Gulf-wide status of the red drum resource (RDSAP 2000). The RDSAP made several assessment runs with a variety of assumptions, and obtained results that ranged from overfished to not overfished (M. Murphy, FWRI, personal communication). In general, however, most assessment runs showed an overfished condition. In contrast, red drum assessments by the Gulf States show the red drum resource is not overfished (M. Murphy, personal communication).

5.2.3.2 Highly Migratory Species

5.2.3.2.1 Swordfish

The most recent assessment of North and South Atlantic swordfish stocks was conducted in 2006. The North Atlantic swordfish biomass at the beginning of 2006 was estimated to be about 99 percent of the biomass needed to produce MSY, and F_{2005} was estimated to be about 14 percent below the fishing mortality rate at MSY. The South Atlantic swordfish stock is in good condition. The current estimated fishing mortality rate for South Atlantic swordfish is likely below that which would produce MSY, and the current biomass is likely above that which would result from fishing at F_{MSY} in the long term.

5.2.3.2.2 Tunas

West Atlantic Bluefin Tuna - The west Atlantic bluefin tuna stock assessment update is anticipated to be released in fall 2008. According to the 2004 west Atlantic bluefin tuna stock assessment, SSB was estimated at 41 percent of SSB_{MSY} and F was estimated to be between 170 and 310 percent of F_{MSY}; therefore, for west Atlantic bluefin tuna, the stock is overfished and overfishing is occurring (SCRS 2007).

Bigeye Tuna - According to the latest Atlantic bigeye tuna stock assessment, conducted in 2006, biomass (B) was estimated at 92 percent of B_{MSY} and F was estimated between 70 and 124 percent of F_{MSY} (SCRS 2007). The stock is considered to be rebuilding and overfishing is not occurring.

Yellowfin Tuna - The 2001 stock assessment for Atlantic yellowfin tuna estimated B at 73 to 110 percent of B_{MSY} and F at 87 to 146 percent of F_{MSY} (SCRS 2007). The stock is considered to be approaching an overfished condition.

North Atlantic Albacore Tuna - The 2005 stock assessment for North Atlantic albacore tuna estimated B at 81 percent of B_{MSY} and F at 150 percent of F_{MSY} (SCRS 2007). The stock is considered to be overfished and overfishing is not occurring.

West Atlantic Skipjack Tuna - The last assessment on Atlantic skipjack tuna was carried out in 1999. Due to the state of the stocks, as well as the stocks in other oceans, show a series of characteristics that make it difficult to conduct an assessment using current models (SCRS 2007). Among these characteristics, the most noteworthy are:

- The continuous recruitment throughout the year, but heterogeneous in time and area, making it impossible to identify and monitor the individual cohorts;

- Apparent variable growth between areas, which makes it difficult to interpret the size distributions and their conversion to ages; and,
- Exploitation by many and diverse fishing fleets (baitboat and purse seine), having distinct and changing catchabilities, which makes it difficult to estimate the effective effort exerted on the stock in the east Atlantic.

For these reasons, no standardized assessments have been able to be carried out on the Atlantic skipjack tuna stocks.

5.2.3.2.3 Billfish

Blue marlin - No new information on stock status has been provided since the 2006 assessment. The recent biomass level most likely remains well below the B_{MSY} estimated in 2000. Current and provisional diagnoses suggest that F has recently declined and is possibly smaller than $F_{replacement}$ but larger than the F_{MSY} estimated in the 2000 assessment. Over the period 2001-05 several abundance indicators suggest that the decline has been at least partially arrested, but some other indicators suggest that abundance has continued to decline. Confirmation of these recent apparent changes in trend will require at least an additional four or five years of data, especially since the reliability of the recent information has diminished and may continue to do so (SCRS 2007).

White marlin - No new information on stock status has been provided since the 2006 assessment. The recent biomass most likely remains well below the B_{MSY} estimated in the 2002 assessment. Current and provisional diagnoses suggest that F is probably smaller than $F_{replacement}$ and probably also larger than the F_{MSY} estimated in the 2002 assessment. Over the period 2001-04 combined longline indices and some individual fleet indices suggest that the decline has been at least partially reversed, but some other individual fleet indices suggest that abundance has continued to decline. Confirmation of these recent apparent changes in trend will require at least an additional four or five years of data, especially since the reliability of the recent information has diminished and may continue to do so (SCRS 2007).

Sailfish - No new assessments of the sailfish stocks have been conducted since 2001. No relative abundance indices have been presented since 2001. Although the 2001 attempts at quantitatively assessing the status of these two stocks (eastern and western sailfish) proved to be unsatisfactory, there were indications of early decreases in biomass for these two stocks. These decreases probably lowered the biomass of the stocks to levels that may be producing sustainable catches, but it is unknown whether biomass levels are below those that could produce MSY (SCRS 2007).

5.2.3.2.4 Sharks

Large coastal sharks (LCS), sandbar sharks, and blacktip sharks were assessed in 2005/2006. Based on this latest assessment, the LCS complex was determined to be unknown, sandbar sharks were determined to be overfished with overfishing occurring, and blacktip sharks were assessed as two populations: an Atlantic and a Gulf population. The Atlantic population of blacktip sharks was determined to be unknown, and the Gulf population was determined to not be overfished with no overfishing occurring. The small coastal shark (SCS) complex and individual species in the complex (blacknose, bonnethead, Atlantic sharpnose, and finetooth) were assessed in 2007. The SCS complex was determined to not be overfished with no overfishing occurring; however, the assessment scientists and peer reviewers recommended using the individual species assessments for stock determinations. According to the individual assessments, bonnethead, Atlantic sharpnose, and finetooth sharks were determined to not be overfished with no overfishing occurring. Blacknose sharks were determined to be overfished with overfishing occurring.

5.2.3.3 Marine Mammals and Protected Species

There are 28 different species of marine mammals that may occur in the Gulf. All 28 species are protected under the MMPA and six are also listed as endangered under the ESA (sperm, sei, fin, blue, humpback and North Atlantic right whales). Other species protected under the ESA occurring in the Gulf include five sea turtle species (Kemp's Ridley, loggerhead, green, leatherback, and hawksbill); two fish species (Gulf sturgeon and smalltooth sawfish), and two coral species elkhorn *Acropora palmata* and staghorn *A. cervicornis*. For information on these protected species in the Gulf, refer to the final EIS to the Council's Generic EFH amendment (GMFMC 2004) and the February 2005 ESA biological opinion on the reef fish fishery. Marine mammal stock assessment reports and additional information is also available on the NOAA Fisheries Service Office of Protected Species website: http://www.nmfs.noaa.gov/pr/species/.

There is a resident population of female sperm whales in the Gulf, and whales with calves are sighted frequently. However, sperm whales are considered to commonly occur beyond shelf edge (> 200 m). Typically, no endangered species of whales occur in the near shore waters over the continental shelf of the Gulf. Occasionally, North Atlantic right whales and humpback whales may be found in near shore waters of the Gulf, usually during the winter season, but sightings of these species are relatively uncommon.

Sperm whale pods have been observed throughout the Gulf from the upper continental slope near the 100-m isobath to the seaward extent of the U.S. EEZ and beyond, from sightings data collected from NOAA cruises from 1991 to 2000 (Roden and Mullin 2000, Baumgartner et al. 2001; Burks et al. 2001). Based on NOAA surveys, opportunistic sightings, whaling catches, and stranding records, sperm whales in the Gulf occur year-round. Sperm whales appear to favor water depths of about 1,000 m and appear to be concentrated in at least two geographic regions of the Northern Gulf: an area off the Dry Tortugas and offshore of the Mississippi River delta (Maze-Foley and Mullin 2006); however, distribution also appears to be influenced by occurrence and movement of cyclonic/anti-cyclonic currents in the Gulf. Davis et al. (2000a) noted the presence of a resident, breeding population of endangered sperm whales within 50 km of the Mississippi River Delta and suggested that this area may be essential habitat for sperm whales. The Southeast United States Marine Mammal Stranding Network received reports of 17 sperm whales that stranded along the Gulf coastline from 1987 to 2003 in areas ranging from Pinellas County, Florida, to Matagorda County, Texas.

The Gulf sperm whale abundance has most recently been estimated at 1,349 whales (CV = 0.23) (Mullin and Fulling 2003), calculated from an average of estimates from surveys conducted between 1996 and 2001.

The Gulf stock is comprised of mostly females and calves, although large mature bulls have been recently sighted in the Gulf. Based on seasonal aerial surveys, sperm whales are present in the northern Gulf in all seasons, but sightings in the northern Gulf are more common during the summer months (Mullin et al. 1991, Davis et al. 2000a). Based on recent survey efforts, sperm whales concentrations are regularly sighted, and the boundaries of these areas of concentration in the northern Gulf appear to be approximately 86.5°W to 90.0°W, north of 27.0°N (K.D. Mullin, NMFS Pascagoula Laboratory, personal communication), and off southern Florida in an area approximately 86.5°W to 85.5°W, 24.0°N to 26.0°N (K.D. Mullin, personal communication); however, sperm whales have been reported throughout the Gulf in waters greater than 200 m.

Bottlenose dolphins, Atlantic spotted dolphins, and Risso's dolphins are the only dolphins in the Gulf that commonly occur in estuarine waters to continental shelf edge (0-200 m). Bottlenose dolphins are the most widespread and common cetaceans of the coastal Gulf waters. They inhabit the Gulf year-round and are the most commonly observed dolphin in near shore waters. Atlantic spotted dolphins prefer tropical to warm-temperate waters over the continental shelf, edge, and upper reaches of the slope. Risso's dolphins are typically found around the continental shelf edge and steep upper sections of the slope (>100 m depths).

The leatherback is the most abundant sea turtle in waters over the northern Gulf continental slope (Mullin and Hoggard 2000). Leatherbacks appear to spatially use both continental shelf and slope habitats in the Gulf (Fritts et al. 1983, Collard 1990), but primarily utilize pelagic waters > 200 m (Davis and Fargion 1996) throughout the northern Gulf. Recent surveys suggest that the region from the Mississippi Canyon to DeSoto Canyon, especially near the shelf edge, appears to be an important habitat for leatherbacks (Mullin and Hoggard 2000). Surveys of sea turtles in the eastern Gulf reported densities of 0.0026 individuals/km^2 (95 percent confidence interval (CI) = 0.0004 - 0.0140) in 0-10 fathoms and 0.0029 individuals/km^2 (95 percent CI = 0.0015 - 0.0057) in 10-40 fathoms (Epperly et al. 2002). Leatherbacks are year-round inhabitants in the Gulf with frequent sightings during both summer and winter (Mullin and Hoggard 2000). Temporal variability and abundance suggest that specific areas may be important to this species, either seasonally or for short periods of time.

Green sea turtles are found throughout the Gulf. They occur in small numbers over seagrass beds along the south of Texas and the Florida Gulf coast. Areas known as important feeding areas include the Homosassa River, Crystal River, and Cedar Key, Florida, and seagrass meadows and algae-laden jetties along the Texas coast. Sea turtle surveys in the eastern Gulf have reported densities of 0.0021 individuals/km^2 (95 percent CI = 0.0006 - 0.0075) in 0-10 fathoms and 0.0137 individuals/km^2 (95 percent CI = 0.0060 - 0.0317) in 10-40 fathoms (Epperly et al. 2002).

The near shore waters of the Gulf are believed to provide important developmental habitat for juvenile Kemp's ridley sea turtles. Ogren (1989) suggests that the Gulf coast, from Port Aransas, Texas, through Cedar Key, Florida, represents the primary habitat for subadult ridleys in the northern Gulf. This species generally remains within the 50-m isobath of coastal areas throughout the Gulf. Surveys of sea turtles in the eastern Gulf reported densities of 0.0079 individuals/km^2 (95 percent CI = 0.0030 - 0.0207) in 0-10 fathoms and 0.0011 individuals/km^2 (95 percent CI = 0.0004 - 0.0035) in 10-40 fathoms (Epperly et al. 2002). Stomach contents from Kemp's ridleys also indicate a near shore distribution by their prey distribution which is consistent with other reported density estimates of 0.065 turtles per km^2 in 0-10 fathoms compared to a decrease of 0.013 turtles per km^2 in 10-40 fathoms (Epperly et al. 2002).

The near shore waters of the Gulf are believed to provide important developmental habitat for loggerhead sea turtles. Loggerhead nesting along the Gulf coast occurs primarily along the Florida Panhandle, although some nesting has been reported from Texas through Alabama as well (NOAA Fisheries Service and FWS 1991). Surveys of sea turtles in the eastern Gulf resulted in reported densities of 0.0532 individuals/km^2 (95 percent CI = 0.0295 - 0.0961) in 0-10 fathoms and 0.0452 individuals/km^2 (95 percent CI = 0.0233 - 0.0880) in 10-40 fathoms (Epperly et al. 2002). Loggerhead abundance does not appear to be significantly different between winter and summer months over shelf waters in the Gulf (Davis et al. 2000b). Although loggerheads are widely distributed during both summer and winter, their abundance in surface waters over the continental slope may be greater during winter than in summer (Mullin and Hoggard 2000), and many sightings occurred near the 100-m isobath (Davis et al. 2000b). Sightings of loggerheads in waters over the continental slope suggest that they may be in transit through these waters to distant foraging sites or seeking warmer waters during the winter. The majority of sightings have occurred in waters over the continental shelf, although many sightings have been reported over the continental slope.

In addition to some distribution over the slope waters, surface sightings of this species have also been made over the outer slope, approaching the 2,000-m isobath. Loggerheads found in deep waters may be traveling to distant nesting beaches, traveling between forage sites on distant and disjunct areas of the continental shelf, or seeking warmer waters during winter (Davis et al. 2000b).

5.2.3.4 Menhaden and Other Bait Fishes

Approximately 50 species of baitfish are in existence worldwide (FWRI 2000). These fishes are important food sources for large predators and represent an integral part of the marine food web. They are used primarily for the production of fish oils and fish meal, pet food, fertilizer, and recreational and commercial fishing bait. In the Gulf, several important species of baitfish exist, including: Gulf menhaden *Brevoortia patronus*, Atlantic thread herring *Opisthonema oglinum*, Spanish sardines *Sardinella aurita*, round scad *Decapterus punctatus*, and bigeye scad *Selar crumenophthalmus*. Of these five species, Gulf menhaden account for greater than 99 percent of the Gulf baitfish landings. A similar species, Atlantic menhaden *Brevoortia tyrannus*, is also landed in significant, although lesser quantities off several U.S Mid-Atlantic States. Figure 5.2.3.4-1 summarizes trends in Gulf menhaden landings and value from 1950-2006. Landings increased from 1950 through the mid-1980s. Beginning in 1984, landings began to decline. Landings during the last five years were approximately 50 percent less than landings during 1983-1987. The most recent stock assessment for Gulf menhaden was conducted by Vaughn et al. (2007). The assessment indicated that Gulf menhaden F and SSB were between target and limit biological reference points, indicating the stock was neither undergoing overfishing or overfished (Vaughn et al. 2007). However, the assessment did express possible concerns regarding a recent increase in F and decrease in population fecundity.

The Atlantic menhaden stock is neither overfished, nor undergoing overfishing (AMTC 2006). The F in 2005 was well below the overfishing limit (56 percent of F_{limit}) and stock fecundity was well above the overfished threshold (317 percent of fecundity limit).

Gulf menhaden are obligate filter feeders, consuming plankton and detritus (Friedland 1985). They are an important food source for many fishes, sea birds, and marine mammals (Ahrenholz 1981, 1991). Gulf menhaden migrate inshore in early spring and offshore in late fall (Roithmayr and Waller 1963). Spawning occurs during fall and winter, peaking in December and January (Lewis and Roithmayr 1981). Ninety-percent of all harvested fish are 1-2 years old, but they may live to be 6 years or older. Gulf menhaden are fully mature by age-2.

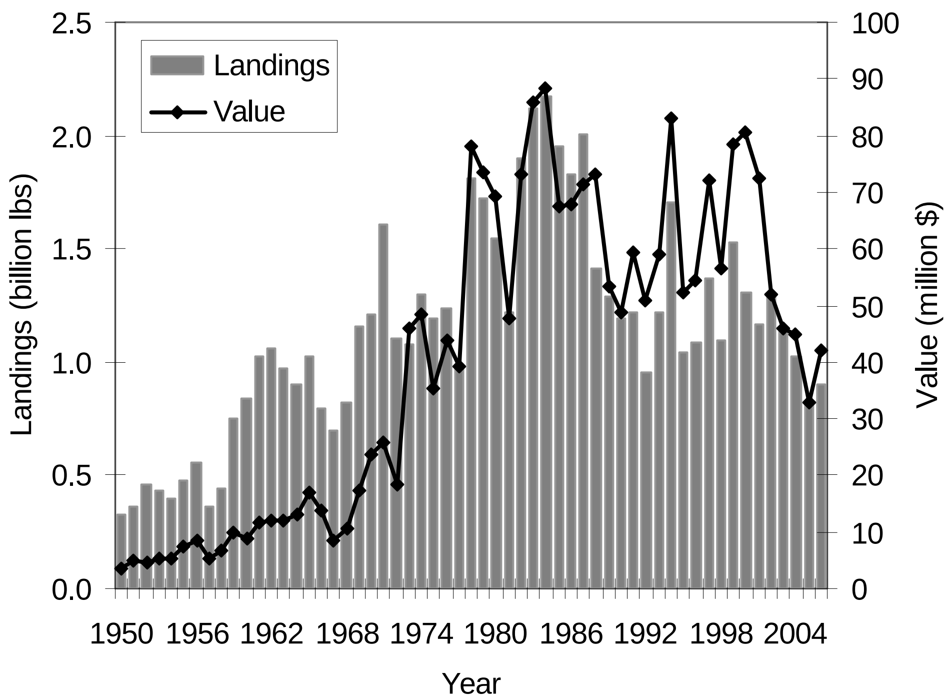

Figure 5.2.3.4-1. Trends in Gulf menhaden landings and value, 1950-2006.

5.3 Description of the Economic and Social Environment - Aquaculture Fishery

5.3.1 Introduction

First, this section begins with descriptions of past and present commercial offshore aquaculture operations in the United States to briefly describe the current state of such operations. Second, it describes past and present proposals for Exempted Fishing Permits for purposes of studying the feasibility of offshore aquaculture in the Gulf. Third, it identifies the likely species to be cultured in the Gulf EEZ, the fisheries of those species, representative fishing counties and communities, existing commercial aquaculture production of those species, if any, and relevant U.S. imports. Finally, it briefly describes the U.S. seafood trade deficit. Collectively, this information describes the economic and social environment of Gulf offshore aquaculture.

5.3.2 Past and Present Commercial Offshore Aquaculture Operations

At present, there are only three commercial offshore aquaculture operations producing cultured fish in the U.S., although a fourth recently discontinued production. None of these operations are or were in the Gulf of Mexico. There are near shore aquaculture operations in state waters of the Gulf; however, their sheltered conditions are not similar to those of the offshore environment with its deep water, large waves, and rapid currents. Offshore aquaculture facilities require different technologies, such as stronger cages and anchoring systems, which can withstand hurricanes and strong currents.

The three existing offshore aquaculture operations in the U.S. are: 1) Hukilau Foods, LLC (formerly Cates International, Inc.), which commercially grows Pacific threadfin (*Polydactylus sexfilis*), also known as moi, in Hawaiian waters; 2) Kona Blue Water Farms, which commercially grows amberjack (*Seriola rirvoliana*), also known as kahala or Hawaiian yellowtail, in Hawaiian waters; and 3) A.E. Lang Fisheries, which commercially raises blue mussels off the coast of New Hampshire. The fourth, Snapperfarm, Inc., which commercially raised cobia off Culebra, Puerto Rico, recently suspended its operations for a variety of reasons and has shifted its focus to a site in Panama.

5.3.2.1 Hukilau Foods LLC

Hukilau Foods, LLC, formerly Cates International, Inc., was formed out of two experiments of the Hawaii Offshore Aquaculture Research Project (Research Project). The Research Project was a partnership between the University of Hawaii, the Oceanic Institute in Waimanalo, Hawaii, and Safety Boats Hawaii (owned by Randy Cates) to explore the biological, economic, and environmental sustainability of offshore aquaculture in Hawaii and the Pacific region. The next two paragraphs briefly summarize the experiments, which were initiated in 1999 and ended in 2000.

The first experiment began in the fall of 1998 when the Research Project ordered an OceanSpar SeaStation 3000™ sea cage, and the Oceanic Institute began growing approximately 90,000 Pacific threadfin (*Polydactylus sexfilis*), also known as moi, fingerlings at its Waimanalo facility in February 1999. One month later, the sea cage was constructed on the surface about 2 miles off Ewa Beach and then deployed, and in mid-April an inner nursery was deployed around the central spur inside the cage (Figure 5.3.2.1).

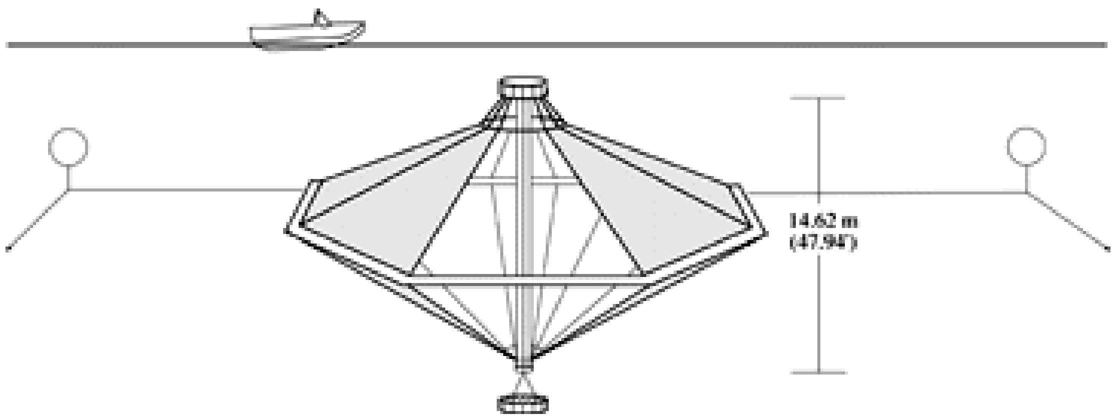

Figure 5.3.2.1 The Hawaii Offshore Aquaculture Research Project's two experiments used a bi-conical cage approximately 25 meters (82 feet) in diameter and 14.6 meters (48 feet) in depth with a working volume of 2,600 cubic meters (91,818 cubic feet). It was made of steel and NASA-developed mesh and designed to withstand 25-foot waves. The cage was kept fully submerged and moored on a four-point anchor system with each anchor attached to the cage with mooring line and a short piece of heavy anchor chain (Helsley 2000).

Days after the deployment of the nursery net, the juvenile fish were transported from Waimanalo to the ocean site. Relocation of the fingerlings from tanks on land to the sea cage occurred over three days and each trip took about five hours and involved the fingerlings being loaded into 1-ton containers, which were lifted by a crane and loaded onto a support boat provided by Safety Boats Hawaii, Inc. for a 2.5-hour trip to the sea cage. The nursery net was stocked with approximately 70,000 fingerlings of two cohort classes: 70-day old and 50-day old moi. The juvenile fish were fed to satiation each morning for six months with commercial dry, pelleted feed that was supplied through a venturi-style system built by Safety Boats Hawaii (Figure 5.3.2.2.). After about one month, the inner nursery net was removed to give the young fish access to the entire main cage. The moi were harvested from early September until November using three to four divers and an air system built by Safety Boats Hawaii and fish ranged from 250 grams (0.55 pounds) to 750 grams (1.65 pounds) in size. At the end of the first experiment in 1999, the sea cage and its mooring system were secured and left at the site for the second experiment.

Figure 5.3.2.2 Using a pipe pictured above, Pacific threadfin, also known as moi, fingerlings were introduced into the offshore sea cage. Using a similar pipe, an operator on a boat at the surface released commercial fish pellets daily into the cage to feed the fish. Oceanic Institute photo. ***Source:*** **NOAA Office of Oceanic and Atmospheric Research (www.oar.noaa.gov/spotlite/archive/spot_hawaii.html).**

The second experiment began and ended in 2000, almost doubling the number of fish raised. In April 2000, eggs of the Pacific threadfin were collected from a spawning group of wild broodstock held at the Oceanic Institute. Six 5-ton circular tanks were stocked with an average of 150,000 eggs each. The larvae hatched in the tanks and were raised to 25 days of age and partially trained to accept pelleted feed. The fry were then harvested from the six tanks and about 120,000 fish were stocked in eight, 5-ton tanks, at an approximate density of 15,000 fish per tank. At 39 days of age, the fish were transferred to ten, 30-ton circular tanks to grow and condition for transfer to the sea cage. Once they were at least 50 days old, they were transported from Waimanalo to the submerged cage. Each hauling bin was supplied with a continuous flow of fresh seawater supplemented with pure oxygen during the trip. Once at the cage site, the fingerlings were gravity fed into a 300 cubic meter nursery net located inside the submerged cage using a 4-inch (10 centimeter) flexible hose and pumped water. During experiment, fish were fed a commercial dry, pelleted feed once or twice daily to satiation using the same venturi-style system as the first experiment. After one month, the nursery net was removed and the juvenile fish had access to the entire cage. The moi were harvested after a 6-month grow out period (approximately 234 to 281 days old), with the average fish being between 0.9 to 1.0 pound commercial weight. Harvests occurred twice weekly through December 2, 2000, for distribution and sale to markets outside Hawaii (Ostrowski et al. 2001). Thirteen harvests were conducted, with each averaging 2,273 kilograms (5,001 pounds) of fish.

In 2001, Cates International, Inc., which was founded in 2000 by Randy Cates, owner of Safety Boats, Inc., and Virginia Enos, began a commercial moi operation. The university continued to run the environmental monitoring program and the Oceanic Institute continued to serve as the hatchery that supplied the company with its juvenile fish. The company leased and later purchased the sea cage from the Research Project and also purchased additional cages and equipment (R. Cates, owner of Cates Internation Inc., personal communication). On March 9, 2001, the State Board of Land and Natural Resources authorized a 20-year ocean leasing agreement, with a 10-year option, between the State and Cates International for the commercial production of fish in offshore sea cages (Hawaii Department of Agriculture 2001). The lease is for 11.2 hectares (28 acres), 3.2 kilometers (2 miles) off Ewa Beach, and up to four cages, anchored 30 to 40 feet below the surface, positioned at the site. According to the lease, rent is assessed as an annual rate of $1,400 or one percent of gross revenues, whichever is higher.

Cates International had its first commercial harvest in January 2002, and signed the actual lease document in August 2002 to become the first in U.S. history to obtain an ocean lease for aquaculture (Hawaii DLNR and DOA 2003). Since signing the lease, the company expanded production and acquired, deployed and operated four Sea Station 3000™ submersible cages. In 2003, Cates International posted sales of moi of $1.4 million, all of which was invested back into the company (Hedlund 2004). The following year the company's production of moi climbed from 6,000 pounds a week to 7,000 to 10,000 pounds a week (Hedlund 2004; Hawaii DLNR and DOA 2003). However, production was inconsistent in 2006 because of problems getting enough fingerlings from the Oceanic Institute to stock its four sea cages. In recent years, the Oceanic Institute and Cates International have worked together to provide a consistent supply of fingerlings (R. Cates, personal communication).

From 2000 through 2006, Cates International received $2.3 million in both direct and guaranteed loans through NOAA's Fisheries Finance Program (www.fedspending.org). It also received Federal government contracts in the sum of $102,762 from 2000 through 2006 from NOAA for aquaculture research.

In January 2006, Cates International obtained a lease for a 4-acre site in the Kalaeloa Agricultural Park on the Leeward Coast of Oahu from Hawaii's Department of Agriculture (DOA) to build a large-scale moi hatchery capable of producing 12 million fingerlings annually (http://hawaii.gov/hdoa/meetings_reports/e-news/january-31-2006). In 2007, the company received up to $4.5 million in private financing from Vision LLC, a company owned by AOL founder and Grove Farm Company owner Steve Case (Hao 2007).

Cates International was renamed Hukilua Foods, LLC, when its controlling interest was acquired by Grove Farm Land Corporation in 2007 (Grove Farm). Hukilau Foods is presently being organized as a subsidiary of Grove Farm Fish and Poi, LLC. The purchase by Grove Farm allowed the former company to build a new fish hatchery in Kalalaeloa, Oahu, which is in the vicinity of Barbers Point Harbor and which is Hawaii's second busiest commercial harbor. To do so, Hukilau Foods obtained a lease for a site on the Leeward Coast of Oahu from the Hawaii Department of Agriculture to build a large-scale hatchery capable of producing up to 14 million fry. According to Hukilau Foods' website (www.hukilaufoods.com/about _us), the hatchery will be completed in 2009 and annual production is expected to be about 10 million fingerlings annually.

According to Global Duns Market Identifiers, as of May 13, 2008, Cates International had annual nets sales of $1.3 million and 5 employees. Hukilau Foods plan to increase hatchery production to 10 million fry per year, which translates into 6.25 to 7.5 million pounds of moi annually or 119,863 to 143,836 pounds per week. This figure is significantly greater than the 7,000 to 10,000 pounds per week produced in 2004 and represents at the minimum a 1,338 percent increase in pounds produced weekly since 2004. To grow out the larger numbers of juvenile fish, the company is seeking several additional ocean sites. According to the Hawaii DOA and Department of Land and Natural Resources (2007), the company is seeking to increase its level of investment to $10 million over the 24-month period from December 2007 to November 2009.

Little moi is commercially fished in the present, although it was much more so in the past. From 2002 through 2006, annual commercial landings of threadfins in Hawaii have averaged 273 pounds with a dockside value of $1,256 and average of $4.59 per pound (NMFS, Commercial Fishery Statistics, Annual Landings). In 2007, 229 pounds of threadfin with a dockside value of $1,373 were landed in Hawaii.

In addition to County permits, the company received three State permits and one Federal permit in order to conduct offshore aquaculture operations in Hawaii marine waters. All offshore waters in Hawaii are classified as a conservation district, and consequently, a Conservation District Use Permit is required by the Hawaii Department of Land and Natural Resources (DLNR). The Conservation District Use Permit is a conditioned permit that describes the conditions of the use of ocean resources, such as species, location and site layout, emergency response considerations, and management plans (Corbin 2006). An Environmental Assessment is required as part of the application for that permit.

The other required State permits are the National Pollution Discharge Elimination System Permit and Zone of Mixing Permit, which are issued by the Hawaii Department of Health. These conditioned permits govern discharges from the aquaculture facilities and require water quality and substrate monitoring. The one Federal permit is the Section 10 Permit issued by the U.S. Army Corps of Engineers (Corps), which is required to place structures in the country's navigable waters.

After all of the permits are issued, the DLNR can issue a long-term lease for a proposed ocean site. The lease document includes provisions, such as duration of the lease (15 to 20 years), a performance bond to cover project removal, rent, and transferability.

5.3.2.2 Kona Blue Water Farms

Kona Blue produces Kona Kampachi® (*Seriola rivoliana*), also known as Hawaiian yellowtail, Almaco jack or kahala. Its hatchery is located in the Natural Energy Laboratory of Hawaii Authority's ocean science and technology park at Keahole Point in Kona on the island of Hawaii. From August 2002 through August 2005, before the company's first offshore harvest, Kona Blue sold 500 to 1,000 pounds of tank-raised fish each week to local restaurants for sashimi as well as fillets to Pacific Rim countries (Command, 2005).

Kona Blue's draft environmental assessment, which was published in January 2003, reflected "two years of discussion with a broad cross-section of the community" (Jarman et al. 2004). Kona Blue conducted specific meetings with Native Hawaiians and met with industry and government specialists during its development process.

In 2003, Kona Blue received approval to lease 90 acres in Hawaiian waters that are 200- to 220-feet deep off Kona to raise Kona Kampachi®, opakapaka and mahi mahi in eight cages (Gonser 2003). In 2004, the company received a $4 million investment from a group led by Thomas McCloskey, President and CEO of Cornerstone Holdings LLC, in Aspen, Colorado, who now serves as Kona Blue's chairman. Other investors to the company also include Garrett Gruener, founder of *Ask Jeeves*.

In 2005, Kona Blue completed installation of the moorings and first pair of submersible grow-out cages off Unualoha Point and stocked them with 30,000 juvenile kalaha (Associated Press, April 7, 2005). The company harvested its first crop in fall 2005 and planned to eventually produce 800 tons of fish each year. It expects to double its production and increase its revenues to $9 million this year (O'Brien 2008).

Kona Blue currently uses eight cages that range from 2,800 to 3,200 cubic meters. In the fall of 2007, the company applied to increase the size of the cages to more than 6,200 cubic meters (Stanton 2008). There has been both public support of and opposition to the planned expansion, including the Kanaka Council and another individual filing an application for contested case against Kona Blue (Stanton 2008). In January 2008, in response to the Kanaka Council's opposition, Kona Blue withdrew its application for expansion.

While 20 percent of the company's product remains in Hawaii, about 80 percent is shipped to the mainland. Retail price has been close to $20 per pound, making Kona kampachi one of the most expensive fish on the market. With such a price, it has been a boutique commodity with a distribution largely limited to upscale retailers and sushi and gourmet restaurants. Contributing to the high price has been the cost of shipping the fish from Hawaii to the mainland, with shipping costs representing 20 percent of Kona Blue's revenue (O'Brien 2008).

To help improve its 'sustainability quotient', and lower its costs of production, Kona Blue has switched to a feed that substitutes proteins and oils from sustainably-managed edible seafood processing byproducts (e.g., B.C. hake fishery) and poultry processing trimmings. It is also planning to reduce handling and shipping costs by expanding production into Mexico and lower production costs by expanding production to achieve economies of scale (Forristall 2008; Honolulu Advertiser.com, January 18, 2008). Furthermore, the company is also considering other locations for production and testing other species, such as the giant grouper (O'Brien 2008). As of January 2009, the company had 33 employees (N. Sims, President/Co-Founder of Kona Blue Water Farms, personal communication).

Kona Blue has also been the recipient of several federal government grants. In fiscal years 2001 through 2003, it was the recipient of a grant totaling $1,499,090 from the U.S.

Department of Commerce's National Institute of Standards and Technology through its Advanced Technology Program. In fiscal year 2006, the U.S. Department of Agriculture's Cooperative State Research, Education and Extension Service awarded Kona Blue $79,088 through its Small Business Innovation Research program.

From August 2002 through August 2005, before the company's first offshore harvest, Kona Blue sold 500 to 1,000 pounds of tank-raised fish each week to local restaurants for sashimi and also fillets to Pacific Rim countries (Command 2005). As of September 2007, the company was producing 13,000 pounds per week, which equals about 677,857 pounds annually. According to the September 10, 2007, *Draft Supplemental Environmental Impact Assessment for an Expanded Production Capacity and Extended Farm Lease for Kona Blue's Offshore Open Ocean Fish Farm Project off Unualoha Point, Kona, Hawaii* (www.kona-blue.com/communityrelations.php), the company had planned to expand and increase production of its Kona Kampachi to 1,489 tonnes (3,262,841 pounds) each year (Command 2008). With the opposition by the Native Hawaiian organization, and withdrawal of the application, these expansion plans are now shelved (N. Sims, personal communication).

An October 2008 issue of *West Hawaii Today* (Command 2008), reports that Kona Blue will rear fish in the Sea of Cortez, which is also called the Gulf of California. It is expected that the Mexico site will significantly reduce transportation costs to the mainland U.S., which have kept the price of the company's Hawaiian product high. In 2007, the company reported an accidental release of about 1,500 fish when evidently a diver failed to lock one of the fish pens (Command 2008).

There is no commercial kahala fishery in Hawaii because wild kahala is prone to ciguatera toxin as a result of their diet. Ciguatera is a reef toxin that can cause serious illness in humans, and internal parasites. Since Kona Blue can control the diet of their fish, there has been no presence of ciguatera toxin in its product.

5.3.2.3 A.E. Lang Fisheries

A.E. Lang Fisheries' (Lang) blue mussel farm was established in 2005 when it took over what had been an experiment of the University of New Hampshire Atlantic Marine Aquaculture Center, formerly known as the Open Ocean Aquaculture Project. It is the nation's first offshore mussel farm, and it is located off the coast of Hampton, NH, near the Isles of Shoals.

The mussels are raised on a set of longlines that are submerged 30 feet (9 meters) under the surface of the water. Each longline spans 600 feet and is anchored to the seafloor at each end by a two-ton granite block. Two clusters of submersible floats raise the line to form corners of a backbone from which grow-out ropes are suspended.

The mussel seed has been collected on one of the longlines during the winter and spring spawning seasons; however, that has meant taking a line out of the grow-out production. Presently, alternative line configurations and types of line material are being tested for future seed collection, such as longlines that float above the grow-out lines.

Another challenge has been that mussel shells break during processing. Open ocean mussels have thin shells that are easily broken by the rough brushes traditionally used to separate individual mussels and remove sand and grit (Zeiber 2008). Broken mussels cannot be sold to local restaurants. Hence, Lang is considering alternative brushes that do not damage the thinner shells of its mussels. The farm sells its mussels under the brand name Isles of Shoals Supremes to local restaurants and markets. As of October 2007, the farm was capable of producing up to 180,000 pounds of mussels annually (UNH Media Relations, 2007).

5.3.2.4 Snapperfarm, Inc.

Snapperfarm, Inc. was founded in 1998 by Brian O'Hanlon and Joseph Ayvazian. Its operation has been in collaboration with the University of Miami.

In 2002, Snapperfarm obtained all the required permits and deployed two sea cages off the coast of Culebra, Puerto Rico. In the fall of that year, the company stocked one of the cages with mutton snapper *Lutjanus analis* and the other with cobia *Rachycentron canadum*, which were purchased from the Aquaculture Center of the Florida Keys. In 2004, the hatchery was bought by Marine Farm (Thurston 2007; Marine Farm website). Weeks after first stocking the cages, Snapperfarm decided to focus its production solely on cobia and obtained a registered trademark for its Culebran Cobia™. In 2003, the company produced 50,000 pounds of fish, mostly cobia (Hedlund 2004). Snapperfarm distributed its product through JC Seafood, Inc., a Miami company, owned and operated by James O'Hanlon.

Initially, the company bought its fingerlings from Marine Farm's Aquaculture Center of the Florida Keys and transported them to its Culebra site, which took 30 hours and was expensive. Access to cobia fingerlings from the Florida Keys hatchery ended with Marine Farm's discontinuation of its hatchery operations in the state. Beginning in 2006 and ending by 2008, Marine Farms transferred its cobia hatchery production to Belize in order to supply its grow-out operations in that country. Snapperfarm secured its fingerlings from Great Bay Aquaculture and the University of Miami starting in 2006.

In 2006, the company received financial backing from Aquacopia Capital Management (Aquacopia, www.aquacopia.com). As of July 1, 2006, Snapperfarm planned to install more cages in 2007 which would increase its production from 50 to 750 tons annually (Thurston 2007); however, those plans were conditioned upon securing additional permits.

Snapperfarm temporarily suspended its operations in Puerto Rico in late 2008. A 2008 article in the Caribbean Business attributed the suspension to the company being "unable to secure the necessary permits in a timely manner". Snapperfarm is considering a restart of the project if it is able to successfully obtain the permits required to expand operations (B.O'Hanlon, founder of Snapperfarm Inc., personal communication).

O'Hanlon and Aquacopia expressed shared interests in Open Blue Sea Farms (www.openblueseafarms.com), a cobia offshore aquaculture operation in Panama expected to begin production in 2009. According to Aquacopia's website, Open Blue Sea Farms has received permits for three offshore aquaculture sites, totaling 900 hectares.

Researchers involved in the Snapperfarm operation identified ciliate protozoan parasites *Amyloodinium*, Cryptocaryon, and Brooklynella, a bacterial disease caused by Photobacterium species as "a major potential threat for cobia during the fingerling, juvenile and adult stages". However, Snapperfarm was able to develop protocols to manage these health risks.

In fiscal year 2005, Snapperfarm was a recipient of a $58,480 NOAA Small Business Innovation Research Program Grant. In fiscal years 2004 and 2006, Snapperfarm was a participant in grants under the National Marine Aquaculture Initiative Grants program awarded to the University of Miami totaling $1,045,937 ($906,337 in 2006 and $200,000 in 2004).

From 1987 through 2006, U.S. annual commercial landings for cobia ranged from a high of 429,378 pounds in 1996 to a low of 165,682 pounds in 2005. Similarly, the Gulf annual landings ranged from a high of 263,969 pounds in 1996 to a low of 93,609 pounds in 2006. Since 1997, there has been a declining trend in commercial cobia landings.

5.3.3 EFP Applications for Gulf Offshore Aquaculture

There have been three applications for the purpose of having an offshore aquaculture operation in the Gulf of Mexico EEZ. These applications and their results are described below.

5.3.3.1 Seafish Mariculture LLC

The first applicant to apply for an EFP to have an experimental offshore finfish aquaculture operation in the Gulf of Mexico EEZ was Seafish Mariculture LLC (SeaFish Mariculture), which received final approval from the Corps, Galveston District, on July 3, 1997 (Waldemar Nelson International Inc. 2001). A week later, NMFS published in the *Federal Register* a notice of receipt of SeaFish Mariculture's application for an exempted fishing permit (EFP) and a request for public comments (62 *FR* 132). In its application for an EFP, SeaFish Mariculture stated its purpose was to study over a 26-month period whether it is feasible to grow commercial quantities of native fish species in the offshore environment of the Gulf of Mexico using aquaculture techniques. To do so, it would place hatchery-raised juvenile fish in three cages attached to working oil and gas platforms operated by Shell Offshore Services, Inc. and located approximately 48 nautical miles south-southwest of Freeport, Texas, feed them, and allow them to grow for approximately 12 months. Then the fish are harvested and landed in Texas to sell.

SeaFish Mariculture received its EFP in October 1997. The EFP authorized SeaFish Mariculture to harvest, possess, and sell red drum *Sciaenops ocellata*, greater amberjack *Seriola dumerili*, and red snapper *Lutjanus campechanus* from Federal waters of the Gulf of Mexico, to possess or sell greater amberjack or red snapper below the minimum size limit, and to harvest or possess red snapper in excess of established trip limits and/or during a closed season. Although SeaFish Mariculture successfully raised red drum from

3-inch hatchery raised fingerlings to market-size fish in a growth cycle of less than 12 months, the project did not make the progress as projected in the permit application. The first group of red drum fingerlings was stocked on November 30, 1997. Operations were disrupted by tropical storms and hurricanes in 1998. In fact, fish were either killed or escaped when the first cage was damaged by two storms and later destroyed by a tropical storm. Another unanticipated loss of fish occurred during an attempt to move the cage as requested by Shell Offshore Services, Inc., who operated the platform, and needed the cage to be moved in order to give its work boats clear access to the platform. In July 1999, SeaFish Mariculture notified NMFS that it planned to terminate the project as a result of increased gas production at the site.

5.3.3.2 Florida Offshore Aquaculture, Inc.

The second EFP request for an experimental offshore aquaculture operation occurred in 2003. On July 30, 2003, NMFS announced that it had received an application for an EFP on behalf of the Florida Offshore Aquaculture, Inc. (Florida Offshore) of Madeira Beach, Florida (NMFS-NOAA 2003a). An environmental assessment accompanied the application.

Florida Offshore proposed a feasibility study for 24 months of net cage culture of cobia, mahi mahi, greater amberjack, Florida pompano, red snapper, and cubera snapper at a site approximately 33 statute miles (53 kilometers) west southwest of John's Pass, Florida. The company proposed to place hatchery-raised fingerlings in 4 to 8 Sea Station™ cages, feed them, allow them to grow about 4 months, harvest each cage three times annually, land them in Florida, and sell them. Each cage was to be 53 feet (16 meters) tall and 83 ft (25 m) in diameter and contain a maximum of 165,000 lb (75,000 kg).

Florida Offshore proposed to obtain the fingerlings from the Aquaculture Center of the Florida Keys and the Marine Institute of the University of Texas and use commercially pelletized feed. It also proposed a monitoring program that included benthic and water quality sampling.

In the July 30 announcement, NMFS stated that it intended to add the following conditions to any issuance of the EFP to ensure that there are no significant impacts on the environment or on its enforcement efforts regarding existing prohibitions on the taking of species. The proposed conditions were:

1. Applicant must notify NMFS of any changes to the list of hatcheries to be used.
2. All fingerlings must be certified by the hatchery to be disease-free prior to placement in the cages.
3. Only chemotherapeutants approved by the FDA or prescribed by a qualified veterinarian may be used.
4. Use of toxic chemicals as defined in 50 CFR 622.2 to control fouling of nets is prohibited.
5. Immediate notification must be provided to NMFS if any of the following events occur:
    a. Damage to cages or malfunction of supporting structures;
    b. large-scale escapement, i.e., loss of more than 20 percent of a cage population;

   c. major disease outbreak resulting in mortalities exceeding 10 percent; or
   d. entanglements of marine mammals or endangered or threatened sea turtles.
6. Quarterly reports are required beginning in 90 days after anchoring cages in site on:
   a. any disease occurrence;
   b. any use of chemotherapeutants approved by the FDA or prescribed by a qualified veterinarian;
   c. outcome of any events requiring immediate notification (see 5 above);
   d. changes in faunal composition of the area around the experimental site;
   e. substrate and water quality monitoring;
   f. harvests of maricultured fish species.
7. The following samples/records must be maintained a minimum of at least one year after the termination of the EFP and made available for inspection:
   a. Sources of feed including batch codes;
   b. Sources of each group of fish stocked including:
      i. Total number of fish by species;
      ii. Estimated size of fish;
      iii. Date of each introduction/stocking;
      iv. Name, address and phone number(s) of supplier(s);
      v. Disease status of supplier's facility including name, address, and phone number of analytical facilities assessing the disease status;
      vi. Samples of frozen specimens of each group of fish including fish harvested from cages, and during any unusual morbidity or mortality events as per USDA standards; and,
      vii. Phase one fry will be satellite DNA documented by Florida FWC geneticists at Port of Manatee Hatchery;
8. Fish must be maintained intact through offloading ashore. Fish will be placed in live haul containers located on the harvest vessels, brought to shore, and loaded on live haul trucks for sale to traditional live markets. Any fish over the capacity of the live market will be processed at Double D Seafood in St. Petersburg, FL, and sold. Once harvested, the maricultured fish must be reported in accordance with State and Federal reporting requirements. Sale is allowed only to dealers licensed by Florida to sell maricultured fishery products landed in Florida.
9. Not less than 24 hours prior to harvest, provide the following information to the NMFS Law Enforcement Office, Southeast Region, St. Petersburg, FL, (727-570-5344): date, port, and facility at which the maricultured product will be landed and name(s) and phone number(s) of licensed dealer(s) receiving the fish.
10. NMFS retains the authority to make periodic inspections of mariculture operations and records. If the applicant becomes a certified Florida aquaculturist, the applicant must notify NMFS Law Enforcement of the annual unique serial number required on all mariculture records, including sales, and the records must be made available for inspection by authorized offices and maintained for the duration of the EFP plus one year.
11. NMFS has the authority to suspend or revoke the EFP if: the application is found to contain false, incomplete or inaccurate information; the applicant fails to comply with its terms and conditions; significant new information becomes available indicating that one of the conditions for denial of the EFP application

applies (50 CFR 600.745(b)(8)). Revocation will require a General Counsel enforcement action per 600.745(b)(8) and 15 CFR 904 regulations.

12. Issuance of the EFP does not eliminate the need for the applicant to obtain any other Federal, State or Local authorizations required by law.

The Gulf Council considered the EFP request at their September 2003 meeting and recommended the EFP application be denied. The Council, as well as environmental organizations and individuals, identified numerous issues of concern documented in the *Federal Registar* (NMFS-NOAA 2003b). In summary, it was concluded the applicants lacked the experience to comply with above EFP conditions and had submitted false information in the application.

5.3.3.3 Biomarine Technologies, Inc.

A third application for an EFP for purposes of studying the feasibility of commercial offshore aquaculture in the Gulf EEZ was received on April 9, 2008, from Dr. Phillip Lee of Biomarine Technologies, Inc. of Galveston, Texas. On June 3, 2008, NMFS notified Dr. Lee and BioMarine Technologies that their application for an EFP had been rejected for multiple reasons. First, it did not include or address the following issues: 1) appropriate justification for issuance of an EFP, 2) a copy of the U.S. Coast Guard documentation, state license, or registration of each vessel to be used under the EFP and the current name, address, and telephone number(s) of the owner and master, if it is not included in the document provided for the vessel; 3) a specification of the amount of broodstock proposed for harvest under the EFP; 4) the approximate time(s) and place(s) broodstock will be collected, and the type, size, and amount of gear to be used; and 5) a description of the anticipated impacts on water quality, benthic habitat, marine finfish and invertebrates, marine mammals, and protected species. Second, the *Mariculture Site Characterization and Environmental Assessment* was incomplete and was not updated based on comments provided on February 10, 2006, by NOAA Fisheries Service regarding an earlier application for a Corps permit. Third, it sought to establish a long-term, commercial-scale aquaculture operation that is not one of the purposes for which an EFP may be issued.

5.3.4 Relevant Fisheries and Communities

Species conducive to commercial aquaculture are fast growing and successfully reproduced in hatcheries. Should there by offshore aquaculture in the Gulf, the following seven managed species are the most likely to be the first cultured species: cobia, red drum, red snapper, mutton snapper, Almaco jack, greater amberjack, and mahi mahi. Others with potential for Gulf aquaculture production are schoolmaster snapper, cubera snapper, gray snapper, dog snapper, lane snapper, yellowtail snapper, yellowedge grouper, red grouper, Warsaw grouper, yellowfin grouper, king mackerel, Spanish mackerel, cero, little tunny tuna, and bluefish. The remainder of this section first places these 22 species within their relevant Gulf Fishery Management Unit, then describes the commercial fisheries, relevant communities, imports and aquaculture of these species.

Of the above species with potential for Gulf offshore aquaculture, the following 14 species are within the Reef Fish Fishery Management Unit: red snapper, mutton snapper, Almaco jack, greater amberjack, schoolmaster snapper, cubera snapper, gray (mangrove) snapper, dog snapper, lane snapper, yellowtail snapper, yellowedge grouper, red grouper, Warsaw grouper, and yellowfin grouper. Almaco jack and greater amberjack are among the seven most likely species to be cultured in the Gulf.

A reef fish permit is required to be on board a fishing vessel that commercially harvests reef fish species, and a reef fish dealer permit is required to purchase reef fish at the first point of sale.

The number of commercial reef fish permits has declined due to non-renewal of permits from approximately 2,200 in 1992 to approximately 1,145 as of July 2004 (GMFMC 2004). Permit data indicate that 908 of those permits were assigned to vessels that were only permitted to fish reef fish commercially. The remaining 237 permits were assigned to vessels that can fish reef fish as commercial vessels or as charter vessels or headboats.

Approximately 227 dealers possess permits to buy and sell reef fish species (NOAA Fisheries Service 2004). Based on mail address data, most of these were located in Florida (146), with 29 in Louisiana, 18 in Texas, 14 in Alabama, 5 in Mississippi and 15 out of the Gulf States region. More than half of all reef fish dealers are involved in buying and selling grouper. These dealers may hold multiple types of permits.

Average employment information per reef fish dealer is not known. Although dealers and processors are not synonymous entities, Keithly and Martin (1997) reported total employment for reef fish processors in the Southeast at approximately 700 individuals, both part and full time. It is assumed that all processors must be dealers, yet a dealer need not be a processor.

Based on the NOAA Fisheries Service annual processor survey, 29 firms were engaged in the processing of snapper and/or grouper in the Gulf of Mexico in 1996. Reported production of snapper and grouper by these 29 firms totaled 2.30 million pounds valued at $12.3 million. In 2005, the number of reported processors equaled 21 and output of processed grouper and snapper product totaled 1.5 million pounds. These numbers would indicate that only a small portion of the harvested reef fish product is processed (at least in the Gulf).

Cobia, dolphinfish, king mackerel, Spanish mackerel, cero mackerel, bluefish and little tunny tuna are included in the Coastal Migratory Pelagics Fishery Management Unit. Cobia and dolphinfish are among the seven species most likely to be cultured in the Gulf. There is no fishing or dealer permit that applies to all species within this unit.

Red drum is fishery management unit to itself, and it is among those species most likely to be cultured in the Gulf. There is no commercial red drum fishery in the Gulf EEZ.

5.3.4.1 Cobia (*Rachycentron canadrum*)

Cobia has a world-wide distribution. It is found in tropical and subtropical seas except in the eastern Pacific. Along the U.S. coast, the species occurs in the Atlantic Ocean from Massachusetts through Florida and the Gulf of Mexico. Its solitary behavior makes it a difficult target for a species-specific fishery. English language common names include black kingfish, black salmon, cabio, crabeater, kingfish, lemonfish, ling, prodigal son, runner, sergeant fish. Cobia is a white fish or white meat fish. Among the other species of white meat fish are cod, haddock, plaice, coley, whiting, lemon sole, skate, halibut, rock salmon/dogfish, ayr, sole, flounder, hake, monkfish, parrot fish, pollack, red and gray mullet, red drum, red snapper, grouper, sea bass, sea bream, tilapia, turbot, tinned tuna. However, not all white meat fish are the same. Cobia is considered a high quality fish because of its firm white flesh, mild flavor, high quality proteins and polyunsaturated fatty acids, and high fat content. It is processed into fillets or steaks, which can be grilled, fried, broiled, smoked or blackened, or served raw as sashimi and sushi. The species is both wild caught and farm-raised both in the U.S and abroad.

Cobia has been included in lists of fish to avoid because of elevated levels of methyl mercury. For example, in April 2008, the North Carolina Department of Health and Human Services included cobia among its species on the state's high-mercury list.

Cobia is jointly managed by the Gulf and South Atlantic Fishery Management Councils in the Coastal Migratory Pelagics FMP and its management area includes the Gulf, South Atlantic and mid-Atlantic. Nonetheless, Federal regulations significantly limit the extent of a commercial cobia fishery in the EEZ. First and foremost, there is a daily possession of cobia to two cobia per person in or from the Gulf, Mid-Atlantic, or South Atlantic EEZ, regardless of the number of trips or duration of a trip (50 CFR § 622.32(c)(1)). Other Federal management actions for wild caught cobia include gear restrictions and a minimum size limit of 33 inches fork length (50 CFR 622.41(c) and 50 CFR 622.37(c)). The daily possession limit combined with the species' solitary behavior mean cobia is taken as incidental catch in the EEZ. In Federal waters, cobia is incidentally caught in fisheries for other pelagic species and in shrimp trawls. Allowable gear are automatic reel, bandit gear, rod and reel and pelagic longline in the Mid-Atlantic and South Atlantic EEZ, and all gear, except drift gillnet and longline gillnet in the Gulf EEZ.

State regulations tend to mirror those on the national level, except it is illegal to sell cobia either caught in Mississippi territorial waters or landed in Mississippi. In Alabama, Georgia, Louisiana, North Carolina, South Carolina, and Virginia, the daily possession limit is 2 cobia per person, while in Texas, there are bag and possession limits of 2 and 4, respectively. In Alabama, Florida, Georgia, Louisiana, Mississippi, North Carolina, and South Carolina the minimum fork length is 33 inches; however, in Texas and Virginia, the minimum length is 37 inches total length. Thus, cobia is incidentally caught by commercial fishers in the states where it can be harvested and sold. In South Carolina, it is caught principally by commercial fishermen in the snapper-grouper fishery (Hammond 2001).

Commercial landings of wild caught cobia increased from 1980 to 1996 by weight and value, peaking at 429,378 pounds with a value of $754,258 in 1996. From 1997 through

2007, commercial landings of cobia fell from 361,147 pounds with a value of $634,598 to 178,234 pounds with a value of $438,120, averaging 241,536 pounds and $484,113 annually during that period (Figure 5.3.4.1.1). During the same 11-year period, the average ex-vessel price of cobia tended to decrease over time (Figure 5.3.4.1.2).

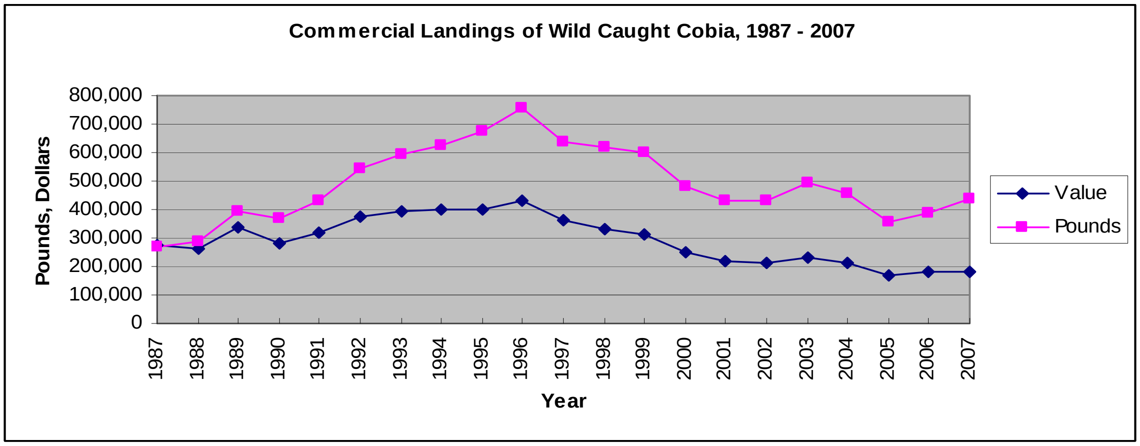

Figure 5.3.4.1.1 U.S. Commercial Landings of Wild Caught Cobia, 1997 – 2007. *Source*: NMFS, Accumulated Landings System.

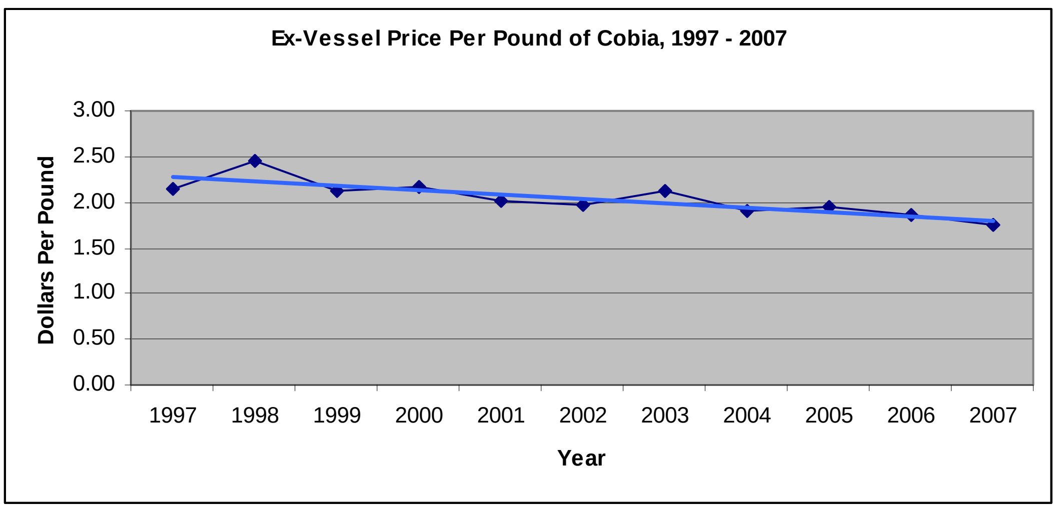

Figure 5.3.4.1.2. Average Ex-Vessel Price of Cobia per Pound, 1987 – 2007, not deflated, with trend line. *Source*: NMFS, Accumulated Landings System.

From 1997 through 2007 commercial landings of wild caught cobia were reported in the following states: Alabama, Florida, Georgia, Louisiana, Maryland, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Texas and Virginia. Florida dominates these landings, averaging 67.25 percent of the total commercial landings (in pounds) of cobia each year, followed by Louisiana with 13.34 percent, North Carolina with 9.53 percent, Texas with 3.86 percent and Virginia with 3.01 percent (Figure 5.3.4.1.3). Those top five states account for 97 percent of the annual commercial landings of wild caught cobia.

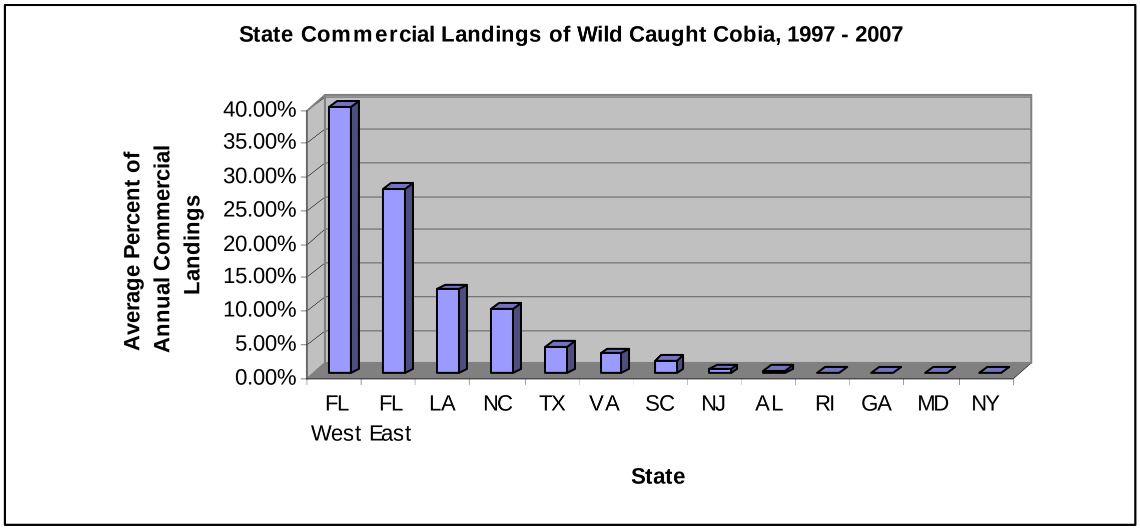

Figure 5.3.4.1.3. Average Percent of Annual Commercial Landings of Cobia by State, 1997 – 2007. ***Source*****: NMFS, Accumulated Landings System.**

Gulf coast landings, on average, make up 57 percent of the annual commercial landings of wild cobia by both weight and value. In the Gulf, cobia winter in the Florida Keys and move north and west along the Gulf coast to Louisiana and Texas in the spring. Cobia form large aggregations and spawn in the Gulf of Mexico from April to September. Commercial landings peak in April, averaging 31 percent of the annual commercial landings on the Gulf coast (Figure 5.3.4.1.4). About 53 percent of annual Gulf coast commercial landings occur from March to May.

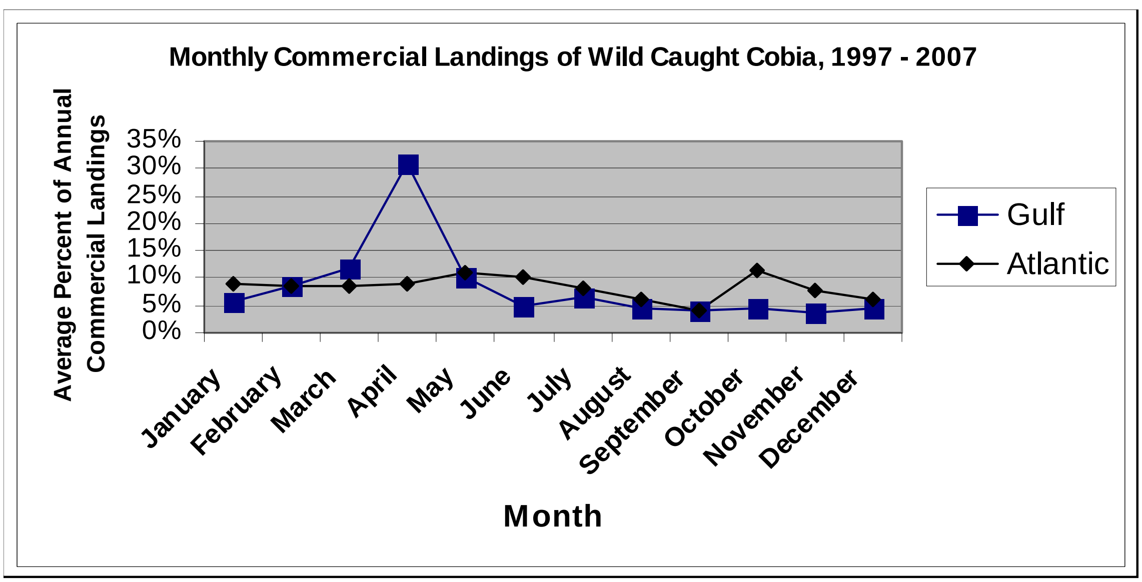

Figure 5.3.4.1.4. Average Monthly Commercial Landings of Wild Caught Cobia, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

From 2005 through 2007 and within Florida, the counties with the largest percentage of annual commercial cobia landings, by pounds, are: Okaloosa (16. 4 percent), Monroe (13.7 percent), Brevard (11.8 percent), Pinellas (11.4 percent) and Palm Beach (6.1 percent). Together these counties account for 59 percent of annual commercial landings of cobia in Florida. The rest of the top ten counties (Duval, Martin, Bay, Indian River and St Lucie) collectively account for another 21.2 percent of the state's annual commercial landings. Annual cobia commercial landings do not represent a significant portion of any county's annual commercial finfish landings. In 2007, commercial landings of cobia in these top 10 counties represented from 0.1 percent (St Lucie County) to 1.85 percent (Okaloosa County) of commercial finfish landings in the respective counties (FWC, Marine Fisheries Information System). Nonetheless, demographic information for the 3 counties is provided in the next three paragraphs.

In 2006, Okaloosa County had 172 nonemployer firms in the Finfish and Shellfish Fishing Industry (NAICS 11411) with receipts of $7.1 million and 4 employer establishments in Finfish Fishing, each with one to four employees (2006 Nonemployer Statistics and 2006 County Business Patterns). The same year there were three employer establishments in the Fish & Seafood Merchant Wholesalers Industry (NAICS 424460), ranging in size from one employing 10 to 19 employees, another from 5 to 9 employees and the smallest from 1 to 4 employees. There were 175 Saltwater Products license holders and 22 Wholesale Dealer license holders in 2007-2008. The county's population was 170,498 in 2000 and rose to an estimated 180,291 in 2006. The per capita money income in 1999 was $20,918, and 9.0 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 88 percent were high school graduates and 24.2 percent had a bachelor's degree or higher (Table 5.3.4.1.1).

Monroe County had 909 nonemployer firms in the Finfish and Shellfish Fishing Industry with receipts of $38.6 million and 7 employer establishments in Finfish Fishing, each with one to four employees, in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year it had 17 employer establishments in Fish & Seafood Merchant Wholesalers (NAICS 424460). Thirteen of these wholesalers employed from 1to 4 persons, one employed from 5 to 9 persons, one employed 10 to 19 persons, and two employed from 20 to 49 persons (County Business Patterns 2006). In 2007-2008, there were 1,467 Saltwater Products license holders and 103 Wholesaler Dealer license holders in the county. The county's population was 79,589 in 2000 and fell to an estimated 74,737 in 2006. The per capita money income in 1999 was $26,102, and 9.2 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 84.9 percent were high school graduates and 25.5 percent had a bachelor's degree or higher (Table 5.3.4.1.1).

In 2006, Brevard County had 267 nonemployer firms in the Finfish and Shellfish Fishing Industry with receipts of $9.2 million and two employer establishments in Finfish Fishing, each with one to four employees (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year the county had 11 employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Seven of these establishments employed one to four persons, one employed from 5 to 9, two employed 10 to 19 persons, and one employed 20 to 49 persons. There were 493 Saltwater Products license holders and 57 Wholesale Dealer license holders in 2007-2008. The county's population was 476,230 in 2000 and rose to an estimated 534,359 in 2006. The per capita money income in 1999 was $21,484, and 9.2 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 86.3 percent were high school graduates and 23.6 percent had a bachelor's degree or higher (Table 5.3.1).

Pinellas County had 343 nonemployer firms in the Finfish Fishing Industry (NAICS 114111) with receipts of about $14.3 million and six employer establishments in Finfish Fishing, each with one to four employees, in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns). There were also that year 19 employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Nine of these establishments employed from 1 to 4 persons, six employed from 5 to 9, two employed from 10 to 19, and two employed from 20 to 49 persons. The county's population was 921,482 in 2000 and rose slightly to an estimated 924,413 in 2006. The per capita money income in 1999 was $23,497, and 11.1 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 84 percent were high school graduates and 22.9 percent had a bachelor's degree or higher (Table 5.3.4.1.1).

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained online at www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

Cobia is not a well-known fish. For example, two 2008 articles in *The Atlanta Journal-Constitution* (July 24) and *The Union Leader* (Manchester, New Hampshire, October 29) describe cobia as unknown to most seafood eaters, although it is a high quality food fish.

Cobia is farm raised, and according to Marine Farms ASA, "cobia has all the traits you want for a farmed fish" (http://www.marinefarms.com/files/Financial%20Info/mafa_-_1q_2008_presentation.pdf):

- excellent eating qualities (broiled, baked, deep fried, sushi & sashimi, etc.)
- white flesh
- large fillets
- high on omega-3
- does well in cages
- fast growth
- year-round egg supplies
- efficient production

Table 5.3.4.1.1. Brevard, Monroe, Okaloosa and Pinellas Counties. Source: U.S. Census Bureau.

	Brevard	Monroe	Okaloosa	Pinellas
Population, 2006 est	534,359	74,737	180,291	924,413
Population, 2000	476,230	79,589	170,498	921,482
Persons under 5 yrs old, % 2006	5.1%	4.7%	7.4%	5.1%
Persons under 18 yrs old, % 2006	20.2%	16.5%	24.2%	19.3%
Persons 65 yrs or older % 2006	19.9%	15.3%	13.1%	20.8%
Female persons, % 2006	50.9%	46.7%	50.0%	51.9%
Male persons, % 2006	49.1%	53.3%	50.0%	48.1%
White persons, % 2006	86.4%	91.8%	83.9%	85.3%
Black persons, % 2006	9.7%	5.4%	9.6%	10.2%
American Indian and Native Alaska persons, % 2006	0.4%	0.4%	0.6%	0.4%
Asian persons, % 2006	2.0%	1.3%	2.9%	0.1%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	0.1%	Z	0.1%	0.1%
Persons reporting 2 or more races, % 2006	1.5%	1.1%	2.9%	1.3%
Persons Hispanic/ Latino, % 2006	6.4%	18.1%	5.3%	6.7%
White not Hispanic, % 2006	80.6%	74.4%	79.2%	79.3%
Foreign born, percent 2000	6.5%	14.7%	5.3%	9.5%
Language other English spoken home, % age 5+, 2000	8.7%	21.4%	7.9%	12.0%
High school graduates, % persons age 25+, 2000	86.3%	84.9%	88.0%	84.0%
Bachelor's degree or higher, % persons age 25+, 2000	23.6%	25.5%	24.2%	22.9%
Housing units, 2006	260,634	53,395	91,239	498,415
Households, 2000	198,195	35,086	66,269	414,968
Persons per household, 2000	2.35	2.23	2.49	2.17
Median household income, 2004	$44,248	$42,195	$45,424	$38,547
Per capita money income, 1999	$21,484	$26,102	$20,918	$23,497
Persons below poverty, % 2004	9.2%	9.2%	9.0%	11.1%

As stated earlier in this document, Snapperfarm, Inc. raised cobia in Puerto Rican waters; however, it ceased production in 2007. Virginia Cobia Farms, which is a joint venture of Blue Ridge Aquaculture, Inc., the nation's largest tilapia producer, and MariCal, Inc., raises cobia in tanks in Saltville, Virginia. Virginia Cobia Farms produced its first crop in May of 2007, estimated at about 100,000 pounds (Seafood Technology, September 2007), which is a level of production equivalent to 56 percent of the total commercial landings of wild caught cobia in 2007. According to the September 24, 2008 online publication of *Images of Martinsville-Henry County, Virginia*, (http://imagesmartinsville henrycounty.com), the company plans to produce one million pounds in 2009, which represents a level of production greater than five times that of the 2007 wild catch. The company does not plan to limit production at that level. According to the May 2007 issue of *Intrafish*, the company plans to increase annual production to 5 million pounds, and then in time expand to 100 million pounds (http://www.youtube.com/watch?v=7mZvBY4e_rE). Another source reports the company plans to eventually produce up to 200 million pounds of cobia annually at its Virginia site (http://www.martinsvillebulletin.com/article.cfm?ID=9738&back=archives). The company is also considering additional production sites. Even if the company does not expand to additional sites, 100 to 200 million pounds would dwarf domestic wild caught production. Consequently, the one Virginia aquaculture company could be a dominant domestic supplier of cobia and have a sizeable share in global cobia production. Should that result, tank aquaculture of cobia could have a large adverse economic impact on commercial fishermen who presently land wild cobia. Advantages of tank aquaculture of cobia are reduced transportation costs, more control over the species' environment, and less risk of losses caused by severe weather, theft, vessel strikes, and other marine incidents. However, disadvantages of tank farming, as opposed to offshore aquaculture, can include costs to dispose of waste, purchase and/or lease land and taxes paid on that land, high energy and other operating costs, high capital costs per unit of production, aquatic animal health issues, and off-flavor taste of the cultured product.

Benetti et al. (2008) estimate 220,462 pounds of cobia were produced by aquaculture in the U.S. in 2007. That level of output places farm production greater than commercial harvest of wild caught cobia for that year. In 2007, U.S. commercial landings of wild caught cobia totaled 178,234.

According to the Food and Agricultural Organization's (FAO's) Fisheries and Aquaculture Information and Statistics Service, (www.fao.org/fishery/culturedspecies/Rachycentron_canadum), the technology to raise large quantities of cobia fry has existed since 1997, and cobia aquaculture has been essentially limited to Taiwan Province, where it began, and China. Production was zero until 1995, then rose from 6,614 pounds in 1995 to almost 56 million pounds in 2006 (Figure 5.3.4.1.5).

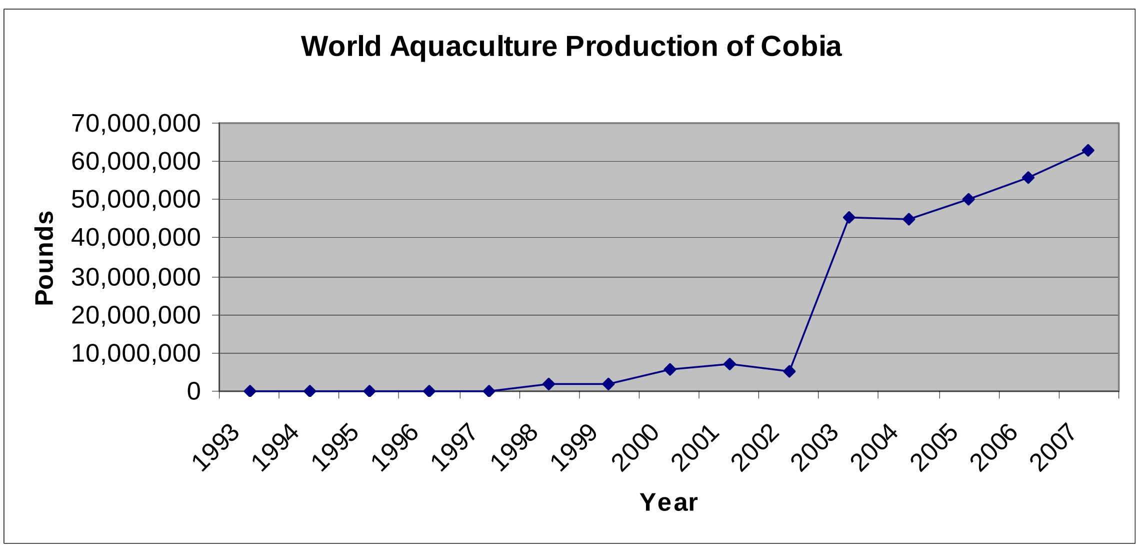

Figure 5.3.4.1.5. World Production of Farm-Raised Cobia, 1993 – 2006. *Source*: FAO Fisheries and Aquaculture Information and Statistics Service for 1993 – 2006, Marine Farms ASA for 2007 estimates.

From 1995 through 2000, Taiwan Province was the sole producer of farm-raised cobia; however, since 2003 China has dominated world production with its share of world production rising from about 80 percent to over 88 percent in just 4 years (Figure

5.3.4.1.6). According to the FAO's Fisheries and Aquaculture Information and Statistics Service, farm-raised cobia was produced in Africa in 2001, 2002, 2005 and 2006; however, its maximum level of production was in 2002 and it represented less than two-tenths of a percent of world aquaculture production that year. In 2007, Vietnam, Philippines, Thailand and Japan joined the group of Asian producers. The U.S. imports cobia from Asia.

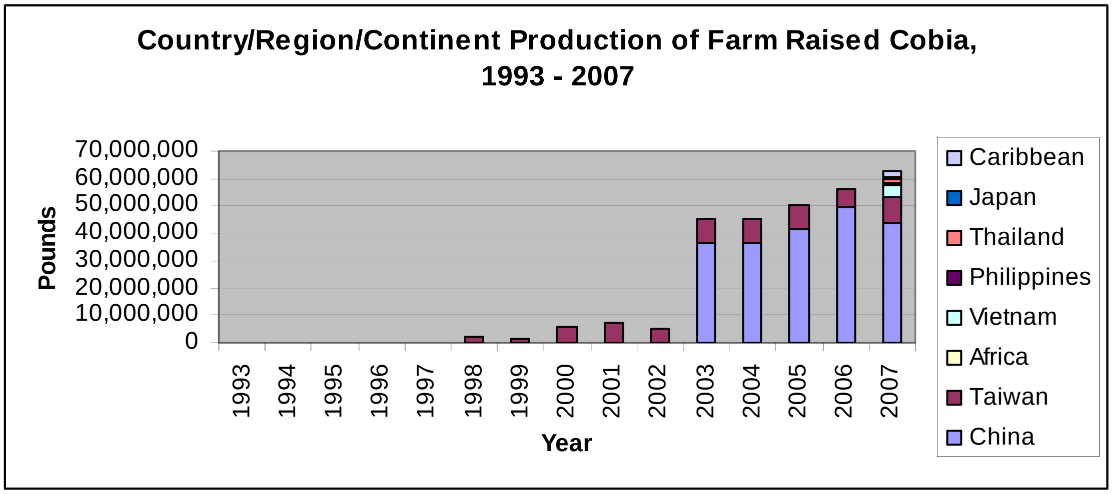

Figure 5.3.4.1.6 Global Aquaculture Production of Cobia by Country/Continent, 1993 – 2006. *Source*: FAO Fisheries and Aquaculture Information and Statistics Service for 1993 – 2006, Marine Farms ASA for 2007 estimates.

Cobia aquaculture has also been developing in the Bahamas, Belize, Brazil, Dominican Republic, Martinique, Mexico, Panama, Philippines, and Vietnam; however, no production is reported by the FAO for these countries from 1995 through 2006. Benetti et al. (2008) estimate cobia farm production in 2007 in the Americas and Caribbean, with the Belize leading with 661,387 pounds produced, and the U.S., Dominican Republic, Mexico and Martinique tied for second with 220,462 pounds produced by each (Table 5.3.4.1.2). These estimates differ from Marine Farms ASA's estimate of 2007 Caribbean production of cobia at 2.2 million pounds (1,000 tonnes) (www.marinefarms.com/files/General_info/Presentation/cobia_dinne_analysts.pdf).

Table 5.3.4.1.2. Estimated Production of Farm Raised Cobia in Americas and Caribbean in 2007. S*ource*: Benetti et al. 2008.

Country	Tonnes	Pounds
Bahamas	< 50	< 110,231
Belize	300	661,387
Brazil	< 10	< 22,046
Dominican Republic	100	220,462
Martinique	100	220,462
Mexico	100	220,462
Panama	< 50	< 110,231
United States	100	220,462
Total	*810*	*1,785,744*

Marine Farms Belize, part of Marine Farms ASA, produces farm-raised cobia and exports it to the U.S. through its exclusive U.S. distributor, Aquagold Seafood Company, in Weston, Florida. Beginning in 2008, Marine Farms Belize was exporting 8,000 pounds of cobia per week, and by the end of 2008, it expects to expand its exports to 20,000 pounds per week (*The Reporter*; January 11, 2008). The U.S. has been its principal buyer, with the farm-raised cobia going to white tablecloth restaurants and upscale supermarkets.

Two major competitive advantages of aquaculture over traditional fishing are consistency of supply and product quality. Aquaculture operations are not limited by the season and can produce fish that have little to no methyl mercury or have ciguatera toxin.

5.3.4.2 Red Drum (*Sciaenops ocellatus*)

Red drum ranges from Massachusetts to Key West along the Atlantic Coast and throughout the Gulf of Mexico; however, the species is less abundant in the southern parts of their range. Among its English language common names are redfish, channel bass, bull red, rat reds, spottail, and red bass. Red drum, like cobia, is a white meat fish with a mild flavor.

Red drum is managed by the GMFMC and the Atlantic States Marine Fisheries Commission. Federal regulations (50 CFR § 622.32(b)(2, 4)) prohibit harvest or possession of red drum in or from the Gulf EEZ and South Atlantic EEZ. Similarly, in the Mid-Atlantic, red drum cannot be harvested or possessed in or from the Mid-Atlantic EEZ south of a line extending in a direction of 115° from true north commencing at a point at 40°29.6′ North latitude., 73°54.1′ West longitude, such point being the intersection of the New Jersey/New York boundary with the 3-nautical mile denoting the seaward limit of state waters (50 CFR § 622.32(b)(3)). When caught in the prohibited areas of the EEZ, red drum must be released immediately with a minimum of harm. Consequently, a red drum fishery cannot exist in either the Gulf EEZ or South Atlantic EEZ, and is essentially nonexistent in the Mid-Atlantic EEZ.

Similarly, some states either ban or significantly reduce commercial fishing of red drum. Commercial red drum fisheries do not exist in Alabama, South Carolina, Florida, Louisiana, and Texas because they prohibit the sale of wild caught red drum. However, Texas, does permit the sale of red drum if it is farm raised. In the Gulf, only Mississippi allows commercial taking of red drum. In Mississippi, no person can sell more than one red drum exceeding 30 inches in total length or possess a red drum under 18 inches total length (www.dmr.state.ms.us/ordinances/TITLE-22-PART-07.pdf). Delaware, Georgia, and Maryland have a daily commercial possession limit of five fish per person; Virginia has a daily commercial possession limit of three fish per person, and New Jersey's daily commercial limit is one fish per person. In North Carolina, the catch of red drum is limited to a bycatch allowance, and it is unlawful to possess more than four red drum per day that are taken in a commercial fishing operation, regardless of the number of individuals or vessels involved. Moreover, no person may possess red drum incidental to any commercial fishing operation unless the weight of the combined catch of flounder, spotted seatrout and/or striped mullet exceeds the weight of the red drum retained (www.ncfisheries.net/procs/procs2k8/FF-68-2008.html). From September 1, 2008, through April 2009, the commercial harvest limit is 60,000 pounds; however, the annual harvest limit is 250,000 pounds in North Carolina. North Carolina prohibits possession or sale of red drum less than 18 inches total length or larger than 27 inches total length (15A NCAC 03.M.0501) and other states have similar size limits.

Commercial landings of red drum dropped precipitously after 1987 with increasingly federal and state regulations protecting the species. While over 5.2 million pounds of red drum with a value over $5.6 million were landed in 1987, commercial landings in 1988 fell to 527,778 pounds with a value of $524,583 and have remained under 350,000 pounds and $480,000 since 1990 (Figure 5.3.4.2.1). Since 1997, the average annual ex-vessel price per pound has risen over time (Figure 5.3.4.2.2).

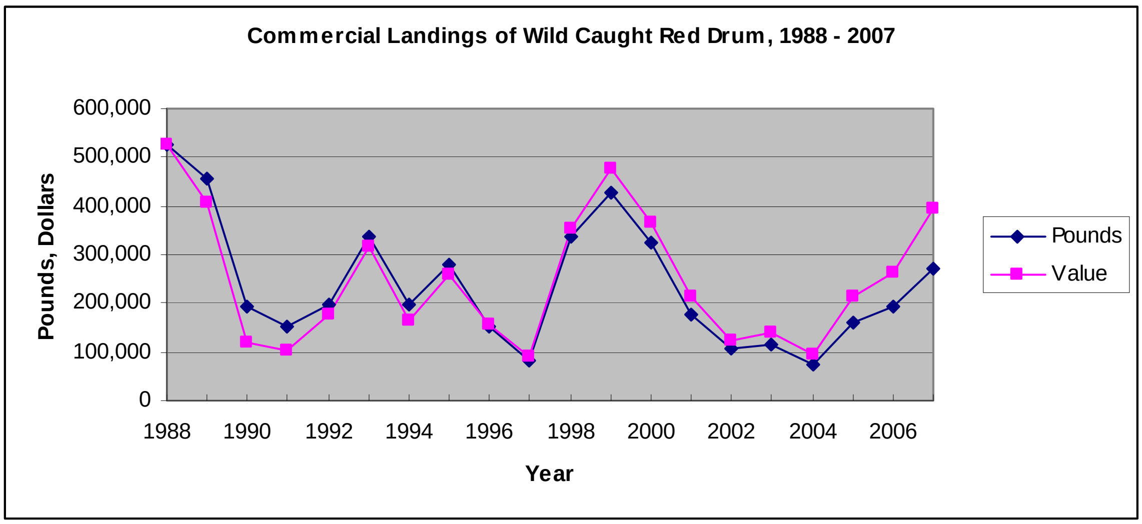

Figure 5.3.4.2.1. U.S. Commercial Landings of Wild Caught Red Drum, 1988 – 2007, Weight and Value. ***Source*****: NMFS, Accumulated Landings System.**

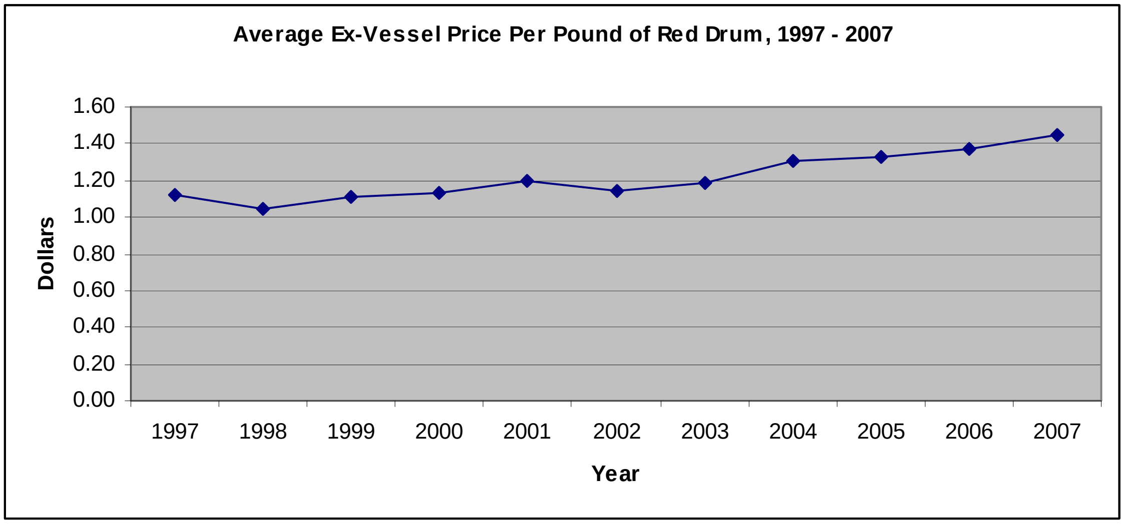

Figure 5.3.4.2.2. Average Annual Ex-Vessel Price per Pound of Red Drum, 1997 – 2007, not deflated. *Source*: NMFS, Accumulated Landings System.

During the 1980s as red drum landings plummeted, commercial landings of black drum rose dramatically from an average 6.1 million pounds to almost 11 million pounds in 1987-1988 as fishermen shifted from red drum to the more plentiful black drum *Pogonias cromis* that is found from Virginia to the northern Gulf of Mexico. By 2004, however, commercial landings of black drum were back to about 5.8 million pounds.

Commercial landings of red drum were reported in nine states from 1997 through 2007 (Georgia, Louisiana, Maryland, Mississippi, New Jersey, New York, North Carolina, Rhode Island, and Virginia); however, from 2005 through 2007 only three of those States have had reported landings (Mississippi, North Carolina and Virginia). Since 1999, commercial landings of red drum in Mississippi have represented 100 percent of landings in the Gulf and since 2005, about 13 percent of annual national landings. North Carolina landings dominate, averaging 86 percent of the annual national commercial since 2005. Virginia, the only other State with commercial landings of red drum since 2005, accounts for just one percent of the annual national commercial landings for the past 3 years (Figure 5.3.4.2.3).

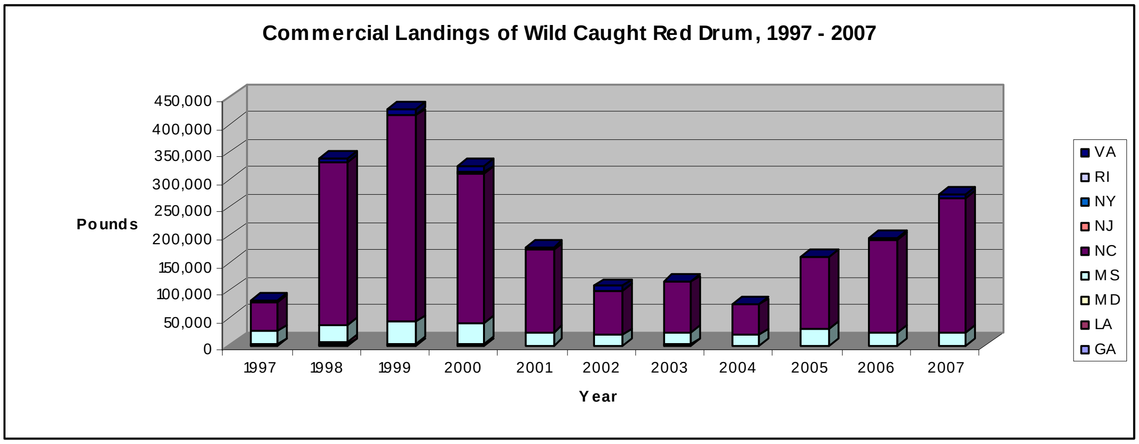

Figure 5.3.4.2.3. U.S. Commercial Landings of Wild Caught Red Drum, 1997 – 2007, by State. *Source*: NMFS, Accumulated Landings System.

Although North Carolina dominates commercial landings, no commercial fishermen in North Carolina rely primarily on red drum to make a living. Red drum is taken mostly as bycatch by fishermen in the North Carolina commercial southern flounder estuaries gill net and striped mullet fisheries. They land on occasion red drum in their nets and target other species as well such as blue crabs, clams and shrimp. From 2001 through 2005, an annual average of 6,881 trips included red drum landings and had an average value of $17.63 per red drum landing (North Carolina Division of Marine Resources and Red Drum Fishery Management Plan Advisory Committee, May 2008, www.ncfisheries.net/download/RDFMP_revised_draft_5-2-08.pdf).

As stated previously, since 1999, only one State, Mississippi, has had commercial landings of red drum since 1999. Hancock County contains Gulfport, a sizeable fishing community in the Gulf. In 2006, the county had 52 nonemployer firms in the Finfish and Shellfish Fishing Industry (NAICS 11411) with receipts of about $2.9 million and no employer establishments in Finfish Fishing (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year, there was one employer establishment in the Fish & Seafood Merchant Wholesalers Industry, employing from 1 to 4 persons. Hancock County's population was 42,967 in 2000 and fell slightly to an estimated 40,421 in 2006. The per capita money income in 1999 was $17,748, and 16.6 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 77.9 percent were high school graduates and 17.3 percent had a bachelor's degree or higher (Table 5.3.4.2.1).

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

According to the June 12, 2007, issue of *Seafood Business* (Skinner 2007), most red drum on the U.S. market is imported from Mexico, Argentina, Ecuador, and Central America. Both ocean perch *Sebastes marinus* and agria (a sea bass that is a member of the Corvina family) are close substitutes. From 2002 through 2007, U.S. imports of ocean perch fell from 20.1 million pounds with a value of $30.3 million to 13.1 million pounds with a value of $23.1 million. During that time, an average of 574,174 pounds with a value of $2.0 million was imported annually.

Red drum, like cobia, is farm raised both in the U.S. and elsewhere. Red drum takes 11 to 18 months to grow to market size, compared to cobia, which takes less than a year. According to Treece (2008), the preferred size for whole red drum is between 1.5 to 3 pounds. Global farm raised production of red drum has increased from 22,046 pounds with a value of $108,000 in 1996 to about 108.6 million pounds with a value of $59.8 million in 2006 (Figure 5.3.4.2.4).

Table 5.3.4.2.1. Hancock County, Mississippi.

	Hancock
Population, 2006 est	40,421
Population, 2000	42,967
Persons under 5 yrs old, % 2006	6.0%
Persons under 18 yrs old, % 2006	23.9%
Persons 65 yrs or older % 2006	14.9%
Female persons, % 2006	50.5%
Male persons, % 2006	49.5%
White persons, % 2006	90.4%
Black persons, % 2006	6.9%
American Indian and Native Alaska persons, % 2006	0.7%
Asian persons, % 2006	0.8%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	Z
Persons reporting 2 or more races, % 2006	1.2%
Persons Hispanic/ Latino, % 2006	2.3%
White not Hispanic, % 2006	88.2%
Foreign born, percent 2000	1.4%
Language other English spoken home, % age 5+, 2000	4.4%
High school graduates, % persons age 25+, 2000	77.9%
Bachelor's degree or higher, % persons age 25+, 2000	17.3%
Housing units, 2006	22,913
Households, 2000	168,897
Persons per household, 2000	2.52
Median household income, 2004	$36,285
Per capita money income, 1999	$17,748
Persons below poverty, % 2004	16.6%

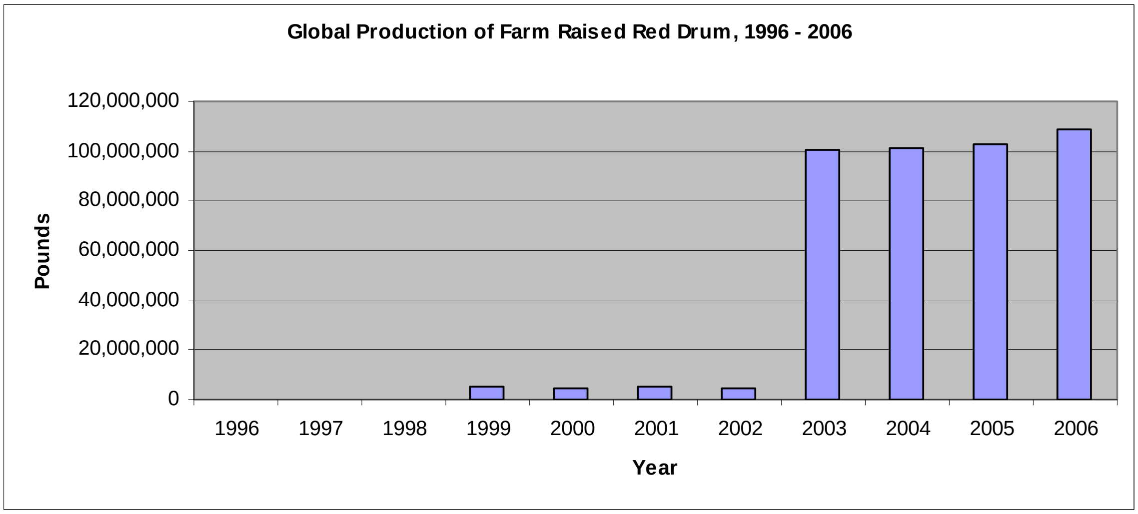

Figure 5.3.4.2.4. Global Production of Farm Raised Red Drum, 1996 – 2006. *Source:* FAO, FIGIS.

According to the FAO, the leading producer is China, whose production dwarfs that of the other countries combined (Figure 5.3.4.2.5). According to the FAO, the U.S. reported production of farm raised red drum in only one year during that period: 2004.

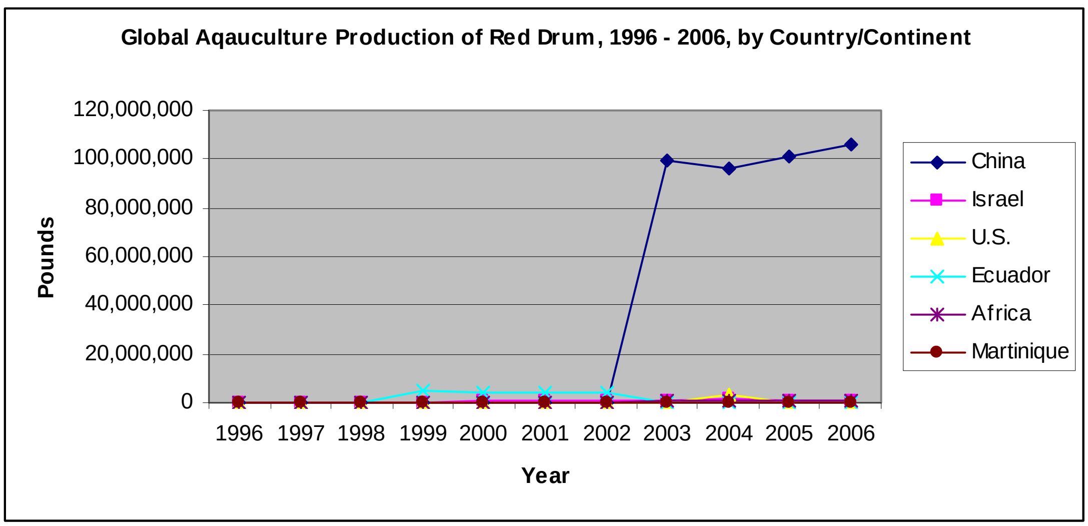

Figure 5.3.4.2.5. Country/Continent Production of Farm Raised Red Drum, 1996 – 2006. *Source*: FAO, FIGIS.

Red drum is cultured in Texas and was in Louisiana. According to a 2008 report by Treece for the Texas Aquaculture Association (www.texasaquaculture.org/Txaqua.pdf), two aquaculture operations in Texas combined to produce an estimated 4 million pounds of red drum with a value of $9.6 million in 2007. These two businesses are Lonestar Aquafarms and Seaside Aquaculture, both in Palacios, which is on the Gulf coast. Seaside Aquaculture is the oldest surviving red drum farm in Texas and presently has a total of 205 acres in culture (175 acres in growout ponds and 30 acres in fingerling ponds). Lonestar Aquafarms has 200 acres. Recently, two other aquaculture operations in the state have converted to red drum production: Harlingen Shrimp Farms, Ltd. in Bayview and R&G Shrimp Co. in Port Lavaca. Harlingen has 450 acres, converted part of its shrimp hatchery to a red drum hatchery and stocked red drum in some of its ponds. R&G discontinued shrimp production, switched to hybrid striped bass, but then in 2007 shifted to red drum on its 200-acre farm. R&G has a red drum hatchery, is selling red drum fry and fingerlings, and has stocked ponds with red drum (Treece 2008). Treece estimates production in 2008 to be over 5 million pounds with a farm-gate value of about $12 million. Farm-gate prices have generally followed the price of wild-caught red snapper, ranging from $1.90 to $2.66 per pound. The 2007 and 2008 levels of U.S. farm production (4 million and over 5 million pounds) dwarf U.S. annual commercial landings of wild caught red drum. In 2007, a total of 273,021 pounds of wild caught red drum was commercially landed, and the average annual total from 1997 through 2007 was 206,542 pounds. However, globally in 2007, China's level of farm raised production of over 100 million pounds shadowed U.S. farm and wild caught production combined (about 5.3 million pounds).

Advantages of pond aquaculture of red drum to producers are reduced transportation costs, potentially more control over the species' environment, and less risks of losses caused by severe weather, theft, vessel strikes, and other incidents. However, disadvantages of pond farming, as opposed to offshore aquaculture, can include the costs to maintain adequate pond temperatures and purchase and/or lease land and taxes paid on that land.

5.3.4.3 Almaco Jack (*Seriola rivoliana*)

The Almaco jack is a pelagic species found in deeper, oceanic waters and with a wide range. It is found throughout the Gulf of Mexico, and in the western Atlantic, it is found from Cape Cod to northern Argentina, although it is rare north of the Carolinas. Almaco jack is also found in the Indian Ocean, West Pacific and East Pacific. Its common names include blackjack, bar jack, almaco, and Spanish jack. It is a firm, white meat fish with a flavor that ranges from mild to strong, depending upon how it is cooked; however, it is also served raw when used in sushi. Its close substitute, Japanese amberjack, is popular in Japan where it is mostly farm raised.

Almaco jack tend to live in small groups on outer reef slopes or offshore banks, and adults tend to be nomadic. The species is not directly targeted by commercial fishermen and is incidentally caught by snapper-grouper, pelagic and reef-fish fishermen.

There have been reports of ciguatera poisoning caused by consumption of the species. Government agencies have issued warnings advising against unlimited or any consumption of wild caught Almaco jack because it can accumulate methyl mercury in its tissues. For examples, in 2003, the Florida Department of Health advised limited consumption of Almaco jack taken in waters of Volusia County (ftp://ftp.dep.state.fl.us/pub/labs/assessment/mercury/fishadvisory.pdf), and in April 2008, the North Carolina Department of Health and Human Services included Almaco jack among its species on the state's high-mercury list.

Almaco jack is managed by the Gulf and South Atlantic Fishery Management Councils. In the Gulf, it is included in the Gulf Reef Fish FMP; while in the South Atlantic, it is part of the Snapper-Grouper Fishery. Federal regulation requires a commercial vessel permit for Gulf reef fish in order to sell Almaco jack in or from the Gulf EEZ, and a moratorium on the issuance of new permits has been in effect since 1992. On July 1, 2005, 1,118 commercial reef fish permits were not expired and 91 were expired but eligible for renewal, yielding potentially up to 1,209 active commercial reef fish permits. From use of these permits, 1,285 vessels reported reef fish landings in 2005, including vessels that transferred permits during the year. As of December 1, 2008, there were 863 active Gulf reef fish permits.

In the South Atlantic, 614 active South Atlantic snapper-grouper unlimited permits and 140 active South Atlantic snapper-grouper limited permits. Federal regulation also requires an individual to have an Annual Dealer Permit to receive Gulf reef fish and South Atlantic snapper-grouper from the South Atlantic EEZ. There were 227 dealers permitted to buy and sell Gulf of Mexico reef fish species in 2005. As of December 1, 2008, there were 150 active Gulf reef fish dealers and 178 active snapper-grouper dealers.

According to NMFS logbook data, a total of 197,845 Almaco jacks were taking by 1,094 commercial trips from 2003 through 2005, for an average of 181 Almaco jacks per trip. From 1997 through 2007, annual commercial landings of Almaco jack never exceeded 187,000 pounds, and over that time ranged from about 53,000 pounds to 186,000 pounds. Similarly, from 1997 through 2007, the value of commercial landings varied from a low of $53,376 in 1998 to a high of $169,557 in 2007 (Figure 5.3.4.3.1). During the same time period, the annual ex-vessel price per pound varied from $0.77 to $1.01 per pound (Figure 5.3.4.3.2).

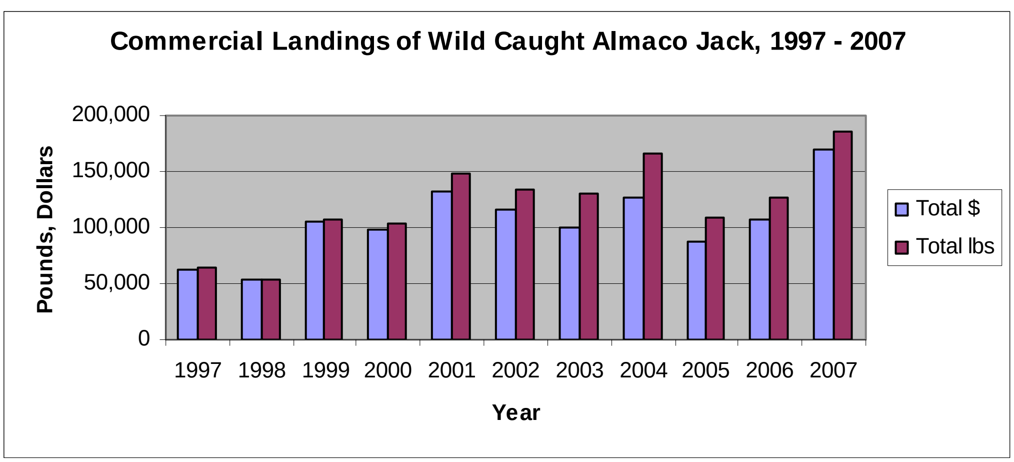

Figure 5.3.4.3.1. Commercial Landings of Wild Caught Almaco Jack, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

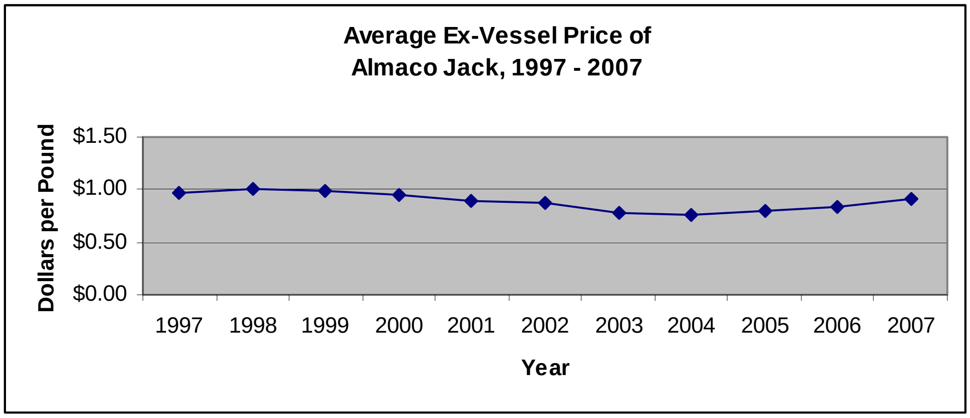

Figure 5.3.4.3.2. Average Annual Ex-Vessel Price per Pound of Wild Caught Almaco Jack, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

From 1997 through 2007, commercial landings of Almaco jack occurred in the following 6 states: Alabama, Florida, Hawaii, Louisiana, North Carolina, and South Carolina. While most of the annual commercial landings were in Florida, annual commercial landings in South Carolina rose dramatically from zero from 1997 through 2002 to about 46,000 pounds in 2007 (Figure 5.3.4.3.3). Only Florida and Louisiana had commercial landings each year during the period, while Alabama had landings only in 2003.

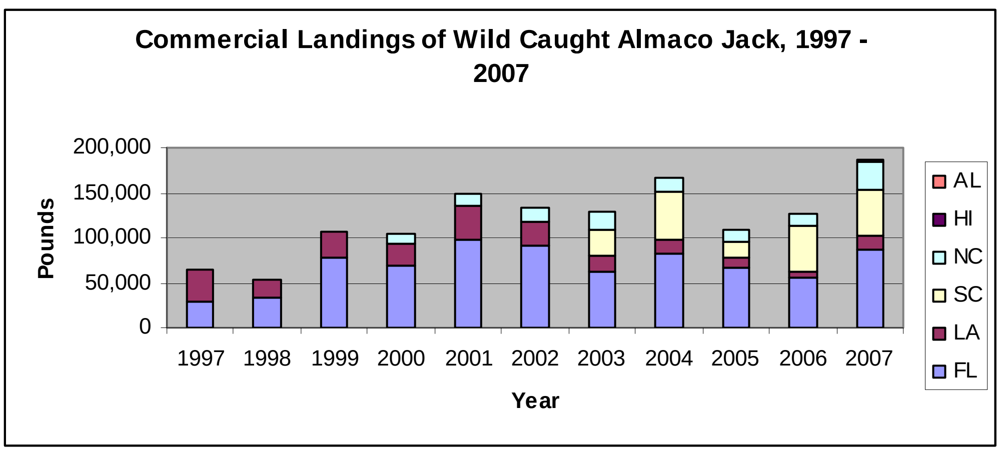

Figure 5.3.4.3.3. Commercial Landings of Wild Caught Almaco Jack by State, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Of the Gulf coast landings, Florida's west coast has had the largest share of commercial landings of Almaco jack since 1998, followed by Louisiana (Figure 5.3.4.3.4). Bay and Pinellas Counties, as leaders in reef fish landings, are believed to represent counties that land Almaco jack in Florida. In Louisiana, representative parishes are Cameron, Jefferson, Lafourche and Vermilion.

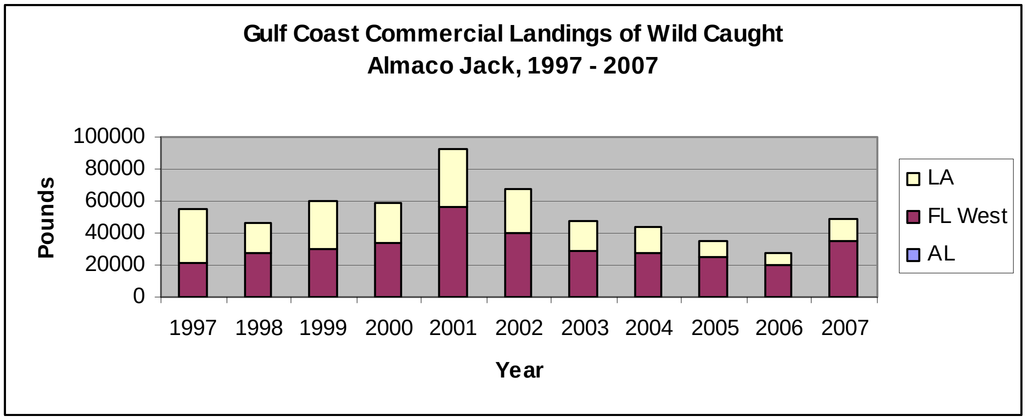

Figure 5.3.4.3.4. Gulf Coast Commercial Landings of Wild Caught Almaco Jack, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Bay County, Florida, includes Panama City. In 2006, the county had 222 nonemployer firms in Finfish and Shellfish Fishing with receipts of $16.5 million and 2 employer establishments in Finfish Fishing, each with 1 to 4 employees (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year it had three employer establishments in the Fish & Seafood Merchant Wholesalers Industry. One of the wholesalers employed from 1 to 4 persons, and other two employed from 5 to 9 persons, each. The 2007-2008 fishing season had 345 Saltwater Product license holders and 44 Wholesale Dealer holders. Its population in 2000 was 148,217 persons and estimated population in 2006 was 163,505. The per capita money income in 1999 was $18,700, and 11.9 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 81.0 percent were high school graduates and 17.7 percent had a bachelor's degree or higher (Table 5.3.4.3.1).

Cameron Parish had 143 nonemployer firms in Finfish and Shellfish Fishing with receipts of $3.8 million and no employer establishments in Finfish Fishing in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year, there were two employer establishments in the Fish & Seafood Merchant Wholesalers Industry, each employing one to four persons. Its population in 2000 was 9,991 persons, which fell by about 22 percent to an estimated 7,792 in 2006. The per capita money income in 1999 was $15,348, and 12.9 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 68.1 percent were high school graduates and 7.9 percent had a bachelor's degree or higher (Table 5.3.4.3.1).

In 2006, Jefferson Parish had 799 nonemployer firms in Finfish and Shellfish Fishing with receipts of $36.3 million and one employer establishments in Finfish Fishing from 1 to 4 employees (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year, there were 14 employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Ten employed from 1 to 4 persons, two employed from 5 to 9 persons, one employed from 10 to 19 persons, and one employed from 20 to 49 persons. Its population in 2000 was 455,466 persons, which fell by about 5.3 percent to an estimated 431,361 in 2006. The per capita money income in 1999 was $19,953, and 16.5 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 79.3 percent were high school graduates and 21.5 percent had a bachelor's degree or higher (Table 5.3.4.3.1).

Table 5.3.4.3.1. Bay County, FL, and Cameron, Jefferson, Lafourche and Vermilion Parishes, LA. Source: U.S. Census Bureau.

	FL	LA			
	Bay	Cameron	Jefferson	Lafourche	Vermilion
Population, 2006 est	163,505	7,792	431,361	93,554	56,021
Population, 2000	148,217	9,991	455,466	89,974	53,807
Persons under 5 yrs old, % 2006	6.7%	5.1%	6.8%	6.4%	7.2%
Persons under 18 yrs old, % 2006	23.0%	24.2%	24.1%	24.7%	25.7%
Persons 65 yrs or older % 2006	14.0%	12.1%	13.7%	11.9%	13.4%
Female persons, % 2006	50.5%	48.9%	51.9%	51.3%	51.4%
Male persons, % 2006	49.5%	51.1%	48.1%	48.7%	48.6%
White persons, % 2006	84.1%	93.8%	68.4%	82.0%	82.1%
Black persons, % 2006	11.2%	4.4%	26.3%	13.8%	14.7%
American Indian and Native Alaska persons, % 2006	0.8%	0.5%	0.5%	2.4%	0.3%
Asian persons, % 2006	1.8%	Z	3.6%	0.8%	2.3%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	0.1%	0.8%	1.1%	Z	Z
Persons reporting 2 or more races, % 2006	2.0%	0.8%	1.1%	1.0%	0.7%
Persons Hispanic/ Latino, % 2006	3.3%	1.9%	8.3%	1.9%	2.1%
White not Hispanic, % 2006	81.3%	68.7%	60.6%	80.3%	80.3%
Foreign born, percent 2000	3.6%	1.6%	7.5%	1.5%	2.0%
Language other English spoken home, % age 5+, 2000	6.4%	14.4%	13.0%	21.5%	27.9%
High school graduates, % persons age 25+, 2000	81.0%	68.1%	79.3%	66.3%	65.6%
Bachelor's degree or higher, % persons age 25+, 2000	17.7%	7.9%	21.5%	12.4%	10.7%
Housing units, 2006	95,105	4,643	184,180	37,200	23,911
Households, 2000	59,597	3,592	176,234	32,057	19,832
Persons per household, 2000	2.43	2.76	2.56	2.75	2.67
Median household income, 2004	$38,972	$36,126	$38,234	$38,437	$32,564
Per capita money income, 1999	$18,700	$15,348	$19,953	$15,809	$14,201
Persons below poverty, % 2004	11.9%	12.9%	16.5%	16.5%	19.0%

Lafourche Parish had 667 nonemployer firms in Finfish and Shellfish Fishing with receipts of $29.4 million and two employer establishments in Finfish Fishing in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns), one employed from 1 to 4 employees and the other employed from 5 to 9 employees. That same year, there were nine employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Five employed from 1 to 4 persons, three employed from 5 to 9 persons, and the other employed from 20 to 49 persons. The population in 2000 was 89,974 persons, which rose by 4 percent to an estimated 93,554 in 2006. The per capita money income in 1999 was $15,809, and 16.5 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 66.3 percent were high school graduates and 12.4 percent had a bachelor's degree or higher (Table 5.3.4.3.1).

In 2006, Vermilion Parish had 161 nonemployer firms in Finfish and Shellfish Fishing with receipts of $10.9 million and no employer establishments in Finfish Fishing (2006 Nonemployer Statistics and 2006 County Business Patterns). Also, in 2006, there were 4 employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Three employed from 1 to 4 persons and the other employed 10 people. Its population in 2000 was 53,807 persons, which fell by about 3.8 percent to an estimated 56,021 in 2006. The per capita money income in 1999 was $14,201, and 19.0 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 65.6 percent were high school graduates and 10.7 percent had a bachelor's degree or higher (Table 5.3.4.3.1).

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

Almaco jack is presently cultured in the United States. In the U.S., Kona Blue produces Kona Kampachi® also known as Hawaiian yellowtail, amberjack or kahala. From August 2002 through August 2005, before the company's first offshore harvest, Kona Blue sold 500 to 1,000 pounds of tank-raised fish each week to local restaurants for sashimi and also fillets to Pacific Rim countries (Command 2005). As of September 2007, the company was producing 13,000 pounds per week, which equals about 677,857 pounds annually. That level of production exceeds the highest annual commercial harvest from 1997 through 2007 by 264 percent. According to the September 10, 2007, Draft Supplemental Environmental Impact Assessment for an Expanded Production Capacity and Extended Farm Lease for Kona Blue's Offshore Open Ocean Fish Farm Project off Unualoha Point, Kona, Hawaii (www.konablue.com/communityrelations.php), the company has plans to expand and increase production of its Kona Kampachi to 1,489 tonnes (3,262,841 pounds) each year. However, there has been opposition by a Native Hawaiian organization, which has asked that the company prepare an environmental impact statement (Command 2008).

An October 2008 issue of *West Hawaii Today* (Command 2008), reports that Kona Blue will rear fish in the Sea of Cortez, which is also called the Gulf of California. It is expected that the Mexico site will significantly reduce transportation costs to the mainland U.S., which have kept the price of the company's product high. According to the company's website its product shows no detectable levels of mercury, which is unlike wild caught Almaco jack that has been shown to have elevated levels of methyl mercury (www.kona-blue.com/download/pr_ongoingtest.pdf). In 2007, the company reported an accidental release of about 1,500 fish when a diver failed to lock one of the fish pens (Command 2008).

5.3.4.4 Greater Amberjack (*Seriola dumerili*)

The greater amberjack is found in subtropical regions throughout the globe. It occurs throughout the Gulf of Mexico, into the Caribbean Sea, and in the western Atlantic Ocean, from Nova Scotia south into Brazil. It also has been documented in the eastern Atlantic Ocean from the British coast south to Morocco and into the Mediterranean Sea.

In the Indo-West Pacific, greater amberjack has been reported from South Africa, the Persian Gulf, southern Japan and the Hawaiian Islands, south to New Caledonia, and the Mariana and Caroline Islands in Micronesia. Among its common English language names are: great amberfish, yellowtail, great yellowtail, greater yellowtail, allied kingfish, and rock salmon. Greater amberjack is a firm, white meat fish with a flavor that ranges from mild to strong, depending upon how it is cooked, and it is popular in sushi. The species is not directly targeted by commercial fishermen and is incidentally caught by snapper-grouper, pelagic and reef-fish fishermen.

Greater amberjack, like Almaco jack, has been listed with other marine fish to contain elevated levels of mercury. For example, in April 2008, the North Carolina Department of Health and Human Services advised pregnant women, women who may become pregnant and children under age 15 to not eat any greater amberjack. It also advised others to eat no more than one meal a week of that fish (www.ncdhhs.gov/pressrel/2008/2008-04-07-2fish-mercury.htm).

Federal regulation requires a commercial vessel permit for Gulf reef fish in order to sell greater amberjack in or from the Gulf EEZ, and since 1992 there has been a moratorium on the issuance of new permits. From March through May of each year, there is a daily commercial possession limit of one greater amberjack per person. On July 1, 2005, 1,118 permits were not expired and 91 were expired by eligible for renewal, which represents potentially up to 1,209 active permits. On December 1, 2008, there were 861 active permits, a 28 percent reduction from July 2005. In 2005, 1,285 vessels reported reef fish landings, including vessels that transferred permits during the year. While all commercial reef fish permitted vessels can harvest greater amberjack, only 519 vessels (43 percent of potentially active permits and 40 percent of vessels) landed greater amberjack in 2005.

Federal regulation also requires an individual to have an Annual Dealer Permit to receive Gulf reef fish and South Atlantic snapper-grouper from the South Atlantic EEZ. There were 227 dealers permitted to buy and sell Gulf of Mexico reef fish species in 2005. Based on vessel logbook records for 2005, 192 (85 percent) of these dealers actively bought and sold greater amberjack. As of December 1, 2008, there are an estimated 150 active reef fish dealers, and it is estimated that 127 of these dealers actively buy and sell greater amberjack.

Florida prohibits commercial harvest of greater amberjack from March through May. On Florida’s Atlantic coast, there is daily vessel/possession limit of 1,000 pounds, while there is no such limit on the Gulf coast. Louisiana’s minimum size limit is 36 inches fork length, and it closes its waters to commercial fishing of greater amberjack from March 1 through May 31 each year. Texas has a daily commercial bag limit of one and possession limit of two, along with a minimum size limit of 32 inches. In Georgia and South Carolina, the minimum fork length of a greater amberjack is 28 inches and there is a daily possession limit of one per person. In Virginia there is a minimum of 32 inches total length and a daily possession limit of two per person.

According to NMFS logbook data, a total of 417,058 greater amberjacks were taken by 1,594 commercial trips from 2003 through 2005, for an average of 262 greater amberjacks per trip. Also, based on an examination of the same logbook data, greater amberjack is among the species most commonly taken on commercial trips with vermilion snapper.

From 1997 through 2007, annual commercial landings of greater amberjack varied from approximately 1.0 to 1.6 million pounds (Figure 5.3.4.4.1). From 1997 through 2007, commercial landings were in six states: Alabama, Florida, Georgia, Louisiana, South Carolina, and Texas. Only Florida and Texas had landings each year during this period. Florida dominates annual landings, followed by Texas and Louisiana. In Florida, commercial landings on the Gulf coast greatly exceed those on the Atlantic coast. As of August 4, 2008, there is a commercial quota for greater amberjack of 503,000 pounds round weight, which represents a 49 percent reduction from 2007 landings.

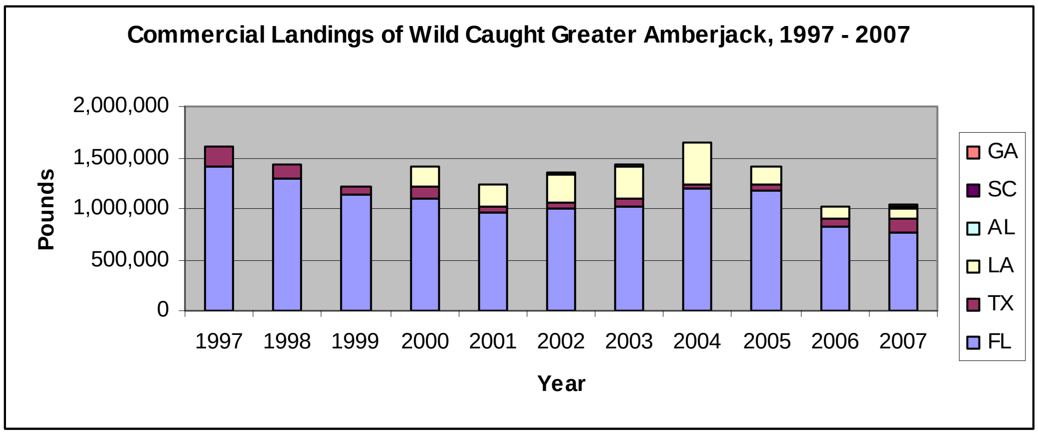

Figure 5.3.4.4.1. Commercial Landings of Wild Caught Greater Amberjack, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

If commercial landings of greater amberjack reach or are projected to reach the quota, the Assistant Administrator for Fisheries, NOAA, will file a notification to close the commercial fishery for the remainder of the fishing year. In addition, if despite such closure, commercial landings exceed the quota, the quota will be reduced the following year by the amount of overage in the prior fishing year.

The average ex-vessel price of greater amberjack has varied from a high of $1.02 to a low of $0.85 per pound from 1997 through 2007 with a general downward trend (Figure 5.3.4.4.2).

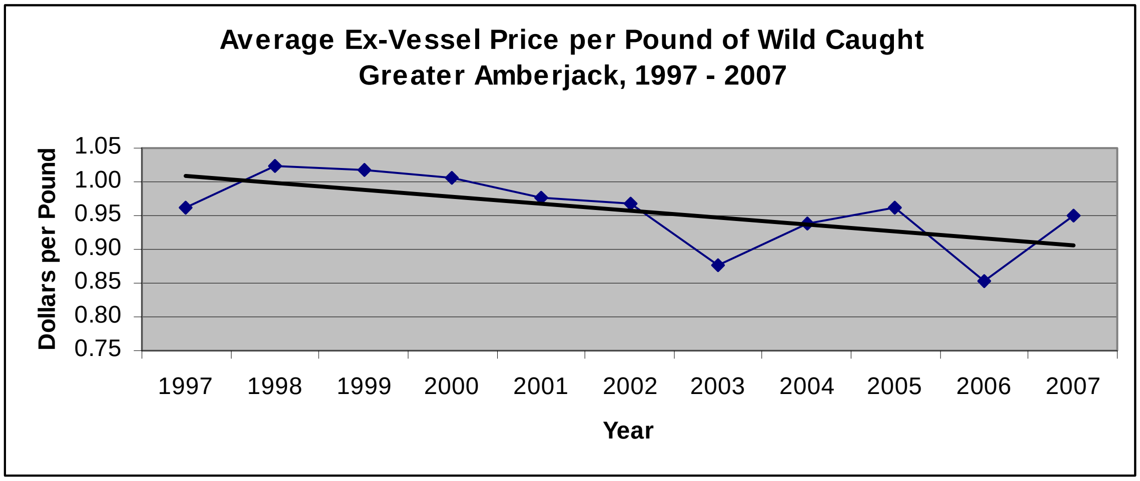

Figure 5.3.4.4.2. Average Ex-Vessel Price per Pound of Wild Caught Greater Amberjack, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

In Florida, representative counties that land greater amberjack are Monroe and Pinellas Counties. For demographic information for these counties (Table 5.3.4.1.1). Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at: www.gulfcouncil.org/beta/gmfmcweb/downloads/FINAL3_EFH_Amendment.pdf

Greater amberjack can be and has been a product of aquaculture. According to Ottolenghi et al. (2004), greater amberjack is cultured in Japan and Hong Kong and was cultured in Spain from 1985 to 1999. In Japan, Japanese amberjack *Seriola quinqueradiata* has historically been the amberjack species of choice; however, when market prices for it fell during the 1990s, there was a corresponding increase in aquaculture production of both greater amberjack and yellowtail amberjack *Seriola lalandi*. Culture production of greater amberjack has grown rapidly in Japan, although it does not show up in FAO statistics. Ottolenghi et al. (2004) reported about 9,000 to over 14,000 greater amberjacks were reared from 1996 through 2001 in that country. In its September 10, 2007, Draft Supplemental Environmental Assessment for the Hawaiian Department of Land and Natural Resources, Kona Blue states that it may culture amberjack *S. dumerili*.

Japanese amberjack is closely related to Almaco jack and is a substitute for it. From 1996 to 2006, global aquaculture production of Japanese amberjack rose varied from 145,773 tonnes (321 million pounds) to 155,004 tonnes (342 million pounds), with Japan accounting for 99.9 percent of global production and the Republic of Korea the rest (Figure 5.3.4.4.3). *Seafood Watch* recommends yellowtail, also known as Almaco jack, amberjack or Japanese amberjack, farmed in the U.S. as an alternative to it farmed elsewhere.

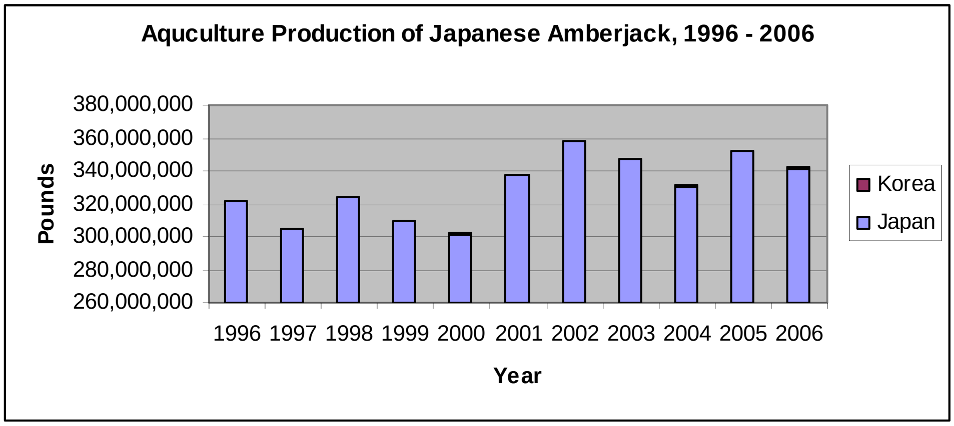

Figure 5.3.4.4.3. Global Aquaculture Production of Japanese Amberjack, 1996 – 2006. *Source:* FAO, FIGIS.

5.3.4.5 Red Snapper (*Lutjanus campechanus*)

Northern red snapper is found throughout the Gulf of Mexico and western Atlantic Ocean, ranging from Massachusetts to Brazil, although it is uncommon north of the Carolinas. Among its common names are red snapper, sow snapper, rat snapper, mule snapper, chicken snapper, American red snapper, Pensacola red snapper, Mexican red snapper, and bream. Northern red snappers form large schools around wrecks and reefs. Consequently, unlike cobia and red drum, which are incidental catch, northern red snapper is and has been a commercially targeted species. Peak spawning season for Northern red snapper is from June to August in the northwest Gulf and from August to September off southwestern Florida.

Southern red snapper *Lutjanus purpureus*, also known as Caribbean red snapper, is almost indistinguishable from Northern red snapper. However, southern red snapper range extends from Cuba to Brazil, and U.S. commercial landings of it are infrequent. There are; however, other snappers that are typically caught in U.S. waters and substitute for northern red snapper. Mutton snapper *Lutjanus analis* also resembles northern red snapper and their taste and appearances are indistinguishable once filleted. In fact, mutton snapper is often marketed as red snapper. Other snappers that are substitutes for red snapper include vermillion *Rhomboplites aurorubens*, gray *Lutjanus griseus*, and yellowtail *Ocyurus chrysurus* snapper. All have firm, white meat and are good for baking and broiling. The cheeks and throat meats of larger red snappers are considered gourmet items (http://govdocs.aquake.org/cgi/reprint/2003/729/7290070.pdf).

Northern red snapper is managed by both the Gulf and South Atlantic Fishery Management Councils; however, because over 90 percent of annual commercial landings come from the Gulf, management actions focus on the Gulf fishery. There is and has been a ceiling on commercial harvest of northern red snapper, which is equivalent to 51 percent of the TAC. The present TAC is 5.0 million round weight, and the commercial TAC is 2.55 million pounds. On January 1, 2007, an Individual Fishing Quota (IFQ) program was implemented. In the Gulf, for a person aboard a vessel, with a commercial vessel permit to fish for, possess, or land Gulf red snapper, regardless of where harvested or possessed, must also have a red snapper IFQ vessel endorsement on board (50 CFR §

622.4(a)(4)(ii)). At the end of 2007, the distribution of the shares of the TAC was: Alabama/Mississippi with 9.5 percent, Florida with 45.5 percent, Louisiana with 9.7 percent, Texas with 28.7 percent, and other states with 6.7 percent.

States also set limits on the commercial harvest of northern red snapper, and some restrict commercial red snapper fishing in their waters to those with a Federal permit for red snapper and an IFQ endorsement. Florida, Louisiana and Texas require a person who sells or attempts to sell red snapper to have a Federal permit for red snapper and IFQ vessel endorsement. Florida has a daily possession limit in state waters of two fish per person on the Atlantic side and four per person on the Gulf side. Alabama, Georgia, North Carolina and South Carolina have a daily commercial possession limit of two fish per person per day. Texas has a daily commercial bag limit of four red snappers per person and a daily possession limit of eight per person. Mississippi has a daily bag/possession limit of 200 pounds, which does not apply to those permitted fishermen and dealers legally harvesting and/or selling red snapper harvested from Federal waters only. In addition to the bag and possession limits, the states also have size limits.

According to NMFS logbook data for 2003 through 2005, a total of 188,736 red snappers were taken during 1,966 commercial trips, for an average of 96 red snappers per trip. Also, based on an examination of the same logbook data, red snapper is among the species most commonly taken on commercial trips with vermilion snapper. In the Gulf from 2002 through 2007, annual commercial landings of red snapper represent 51.5 percent of all commercial snapper landings by weight and 57.5 percent by value. Hence, it is and has been the most valuable species in the Gulf snapper fishery as a whole.

From 1997 through 2007, annual commercial landings of northern red snapper averaged approximately 4.6 million pounds, and there was an upward trend in the value of annual commercial landings (Figure 5.3.4.5.1). During the same time period, the average ex-vessel price of red snapper has been increasing annually and in 2007, it averaged $3.19 per pound on the Gulf coast and $3.49 on the Atlantic coast (Figure 5.3.4.5.2).

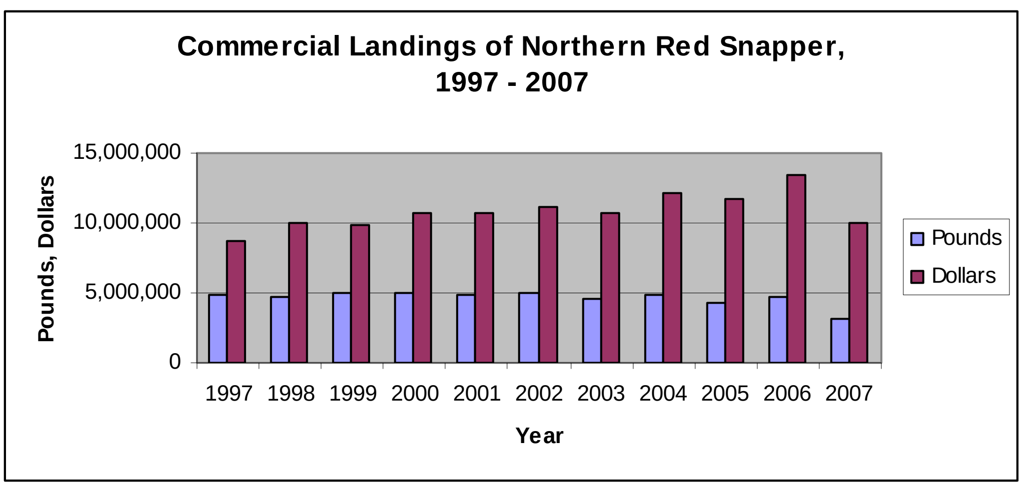

Figure 5.3.4.5.1. Commercial Landings of Wild Caught Northern Red Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

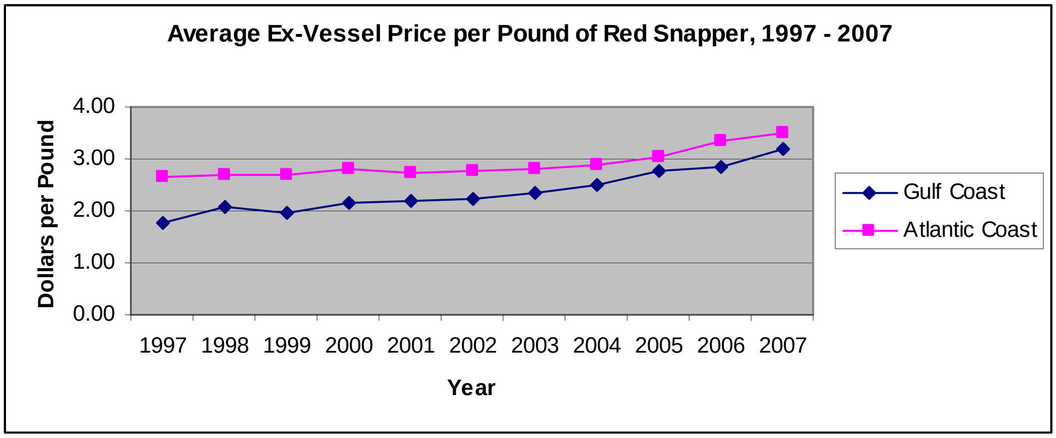

Figure 5.3.4.5.2. Average Ex-Vessel Price per Pound of Wild Caught Northern Red Snapper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

Caribbean red snapper is not included in the above commercial landings of red snapper. From 1997 through 2007, less than 1,800 pounds of Caribbean red snapper were commercially caught, and all landings were on Florida's Gulf coast from 2000 through 2001.

Louisiana and Texas commercial landings make up the bulk of national commercial landings of red snapper, combining to produce an average of 79 percent of annual pounds landed from 1997 through 2007. The other top four States are Florida (16 percent) and Mississippi (2 percent); however, there were no reported commercial landings of red snapper in Mississippi in 2006 and 2007 (Figure 5.3.4.5.3). In 2007, after the IFQ

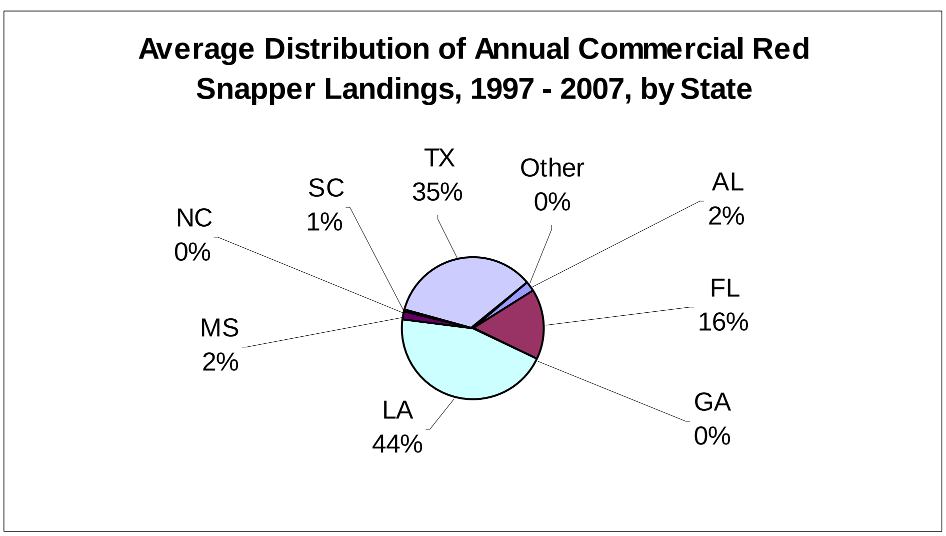

Figure 5.3.4.5.3. Average Distribution of Pounds of Wild Caught Red Snapper Commercially Landed, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Program was implemented, the distribution of commercial red snapper landings for that year by State was: Texas with 39 percent of pounds landed, Florida with 32 percent, Louisiana with 26 percent, Alabama with 2 percent, and South Carolina, North Carolina and Georgia combining for the remaining one percent.

Many of the commercial fishermen who fish for red snapper also fish for other reef fish. Some fishermen fish throughout the Gulf and unload in various locations, making it difficult to identify communities that would be most affected by offshore aquaculture production in the Gulf. In Florida, commercial landings of red snapper represent a significant portion of some counties' annual commercial landings of finfish. In 2007, for example, commercial landings of red snapper (in pounds) represented about 29 percent of commercial finfish landings in Okaloosa County, 14 percent in Escambia County, 12 percent in Bay County, and 10 percent in Levy County. These four counties are on Florida's Gulf coast. In seven other Florida counties, commercial landings of red snapper represented from about 2 to 3 percent of finfish landings in 2007, while the remaining counties had commercial red snapper landings that represented less than one percent of their finfish landings. This analysis highlights the Texas counties of Cameron and Galveston and the Florida counties of Okaloosa, Escambia, Bay, and Levy.
A brief summary of Bay County demographics is found in Table 5.3.4.3.1 and the preceding Almaco jack subsection.

Cameron County includes the city of Port Isabel. In 2006, Cameron County has 719 nonemployer firms in the Finfish and Shellfish Fishing Industry (NAICS 11411) with receipts of $39.8 million and two employer establishments in the Finfish Fishing Industry (NAICS 114111), both with one to four employees (2006 Nonemployer Statistics, 2006 County Business Patterns, U.S. Census). That same year there were 10 employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Six employed from 1 to 4 persons, three employed from 5 to 9, and one employed from 10 to 19 persons. In 2000, the population of the county was 335,227 persons, and it is estimated that that increased to 387,717 persons in 2006. The per capita money income in 2002 was $10,960 and 29.4 percent of the county's population lived below poverty. In 2000, of the population over 25 years and older, 55.2 percent were high school graduates and 13.4 percent had a bachelor's degree or higher. The county has a large Hispanic or Latino influence, with 86.1 percent of the estimated 2006 population being of Hispanic or Latino origin. In 2000, for 79 percent of the population, a language other than English was spoken at home and about 26 percent were foreign born (Table 5.3.4.5.1).

Galveston County, Texas, has 453 nonemployer firms in the Finfish and Shellfish Fishing Industry with receipts of about $28.3 million and no employer establishments in finfish fishing (2006 Nonemployer Statistics, 2006 County Business Patterns, U.S. Census). That same year, there were five employer establishments in the Fish & Seafood Merchant Wholesalers Industry. One employed from 20 to 49 persons, two employed from 10 to 19 employees, one employed from 5 to 9 persons and the other employed from 1 to 4 persons. In 2000, the population of the county was 250,158, and it is estimated that its 2006 population was 283,551 persons. The per capita money income in 1999 was $21,568, and 13.4 percent of the county's population lived below poverty in 2004. In 2000, of the population over 25 years and older, 80.9 percent were high school graduates and 22.7 percent had a bachelor's degree or higher. In 2006, about 20 percent of the estimated population was of Hispanic or Latino origin and 3 percent is Asian. In 2000, for 17 percent of the population, a language other than English was spoken at home and about 8 percent were foreign born (Table 5.3.4.5.1).

Escambia County includes the fishing city of Pensacola, which has a long history in the commercial red snapper fishery. After the Civil War the commercial fishery was centered in Pensacola and the fish became known as Pensacola red snapper. In 2006, there were 194 nonemployer firms in the Finfish and Shellfish Industry with receipts of $9.5 million and no employer establishments in finfish fishing (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year there were three employer establishments in the Fish & Seafood Merchant Wholesalers Industry, ranging in size from one employing from 10 to 19 persons and another employing from 1 to 4 persons. The 2007-2008 fishing season had 140 Saltwater Product licenses and 19 Wholesale Dealer licenses. Its population in 2000 was 294,410 persons and estimated population in 2006 was 295,426. The per capita money income in 1999 was $18,641, and 14.2 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 82.1 percent were high school graduates and 21.0 percent had a bachelor's degree or higher (Table 5.3.4.5.2).

Table 5.3.4.5.1. Cameron and Galveston County Demographics. Source: U.S. Census Bureau.

Texas Counties	Cameron	Galveston
Population, 2006 est.	387,717	283,551
Population, 2000	335,227	250,158
Persons under 5 yrs old, % 2006	11.2%	7.1%
Persons under 18 yrs old, % 2006	34.1%	25.5%
Persons 65 yrs or older % 2006	10.9%	10.9%
Female persons, % 2006	52.0%	51.0%
Male persons, % 2006	48.0%	49.0%
White persons, % 2006	97.4%	80.8%
Black persons, % 2006	0.9%	14.8%
American Indian and Native Alaska persons, % 2006	0.6%	0.5%
Asian persons, % 2006	0.6%	2.8%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	0.1%	0.1%
Persons reporting 2 or more races, % 2006	0.4%	20.3%
Persons Hispanic/ Latino, % 2006	86.1%	20.3%
White not Hispanic, % 2006	12.8%	61.3%
Foreign born, percent 2000	25.6%	8.3%
Language other English spoken home, % age 5+, 2000	79.0%	17.2%
High school graduates, % persons age 25+, 2000	55.2%	80.9%
Bachelor's degree or higher, % persons age 25+, 2000	13.4%	22.7%
Housing units, 2006	140,676	128,453
Households, 2000	97,267	94,782
Persons per household, 2000	3.40	2.60
Median household income, 2004	$26,719	$45,735
Per capita money income, 1999	$10,960	$21,568
Persons below poverty, % 2004	29.4%	13.4%

In 2006 in Levy County, Florida, there were 88 nonemployer firms in Finfish and Shellfish Fishing with receipts of $16.5 million and no such employer establishments (2006 Nonemployer Statistics and 2006 County Business Patterns). Also, in 2006, there were six employer establishments in the Fish & Seafood Merchant Wholesalers Industry, ranging in size from 5 to 9 employees to the others employing from 1 to 4 employees. In the 2007-2008 seasons, 405 Saltwater Products licenses and 59 Wholesale Dealer licenses were issued in the county. The county's population was 34,450 in 2000 and estimated at 39,076 in 2006. The per capita money income in 1999 was $14,746, and 15.0 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 73.9 percent were high school graduates and 10.6 percent had a bachelor's degree or higher (Table 5.3.4.5.2).

In 2006, Okaloosa County had 172 nonemployer firms in the Finfish and Shellfish Fishing Industry with receipts of $7.1 million and four employer establishments in Finfish Fishing, each with 1 to 4 employees (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year, there were three employer establishments in the Fish & Seafood Merchant Wholesalers Industry, ranging in size from one employing from 10 to 19 employees, and another establishment employing from 1 to 4 employees. For the 2007-2008 seasons, 175 Saltwater Product licenses and 22 Wholesale Dealer licenses were issued in the county. The county's population was 170,498 in 2000 and estimated at 180,291 in 2006. The per capita money income in 1999 was $20,918, and 9.0 percent of the population lived below poverty. In 2000, of the population over 25 years and older, 88.0 percent were high school graduates and 24.2 percent had a bachelor's degree or higher (Table 5.3.4.5.2).

Table 5.3.4.5.2. Escambia, Levy and Okaloosa County Demographics. Source: U.S. Census Bureau.

		Escambia	Levy	Okaloosa
Population, 2006 est.		295,426	39,076	180,291
Population, 2000		294,410	34,450	170,498
Persons under 5 yrs old, % 2006		6.8%	5.6%	7.4%
Persons under 18 yrs old, % 2006		23.0%	21.8%	24.2%
Persons 65 yrs or older % 2006		14.8%	17.8%	13.1%
Female persons, % 2006		50.7%	51.5%	50.0%
Male persons, % 2006		49.3%	48.5%	50.0%
White persons, % 2006		71.3%	87.3%	83.9%
Black persons, % 2006		23.0%	10.6%	9.6%
American Indian and Native Alaska persons, % 2006		0.9%	0.4%	0.6%
Asian persons, % 2006		2.4%	0.5%	2.9%
Nat. Hawaiians, Other Pacific Is. persons, % 2006		0.1%	Z	0.1%
Persons reporting 2 or more races, % 2006		2.2%	1.2%	2.9%
Persons Hispanic/ Latino, % 2006		3.0%	5.2%	5.3%
White not Hispanic, % 2006		68.8%	82.4%	79.2%
Foreign born, percent 2000		3.7%	2.6%	5.3%
Language other English spoken home, % age 5+, 2000		6.8%	6.1%	7.9%
High school graduates, % persons age 25+, 2000		82.1%	73.9%	88.0%
Bachelor's degree or higher, % persons age 25+, 2000		21.0%	10.6%	24.2%
Housing units, 2006		136,861	17,763	91,239
Households, 2000		111,049	13,867	66,269
Persons per household, 2000		2.45	2.44	2.49
Median household income, 2004		$36,743	$29,314	$45,424
Per capita money income, 1999		$18,641	$14,746	$20,918
Persons below poverty, % 2004		14.2%	15.0%	9.0%

Additional information regarding the description of the red snapper fishery and relevant fishing communities can be found in the Final Supplemental Environmental Impact Statement for Amendment 26 to the Gulf Reef Fish Fishery Management Plan to Establish a Red Snapper Individual Fishing Quota Program, which is available online at www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Amend%2026%20FSEIS%20072706.pdf.

The U.S. imports both fresh and frozen snapper *Lutjanidae* spp. From 2002 through 2007, imports of snapper ranged from a low of 34.0 million pounds with a value of $54.2 million to a high of 41.5 million with a value of $84.2 million (Figure 5.3.4.5.4). During those same years, annual commercial landings of all snappers in the Gulf of Mexico ranged from a low of 6.8 million pounds with a value of $18.3 million to a high of 9.0 million pounds with a value of $20.2 million, averaging 8.3 million pounds with a value of $19.4 million.

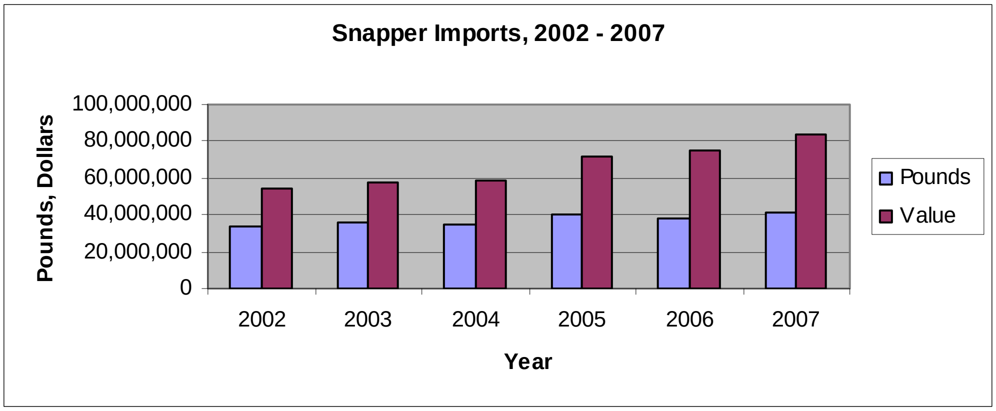

Figure 5.3.4.5.4. U.S. Imports of Snapper (*Lutjanidae* spp.), 2002 – 2007. *Source:* NMFS, Fisheries Statistics and Economics Division.

There are no reports of commercial production of farm raised northern red snapper because, to date, hatchery success has been too low for economic viability. However, Posadas and Bridger (2004) claim commercial aquaculture of the species can be viable. Moreover, the Louisiana Platforms for Mariculture Task Force (http://dnr.louisiana.gov/mariculture/TaskForce_FirstDraft.pdf) includes red snapper in its lists of species suitable for cage/net-pen and platform aquaculture.

5.3.4.6 Mutton Snapper (*Lutjanus analis*)

Mutton snapper is found throughout the Gulf of Mexico and in the western Atlantic Ocean from Massachusetts to Brazil. Among its common names are mutton fish, king snapper, and virgin snapper. As stated previously, mutton snapper is such a close substitute for northern red snapper in taste and appearance once filleted that it is often marketed as red snapper. Adult mutton snapper tend to solitary behavior; however, they aggregate during the spawning season, which occurs during February in the Caribbean region and during the summer in other areas.

The Atlantic, Gulf and Caribbean Fishery Management Councils manage the commercial mutton snapper fishery in Federal waters. During May and June of each year, the possession of mutton snapper in or from the EEZ on board a vessel that has a commercial permit for South Atlantic snapper-grouper is limited to 10 mutton snappers per person per day or 10 per person per trip, whichever is more restrictive. From April 1 through June 30 of each year, no person can fish for or possess mutton snapper in or from the Caribbean EEZ. There is no trip or possession limit on mutton snapper in or from the Gulf EEZ. In the Gulf and South Atlantic EEZ, there is a minimum size limit of 16 inches total length. Florida has the same minimum size limit. In Federal waters, over 80 percent of annual commercial landings occur in the Atlantic coast.

Commercial landings of mutton snapper from 1997 through 2007 ranged from 203,008 to 354,290 pounds, averaging 264,700 pounds annually. During the same time period, the average ex-vessel price of mutton snapper increased from under $2 to over $2 per pound (Figures 5.3.4.6.1 and 5.3.4.6.2).

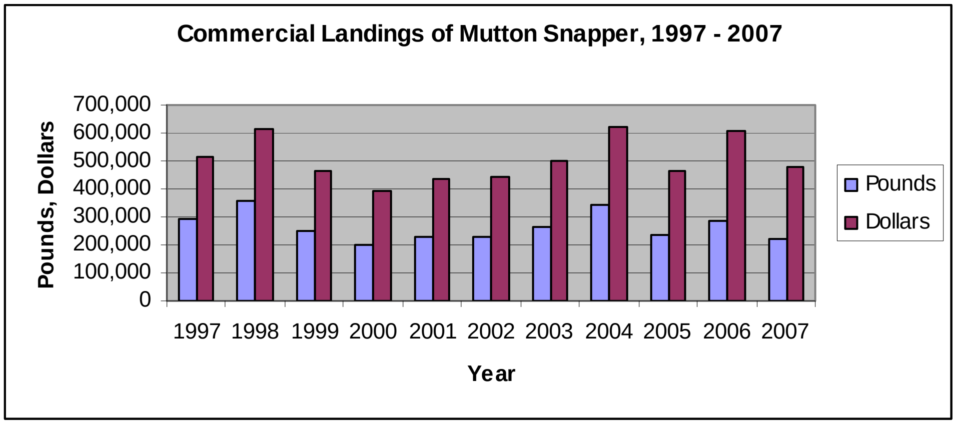

Figure 5.3.4.6.1. Commercial Landings of Wild Caught Mutton Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

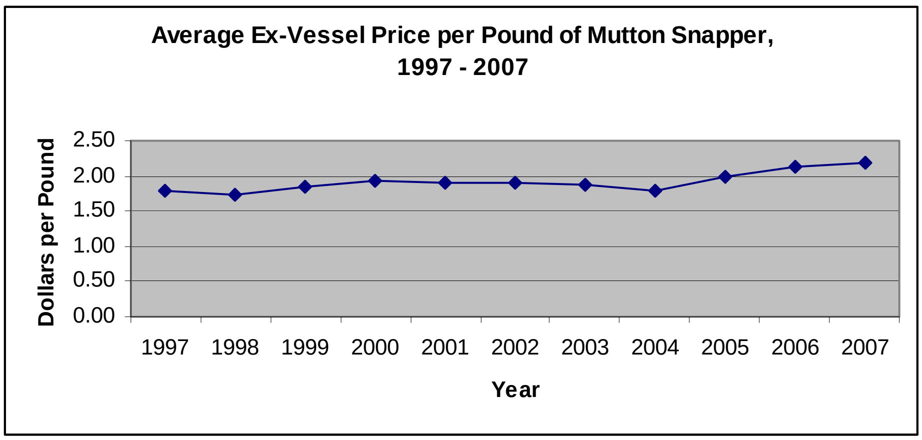

Figure 5.3.4.6.2. Average Ex-Vessel Price per Pound of Wild Caught Mutton Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Mutton snapper follows red, vermilion, yellowtail and gray snapper in terms of Gulf commercial landings of snapper because of its lower price. For example, while the ex-vessel price of red snapper from 1997 through 2007 averaged at $2.38 per pound, the average ex-vessel price of mutton snapper was $1.91 during the same period. From 2002 through 2007, commercial landings of mutton snapper in the Gulf represented 2.8 percent of pounds and 2.2 percent of the value landed of all snappers in the Gulf.

Florida landings dominate annual commercial landings of mutton snapper. From 1997 through 2007, Florida's landings represented an average of 98 percent of annual commercial landings and never fell to less than 97 percent of annual landings for any year (Figure 5.3.4.6.3).

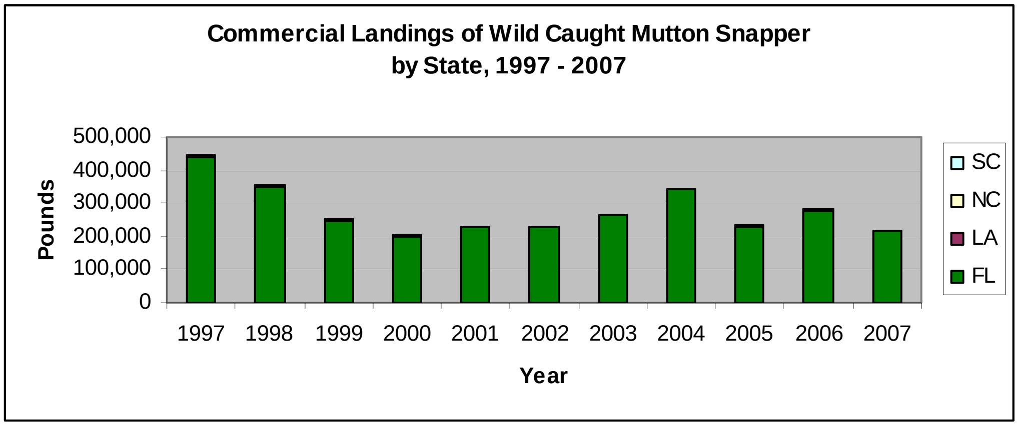

Figure 5.3.4.6.3. Commercial Landings of Mutton Snapper by State, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System**.

From 2005 through 2007 and within Florida, Monroe County accounted for 54 percent of annual commercial landings of mutton snapper, followed by Pinellas County landings that represented 27 percent of the State's annual landings (Florida Fish and Wildlife Conservation Commission, Marine Fisheries Information System). The other top five counties are Miami-Dade, Lee and Manatee Counties, each with approximately 3 percent of the State's annual commercial landings. Collectively, these five counties account for about 90 percent of the state's commercial mutton snapper landings. Mutton snapper landings; however, do not represent a significant portion of any county's commercial finfish landings. For example, in 2007, Monroe County accounted for 54 percent of the State commercial landings of mutton snapper, but those mutton snapper landings represented less than 3 percent of the County's commercial finfish landings for that year. Of all other counties with commercial landings of mutton snapper in 2007, mutton snapper landings represented about one percent of one county's finfish landings and less than one percent for the remaining counties. This suggests Florida commercial fishermen are not dependent upon mutton snapper for their livelihoods, although they have almost all of the national landings year after year. Demographic information for Monroe and Pinellas County are found in Table 5.3.4.1.1.

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at:
www.gulfcouncil.org/beta/gmfmcweb/downloads/FINAL3_EFH_Amendment.pdf
Mutton snapper have been products of aquaculture in the United States. The Aquaculture Center of the Florida Keys (ACFK) was a hatchery that produced mutton snapper fingerlings, and in 2002, Snapperfarm stocked a sea cage with an estimated 7,500 mutton snapper fingerlings, which were purchased from the ACFK (http://usasearch.gov/search?affiliate=lib.noaa.gov&v%3Aproject=firstgov&query=benetti). Weeks after first stocking the cages; however, Snapperfarm decided to focus its production solely on cobia. ACFK ended operations when its owner, Marine Farms ASA, transferred its hatchery operations to Belize to supply its cobia grow-out facility in that country. According to the FAO there is presently no commercial aquaculture of mutton snapper. However, it is a potential species for aquaculture in the Gulf EEZ as

identified by the Louisiana Platforms for Mariculture Task Force. *Lutjanus* spp. have been the products of aquaculture in Asia (e.g., Brunei Darussalem, Philippines and Singapore; Figure 5.3.4.6.4). The Taiwan Province of China has been an aquaculture producer of *Lutjanus* spp.; however, its production fell dramatically from 2003 when it topped at about 1.2 million pounds to 13,228 pounds in 2006.

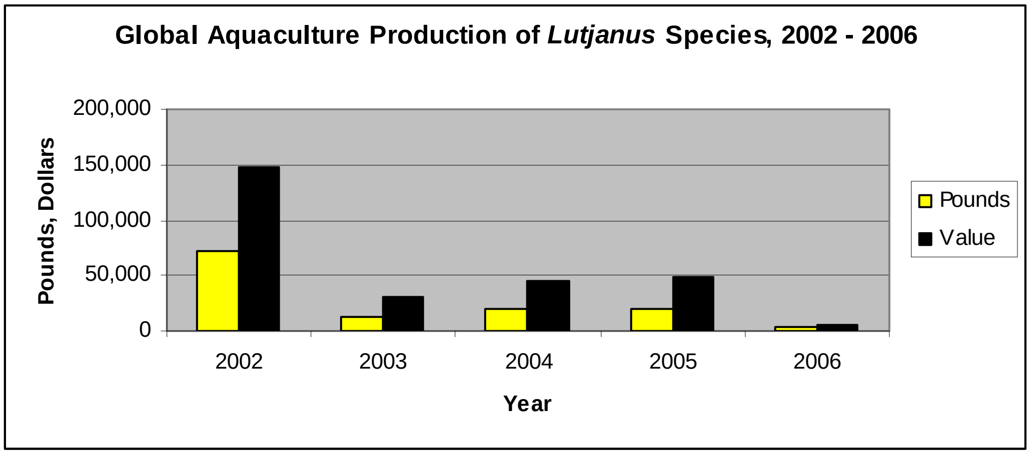

Figure 5.3.4.6.4. Global Aquaculture Production of Lutjanus Species, 2002 – 2007. ***Source:*** **FAO, FIGIS.**

5.3.4.7 Dolphinfish/Mahi Mahi (*Coryphaena hippurus)*

Dolphinfish or mahi mahi is found in tropical and subtropical waters throughout the Atlantic, India and Pacific Oceans and throughout the Gulf of Mexico, Florida Current and Caribbean Sea. It is a pelagic fish found near the coast in waters from 0 to 85 meters deep. Young dolphinfish travel together in schools, while larger adults tend to travel alone or in pairs. It is most commonly known by its market name of mahi mahi, but is also known as common dolphinfish, dolphin and dorado. The meat of dolphinfish is firm with a sweet, mild flavor that is similar to swordfish. Its substitutes include snapper and grouper. Mahi mahi's primary consumers are in the U.S., Japan, Europe and Caribbean region. Ciguatera poisoning has been reported from its consumption and cases of histamine poisoning have been reported due to poor handling.

In the South Atlantic EEZ, dolphinfish is managed under the Dolphin Wahoo Fishery Management Plan (FMP). Commercial fishing regulations include a 1.5 million pound cap on commercial landings, a 20-inch fork length minimum size limit off the coasts of Florida and Georgia and gear restrictions. A commercial vessel permit for Atlantic dolphinfish must be on board a vessel that sells dolphinfish. However, if a vessel has a Federal commercial vessel permit in any other fishery, it is exempt from bag and possession limit and may sell dolphin subject to trip and geographical limits. In the Gulf EEZ, dolphinfish is considered to be a coastal pelagic migratory fish. A dealer permit is required to sell dolphinfish from either the Atlantic or Gulf EEZ.

Commercial landings of dolphinfish varied from under one million pounds to about 3.2 million pounds from 1997 through 2007. During that time period, the number of pounds landed of mahi mahi slightly increased, while the value of those landings has risen substantially (Figure 5.3.4.7.1). This is largely due to increased ex-vessel value and landings of the species in Hawaii. While Florida landings dominated from 1997 through 2001, they fell during the 11-year period and Hawaii's rose dramatically. From 1997 through 2001, there were no commercial landings in Hawaii. However, since 2002, Hawaii has had average annual commercial landings of about 1.5 million pounds. During the period from 2005 through 2007, Hawaiian commercial landings represented about 63 percent of annual national landings (Figure 5.3.4.7.2).

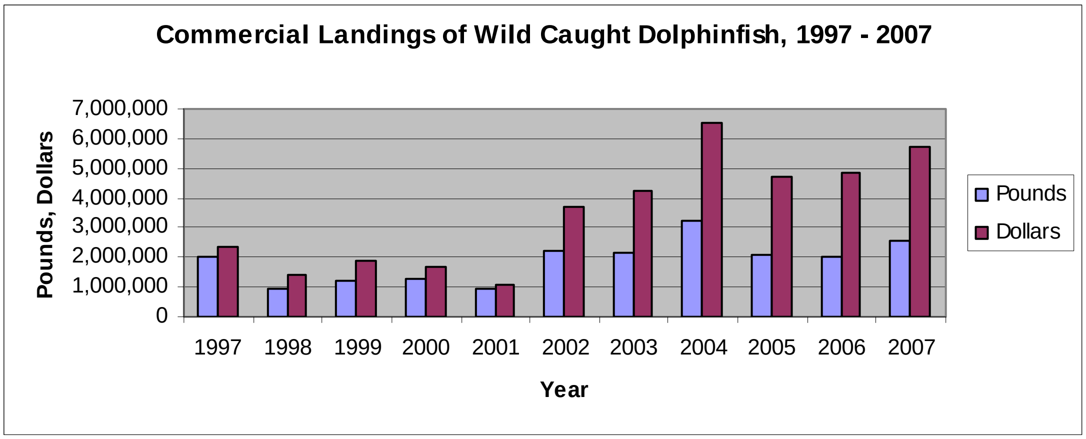

Figure 5.3.4.7.1 Commercial Landings of Wild Caught Dolphinfish, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

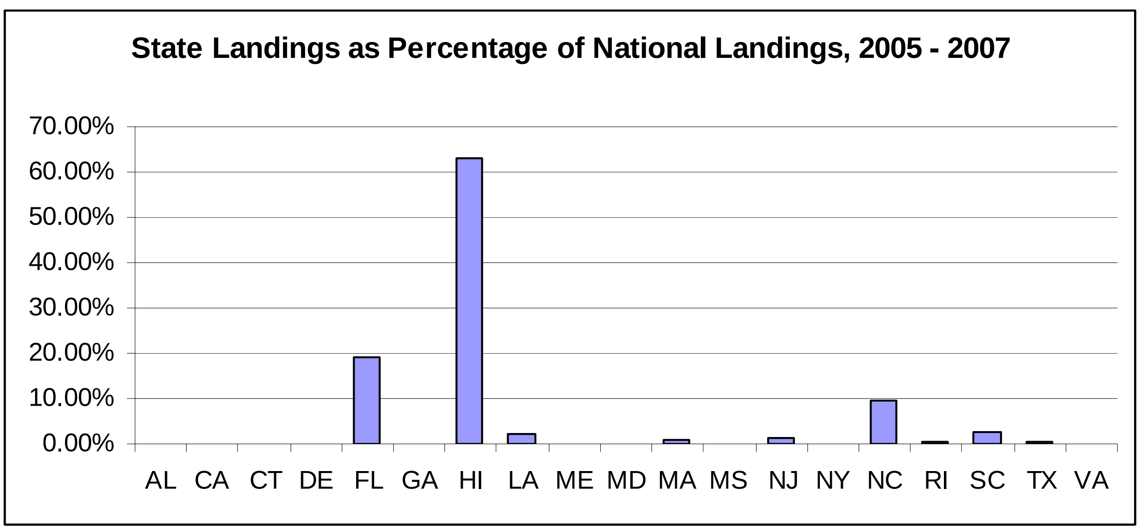

Figure 5.3.4.7.2. State Landings as Percentage of National Commercial Landings of Wild Caught Dolphinfish, 2005 – 2007. *Source:* NMFS, Accumulated Landings System.

Within the Gulf and South Atlantic States from 1997 through 2007, Florida had the largest portion of the combined annual commercial landings of dolphinfish, averaging 58 percent of those landings, and Louisiana came in second with 14 percent of those landings.

Commercial landings of dolphinfish increased substantially in North Carolina in 2007. From 1997 through 2006, commercial landings in North Carolina ranged from 139,759 to 229,783 pounds; however, in 2007, they rose to 369,462 pounds (Figure 5.3.4.7.3). Commercial landings of dolphinfish in North Carolina; however, historically rank low in terms of their contribution to the State's total finfish landings and trips. According to Bianchi in a September 2003 socioeconomic report for the North Carolina Division of Marine Fisheries (www.ncfisheries.net/download/index.html), commercial landings of dolphinfish ranked 28th by pounds and 30th by number of trips during the period from 1994 through 2001.

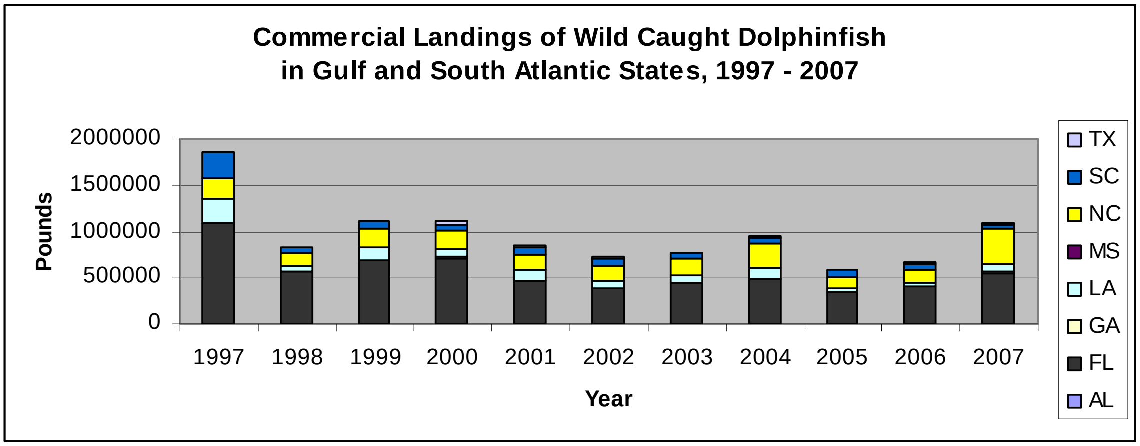

Figure 5.3.4.7.3. Gulf and South Atlantic States Landings as Percentage of National Commercial Landings of Wild Caught Dolphinfish, 2005 – 2007. *Source:* NMFS, Accumulated Landings System.

In Florida, the following five counties account for 73 percent of the state's commercial landings of dolphinfish from 2005 through 2007: Monroe (34 percent), Duval (13 percent), St Johns (13 percent), Bay (7 percent), and Miami-Dade (6 percent). From 2005 through 2007, annual commercial landings of dolphinfish accounted for less than one percent of annual finfish commercial landings for 28 of Florida's 37 coastal counties. However, they represented as much as 71 percent of Walton County's, 21 percent of St. John County's and 5 percent of Duval County's commercial finfish landings in 2007. On average, from 2005 through 2007, annual commercial landings of dolphinfish represented 24 percent of Walton County's commercial finfish landings, 11 percent of St. Johns', 4 percent of Duval County's, 4 percent of Miami-Dade County's and 3 percent of Monroe County's annual commercial finfish landings. This suggests annual commercial landings of dolphinfish are or have been economically significant to Walton, St. Johns and Duval Counties for at least one year during the above 3-year time period.

In 2006, Walton County had 30 nonemployer firms in Finfish and Shellfish Fishing with receipts of $1.2 million and two employer establishments in Finfish Fishing in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns), one employed from 1 to 4 employees and the other employed from 5 to 9 employees. That same year it had no employer establishments in the Fish & Seafood Merchant Wholesalers Industry. Sixty Saltwater Product Licenses and six Wholesale Dealers licenses were issued for 2007-

2008. Its population in 2000 was 89,974 persons, which rose by 4 percent to an estimated 93,554 in 2006. The per capita money income in 1999 was $15,809, and 16.5 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 66.3 percent were high school graduates and 12.4 percent had a bachelor's degree or higher (Table 5.3.4.7.1).

St Johns County had 101 nonemployer firms in Finfish and Shellfish Fishing with receipts of $3.7 million and no employer establishments in Finfish Fishing in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year it had no employer establishments in the Fish & Seafood Merchant Wholesalers Industry. In the 2007-2008 fishing season, 162 Saltwater Products licenses and 28 Wholesale Dealer Licenses were issued. Its population in 2000 was 123,135 persons, which rose by 37.4 percent to an estimated 169,224 in 2006. The per capita money income in 1999 was $28,674, and 7.5 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 87.2 percent were high school graduates and 33.1 percent had a bachelor's degree or higher (Table 5.3.4.7.1).

Table 5.3.4.7.1. Duval, St Johns and Walton Counties. Source: U.S. Census Bureau.

	Duval	St Johns	Walton
Population, 2006 est.	837,964	169,224	52,270
Population, 2000	778,879	123,135	40,601
Persons under 5 yrs old, % 2006	7.6%	5.0%	5.6%
Persons under 18 yrs old, % 2006	26.0%	20.3%	20.7%
Persons 65 yrs or older % 2006	10.4%	14.5%	14.7%
Female persons, % 2006	51.3%	50.9%	49.0%
Male persons, % 2006	48.7%	49.1%	51.0%
White persons, % 2006	64.4%	90.9%	89.4%
Black persons, % 2006	30.2%	5.9%	6.8%
American Indian and Native Alaska persons, % 2006	0.4%	0.2%	1.1%
Asian persons, % 2006	3.4%	1.9%	0.6%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	0.1%	0.1%	0.1%
Persons reporting 2 or more races, % 2006	1.6%	1.0%	2.0%
Persons Hispanic/ Latino, % 2006	5.7%	3.9%	3.2%
White not Hispanic, % 2006	59.6%	87.3%	86.5%
Foreign born, percent 2000	5.9%	4.9%	3.2%
Language other English spoken home, % age 5+, 2000	9.5%	6.7%	5.1%
High school graduates, % persons age 25+, 2000	82.7%	87.2%	76.0%
Bachelor's degree or higher, % persons age 25+, 2000	21.9%	33.1%	16.2%
Housing units, 2006	379,564	80,369	40,042
Households, 2000	303,747	49,614	16,548
Persons per household, 2000	2.51	2.44	2.35
Median household income, 2004	$41,736	$55,712	$37,350
Per capita money income, 1999	$20,753	$28,674	$18,198
Persons below poverty, % 2004	11.7%	7.5%	11.5%

In 2006, Duval County had 188 nonemployer firms in Finfish and Shellfish Fishing with receipts of $6.6 million and one employer establishments in Finfish Fishing employed from 1 to 4 employees (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year it had seven employer establishments in the Fish & Seafood Merchant Wholesalers Industry that ranged in size from two that employed from 20 to 49 employees to three that employed from 1 to 4 persons. In the 2007-2008 fishing season 372 Saltwater Products licenses and 60 Wholesale Dealers licenses were issued. Its population in 2000 was 778,879 persons, which rose by 7.6 percent to an estimated 837,964 in 2006. The per capita money income in 1999 was $20,753, and 11.7 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 82.7 percent were high school graduates and 21.9 percent had a bachelor's degree or higher (Table 5.3.4.7.1).

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at www.gulfcouncil.org/Beta/GMFMCWeb/downloads/EFH%20Appendices/Appendix%20B.pdf, and the Fishery Management Plan for the Dolphin and Wahoo Fishery of the Atlantic (January 2003) at: http://www.safmc.net/Library/DolphinWahoo/tabid/410/Default.aspx.

The U.S. is and has been a major importer of frozen dolphinfish filets. From 2003 through 2007, the U.S. imported from about 12 million kilos (26.5 million pounds) with a value of $44.5 million in 2003 to about 16 million kilos (36.2 million pounds) with a value of $84.8 million of frozen dolphinfish fillets in 2007 (Figure 5.3.4.7.4). Eighty-eight percent of these imports (in pounds) came from the following countries: China-Taipei (40 percent), Ecuador (21 percent), Peru (20 percent), Viet Nam (5 percent), and China (2 percent). The combined value of these imports was $84.8 million in 2007.

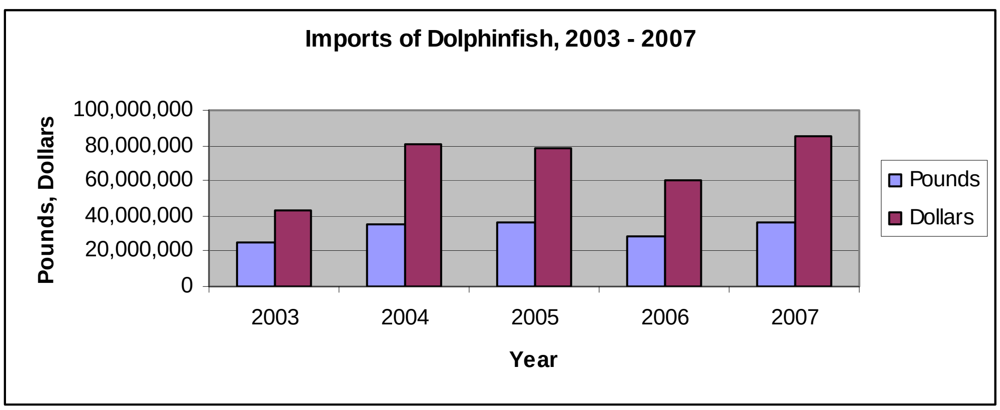

Figure 5.3.4.7.4. U.S. Imports of Dolphinfish. ***Source:*** **NMFS, Fisheries Statistics and Economics Division.**

Presently there is no commercial aquaculture production of mahi-mahi; however, a company in Australia is close to doing so. Furthermore, according to the September 10, 2007, Draft Supplemental Environmental Impact Assessment for an Expanded Production Capacity and Extended Farm Lease for Kona Blue's Offshore Open Ocean Fish Farm Project, it has plans to expand its aquaculture production to include mahi-mahi.

According to a 2002 issue of *Seafood Business*, Delmarva Premium Seafood Company opened an aquaculture operation in Hurlock, Pennsylvania in August 2002 with the capacity to grow more than 150,000 pounds of fish a year and mahi-mahi was one of the potential species to be cultured. However, recent information suggests the operation did not materialize.

5.3.4.8 Lane Snapper (*Lutjanus synagris*)

Lane snapper *Lutjanus synagris,* occurs in the western Atlantic Ocean from North Carolina to Southern Brazil. It is most abundant in the Antilles, off Panama, and northern coast of South America. It is also found in the Gulf of Mexico and Bermuda. Adults are most commonly observed around reefs and sandy bottoms in shallow inshore waters; however, the species has also been reported in offshore waters, 400 meters in depth. Lane snapper is found in areas where shrimp fishing occurs and for that reason, it is a common incidental catch of shrimp trawlers. Its flavor is much like red and other snappers, except it is less firm than red snapper. Spawning occurs throughout the spring and summer, depending upon the location. From April 1 through June 30 of each year, no person can fish for or possess lane snapper in or from the Caribbean EEZ.

In the Gulf EEZ, the regulations that apply to all species in the reef fish fishery management unit apply to lane snapper. Similarly, in the South Atlantic EEZ, the regulations that apply to all species in the snapper-grouper fishery management unit apply to lane snapper. There is no legal restriction on the level of catch. Florida has minimum size limit of 8 inches total length.

Lane snapper tends to be an incidentally caught species. Commercial landings of lane snapper represent less than one percent of Gulf commercial landings of lane snapper by weight and value from 2002 through 2007; hence, it is considered a minor commercial snapper species. Landings dropped significantly from 1997 through 2007, falling from over 102,867 pounds with a value of $131,346 in 1997 to 33,241 pounds with a value of $70,503 in 2007 (Figure 5.3.4.8.1). During this time, the average ex-vessel price has risen from $1.28 in 1997 to $2.12 in 2007 (Figure 5.3.4.8.2).

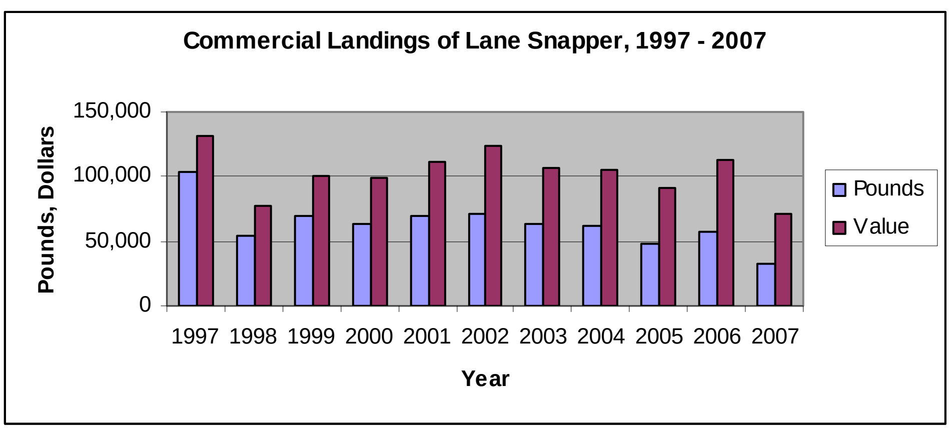

Figure 5.3.4.8.1. Commercial Landings of Lane Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

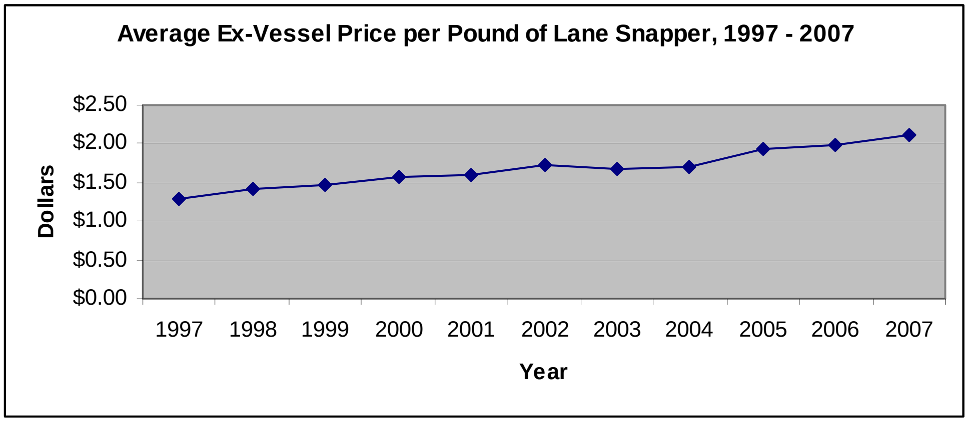

Figure 5.3.4.8.2. Average Annual Ex-Vessel Price per Pound of Lane Snapper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

During the period from 1997 through 2007, commercial landings of lane snapper were reported in the following four states: Alabama, Florida, Louisiana and Texas. Historically, Florida has had the largest portion of national commercial landings, averaging 64 percent of annual landings, followed by Louisiana with 25 percent, and Texas with 6 percent (Figure 5.3.4.8.3). Texas landings rose from zero in 2001 to 10,632 pounds in 2007.

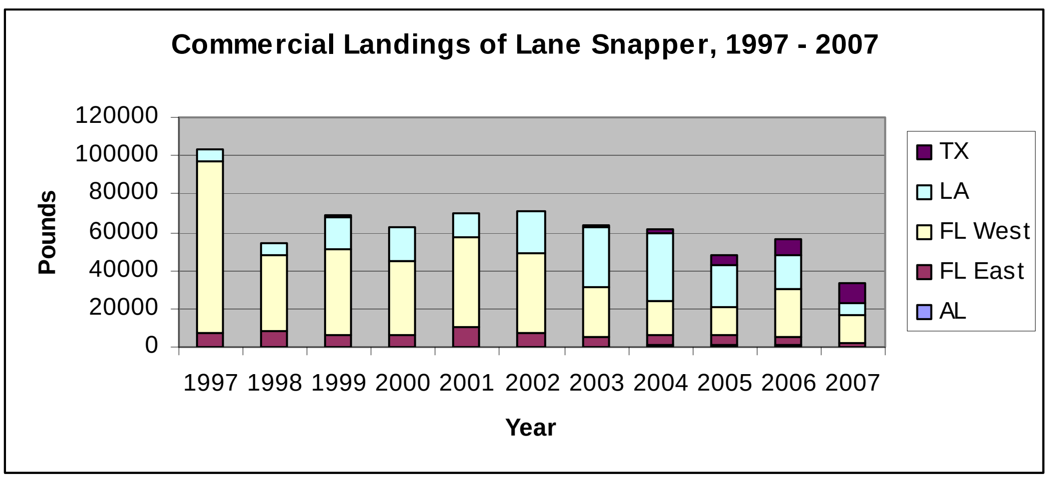

Figure 5.3.4.8.3. Commercial Landings of Wild Caught Lane Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

In Florida, the top five counties by average share of the State's commercial landings of lane snapper are: Monroe with 22 percent of landings (by pounds), Franklin with 16 percent, Palm Beach County with 10 percent, Citrus County with 9 percent, and Lee County with 6 percent. Annual commercial lane snapper landings represent less than half a percent of any of these counties' commercial finfish landings in 2007. Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat

Amendment (March 2004), obtained on line at
www.gulfcouncil.org/beta/gmfmcweb/downloads/FINAL3_EFH_Amendment.pdf
To date, there are no reports of commercial aquaculture of lane snapper. However, it is the subject of aquaculture research.

5.3.4.9 Gray Snapper (*Lutjanus griseus*)

Gray snapper occurs in the Gulf of Mexico and western Atlantic, from Massachusetts southward to Brazil. It is especially abundant around the Florida coastline. Its common names include mangrove snapper and mango snapper. Large aggregations of gray snapper are observed around rocky areas, coral reefs, mangrove habitats and estuaries. Spawning occurs from April to November with its peak during the summer months. It flavor is similar to all snapper. There have been reports of ciguatera poisoning caused by consumption of the species.

Gray snapper is an incidental catch in other fisheries, such as shrimp trawls. It ranks fourth in pounds landed among the snappers commercially landed in the Gulf. The top three are red, vermilion and yellowtail snapper. From 1997 through 2007, commercial landings of gray snapper represented 3.7 percent of annual commercial landings of snapper in the Gulf.

Commercial landings of gray snapper have not shown a definite trend since 1997; however, they fell from a high of 510,711 pounds in 1997 to 241,196 pounds in 2007 (Figure 5.3.4.9.1). During the same time period, the average ex-vessel price has climbed from $1.67 to $2.16 per pound (Figure 5.3.4.9.2).

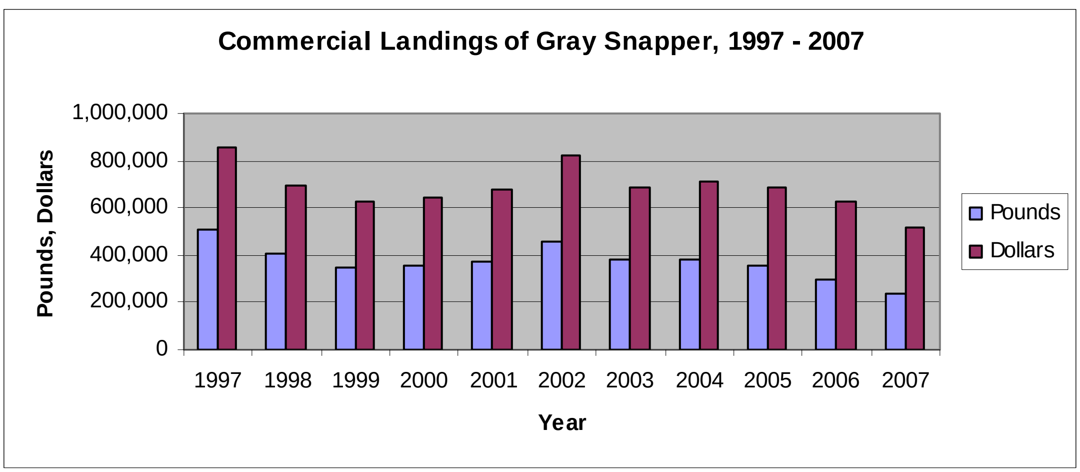

Figure 5.3.4.9.1. Commercial Landings of Gray Snapper, 1997 – 2007. *Source*: NMFS, Accumulated Landings System.

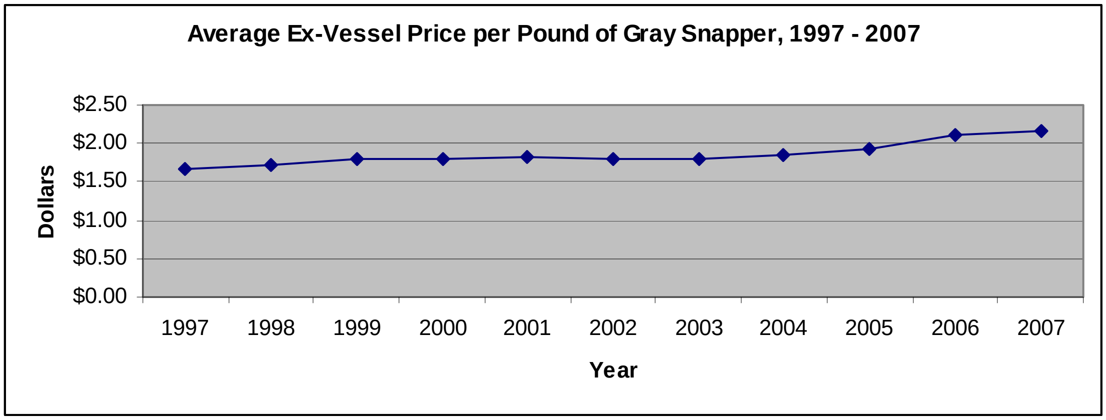

Figure 5.3.4.9.2. Average Annual Ex-Vessel Price of Gray Snapper, 1997 – 2007, not deflated. *Source*: NMFS, Accumulated Landings System.

Gulf landings dominate those of the Atlantic, representing on average 86 percent of annual national commercial landings of gray snapper, and within the Gulf, the largest landings occur on Florida's west coast. The commercial landings of gray snapper on Florida's west coast represent an average of 77 percent of annual national commercial landings and 89 percent of annual Gulf commercial landings.

The top six Florida counties in terms of annual commercial landings of gray snapper are: Monroe County with 57 percent of State landings, Pinellas County with 13 percent, Franklin with 4 percent, Bay with 4 percent, Miami-Dade with 3 percent and Pasco with 2 percent. County gray snapper landings represent less than one percent of finfish landings in Monroe, Pinellas, Franklin and Bay Counties. They represent about 2 percent of county commercial finfish landings in Miami-Dade County and about 7 percent of county commercial finfish landings in Pasco County.

Pasco County had 125 nonemployer firms in the Finfish and Shellfish Industry with receipts of $4.7 million and no employer establishments in finfish fishing in 2006 (2006 Nonemployer Statistics and 2006 County Business Patterns). That same year there were four employer establishments in the Fish and Seafood Merchant Wholesalers Industry, ranging in size from one employing from 20 to 49 persons and three employing from 1 to 4 persons. In the 2007-2008 fishing season, 271 Saltwater Products licenses and 22 Wholesaler Dealers were issued in the county. Its population in 2000 was 344,765 persons and estimated population in 2006 was 450,171. The per capita money income in 1999 was $18,439, and 10.8 percent of the 2004 population lived below poverty. In 2000, of the population over 25 years and older, 77.6 percent were high school graduates and 13.1 percent had a bachelor's degree or higher.

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at:
www.gulfcouncil.org/beta/gmfmcweb/downloads/FINAL3_EFH_Amendment.pdf

Gray snapper has been successfully reared in aquaculture. The FAO has reported commercial aquaculture of *Lutjanus* spp. in Brunei Darusallam, Philippines and Singapore. In 2006, however, total production was 4,409 pounds with a value of $6,000.

5.3.4.10 Yellowtail Snapper (*Ocyurus chysurus*)

Yellowtail snapper is found in the Gulf of Mexico, Caribbean Sea and western Atlantic Ocean from Massachusetts to southeastern Brazil. Its common names include yellowtail and cola. Adults live over sandy areas near deep water reefs at depths 10 to 70 meters deep. It is most common in waters of the Bahamas and off south Florida and in the Caribbean Sea. Yellowtail snapper is the third most caught snapper of annual Gulf coast landings in terms of pounds.

From 1997 through 2007 commercial landings of yellowtail snapper ranged from a high of about 1.7 million pounds to a low of almost a million pounds (Figure 5.3.4.10.1). During this time period, annual landings averaged at about 1.4 million pounds with a value of $3.1 million. Ex-vessel price fluctuated around $2 per pound from 1997 through 2003, and then increased to $2.61 in 2007 (Figure 5.3.4.10.2).

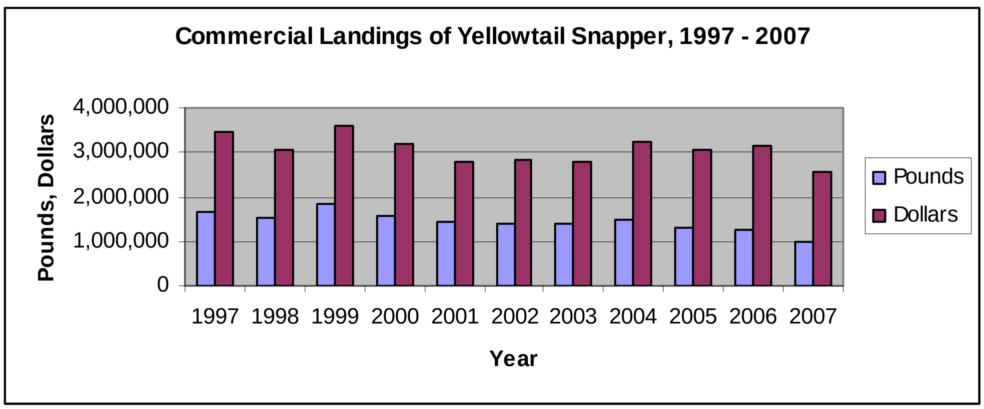

Figure 5.3.4.10.1. Commercial Landings of Yellowtail Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

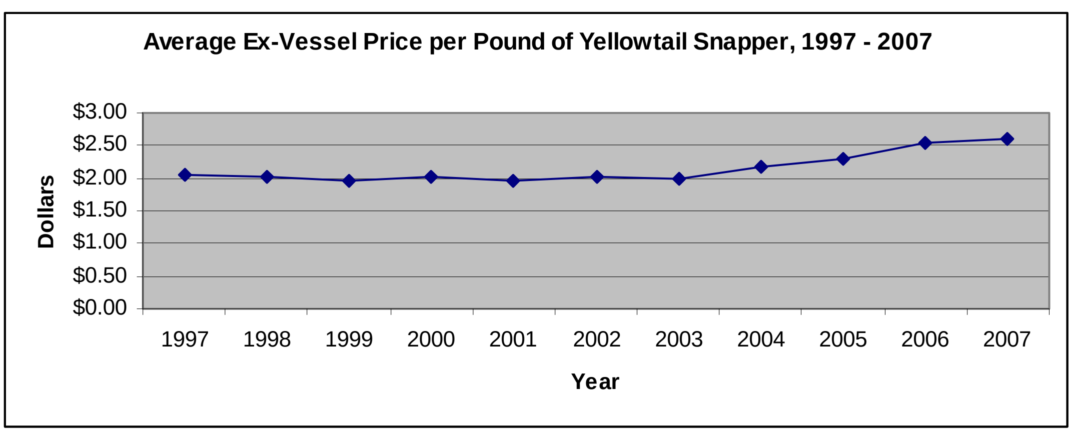

Figure 5.3.4.10.2. Average Annual Ex-Vessel Price per Pound of Yellowtail Snapper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

Most of the commercial landings occur in Florida's Gulf coast, averaging 93 percent of annual landings from 1997 through 2007. From 2005 through 2007, four counties accounted for 99 percent of Florida's annual commercial landings: Monroe with 91 percent, Miami-Dade with 6 percent, and Palm Beach and Broward Counties, both with one percent. Yellowtail landings are a significant portion of commercial finfish for Monroe and Miami-Dade Counties. In 2007, commercial landings of yellowtail snapper represented about 21 percent of Monroe County's and 11 percent of Miami-Dade's commercial finfish landings for that year. Landings of yellowtail represented about 2 percent of Broward County's and under one percent of Palm Beach County's finfish landings for that year. Monroe County is described earlier in this section.

Miami-Dade had 438 nonemployer firms in Finfish & Shellfish Fishing with receipts of $13.1 million in 2006 and four employer establishments in Finfish Fishing the same year. Three of the Finfish Fishing establishments employed from 1 to 4 persons and the other employed from 5 to 9 persons. Also, in 2006, there were 79 employer establishments in the Fish & Seafood Merchant Wholesalers Industry, ranging in size from one that employed from 100 to 249 persons to 44 that employed from 1 to 4 persons. During the 2007-2008 fishing season, there were 176 Saltwater Products licenses and 198 Wholesale Dealer licenses issued to persons in the county. In 2000, the population of the county was 2,253,362 persons and rose to an estimated 2.4 million in 2006. The median household income in was $34,682 and 17.1 percent of the population live below poverty in 2004 (Table 5.3.4.10.1).

Table 5.3.4.10.1. Miami-Dade County. Source: U.S. Census Bureau.

	Miami-Dade
Population, 2006 est.	2,402,208
Population, 2000	2,253,362
Persons under 5 yrs old, % 2006	6.80%
Persons under 18 yrs old, % 2006	23.9%
Persons 65 yrs or older % 2006	14.2%
Female persons, % 2006	51.5%
Male persons, % 2006	48.5%
White persons, % 2006	77.0%
Black persons, % 2006	20.2%
American Indian and Native Alaska persons, % 2006	0.3%
Asian persons, % 2006	1.5%
Nat. Hawaiians, Other Pacific Is. persons, % 2006	0.1%
Persons reporting 2 or more races, % 2006	0.9%
Persons Hispanic/ Latino, % 2006	61.3%
White not Hispanic, % 2006	18.3%
Foreign born, percent 2000	50.9%
Language other English spoken home, % age 5+, 2000	67.9%
High school graduates, % persons age 25+, 2000	67.9%
Bachelor's degree or higher, % persons age 25+, 2000	21.7%
Housing units, 2006	953,025
Households, 2000	776,774
Persons per household, 2000	2.84
Median household income, 2004	$34,682
Per capita money income, 1999	$18,497
Persons below poverty, % 2004	17.1%

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at.
www.gulfcouncil.org/beta/gmfmcweb/downloads/FINAL3_EFH_Amendment.pdf

5.3.4.11 Schoolmaster Snapper (*Lutjanus apodus)*

Schoolmaster snapper is found in the western Atlantic from Massachusetts to Brazil and into the Gulf of Mexico. Adults are found near shore especially around coral reefs; however, larger adults have been found on the continental shelf. In the U.S. it is most often found in waters of the Florida Keys. Schoolmaster snapper is also called schoolmaster.

Schoolmaster snapper is an incidentally caught commercial species, all of it landed in Florida. From 1997 through 2007, annual commercial landings ranged from a high of

167 pounds in 1997 with a value of $291 to a low of 0 pounds in 1998, 2001, and 2005 through 2007 (Figure 5.3.4.11.1).

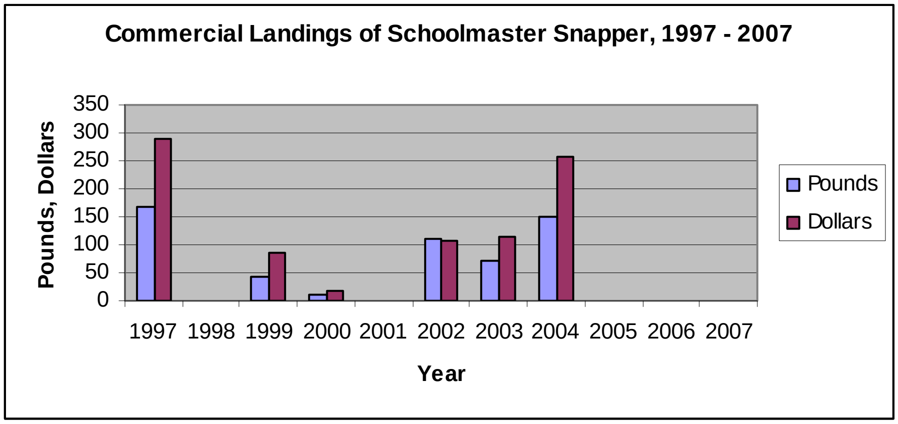

Figure 5.3.4.11.1. Commercial Landings of Schoolmaster Snapper, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

5.3.4.12 Cubera Snapper (*Lutjanus cynaopterus*)

Cubera snapper is found in the western Atlantic from Massachusetts to Brazil; however, it is rarely found north of Florida. It is rarely found in the Gulf of Mexico. Among its common names are cubera, canteen snapper and Cuban snapper. It is a solitary reef dweller that lives inshore or near shore. Cases of ciguatera poisoning have been reported from its consumption.

Cubera snapper is an incidentally caught species. From 1997 through 2007, annual commercial landings of cubera snapper ranged from a low of 2,209 pounds in 2005 to a high of 9,261 pounds in 1997. During the above time period, annual landings have averaged 5,560 pounds with a value of $7,673. From 1997 through 2004, the average ex-vessel price was under $1.5 per pound; however, since 2005, the annual ex-vessel price has been above $2 per pound an average of 63 percent of annual commercial landings occurred along the Atlantic coast and 37 percent along the Gulf from 1997 through 2007 (Figures 5.3.4.12.1 and 5.3.4.12.2) . Cubera commercial landings represent 0.02 percent of all the annual Gulf commercial snapper landings.

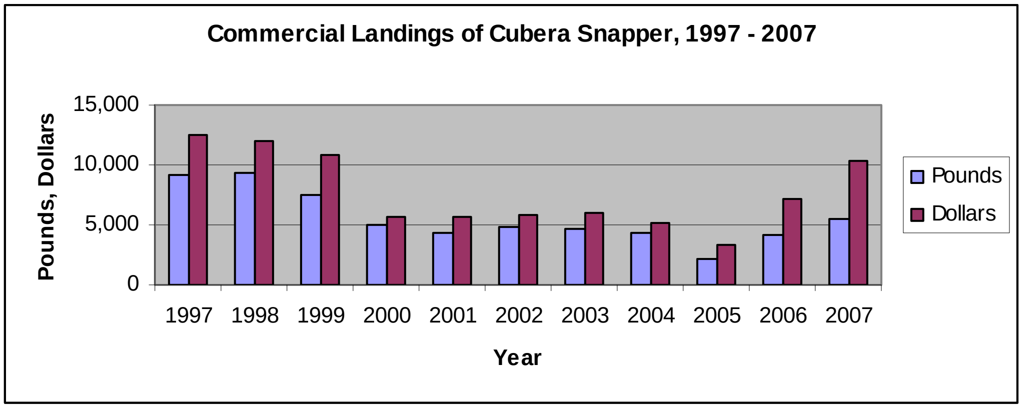

Figure 5.3.4.12.1. Commercial Landings of Cubera Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

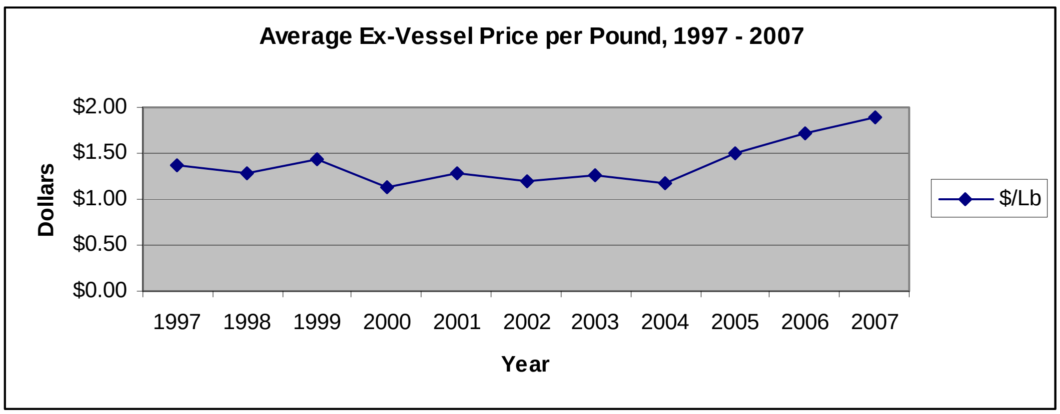

Figure 5.3.4.12.2. Average Ex-Vessel Price per Pound of Cubera Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

5.3.4.13 Dog Snapper (*Lutjanus jocu*)

Dog snapper occurs in the western Atlantic from Massachusetts to Brazil, but is rare north of Florida. It is commonly found in coral reefs and waters with rocky bottoms of depths from 5 to 30 meters. It is solitary and wary, preferring secluded areas of reef. Among its common names are dogtooth snapper, dogteeth snapper, dog's tooth snapper and dogteeth pargue. It is the only Lutjanid found in freshwater. Its consumption has been linked to ciguatera poisoning.

Dog snapper is an incidentally caught species. From 1997 through 2007, annual commercial landings averaged 1,789 pounds with a value of $2,261 (Figure 5.3.4.13.1). All commercial landings of dog snapper from 1997 through 2007 occurred in Florida, with the exception of landings in Louisiana in 2005. Annual landings of dog snapper represent 0.02 percent of annual Gulf commercial landings of snapper.

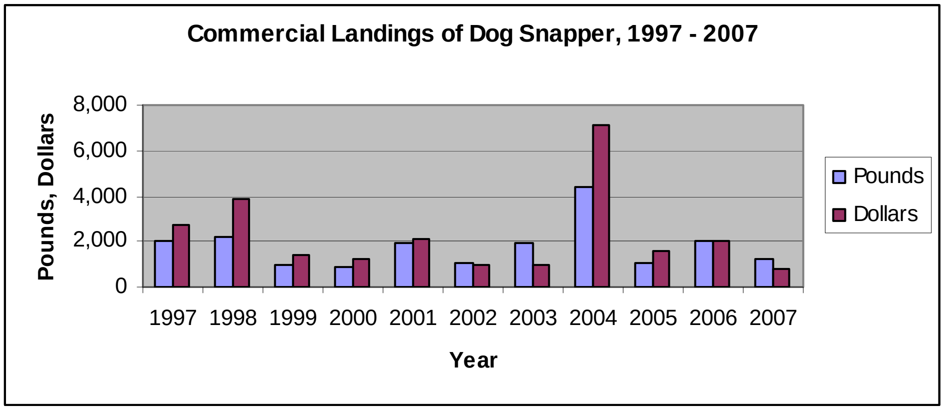

Figure 5.3.4.13.1. Commercial Landings of Dog Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at: http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20EFH%20EIS.pdf.

5.3.4.14 Vermilion Snapper (*Rhomboplites aurorubens*)

Vermilion snapper occurs in the western Atlantic from North Carolina to Brazil and in the Gulf of Mexico. Among its common names are b-liner, beeline snapper, bastard snapper, and mungo snapper. It is most commonly found in waters off the southeastern U.S. and often vermilion snapper often forms schools. Because of its meat being similar to red snapper, it is often sold as red snapper.

In the Gulf EEZ, there is a 10-inch total length minimum and commercial quota of 440,000 pounds gutted weight. There is a 12-inch minimum total length in the South Atlantic and a commercial quota of 1.1 million pounds gutted weight. There are also gear restrictions in the South Atlantic.

Vermilion snapper ranks second in Gulf coast commercial landings of snapper. From 1997 through 2007, annual commercial landings of vermilion snapper ranged from a low of about 2.5 million pounds with a value of $4.9 million to a high of almost 3.5 million pounds with a value of $8.4 million, averaging 2.9 million pounds with a value of $6.2 million annually (Figure 5.3.4.14.1). Average price per pound for vermilion snapper has ranged from $2 to $2.50 over the last 10 years (Figure 5.3.4.14.2).

About 67 percent of annual commercial landings occur along the South Atlantic, with the remaining 33 percent along the Gulf coast. Along the Gulf Coast, Florida's west coast accounts for 51 percent of annual commercial landings of vermilion snapper, followed by Louisiana with 30 percent, Texas with 16 percent, Alabama with 2 percent, and Mississippi with 1 percent. Similarly, in the South Atlantic, North Carolina leads with 42 percent of that coast's annual commercial landings of vermilion snapper, followed by South Carolina with 36 percent, Florida's east coast with 15 percent and Georgia with 6 percent (Figures 5.3.4.14.3 and 5.3.4.14.4).

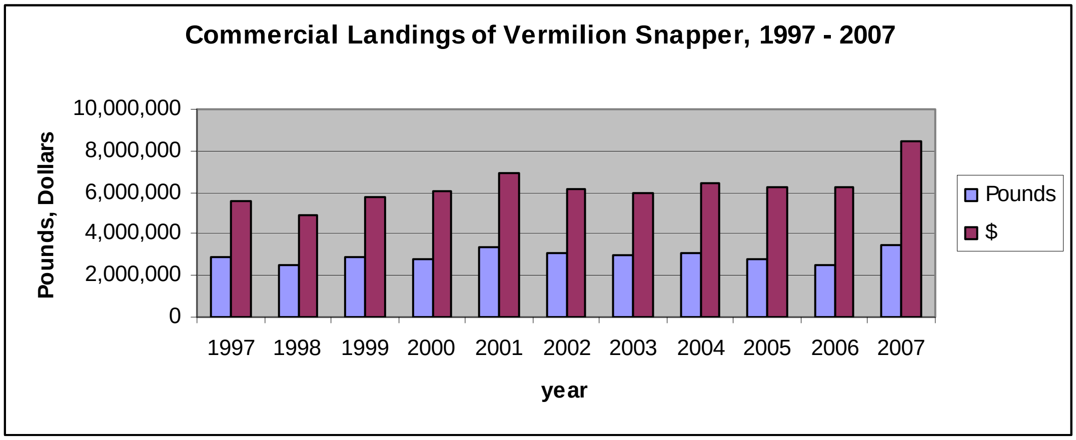

Figure 5.3.4.14.1. Commercial Landings of Vermilion Snapper, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

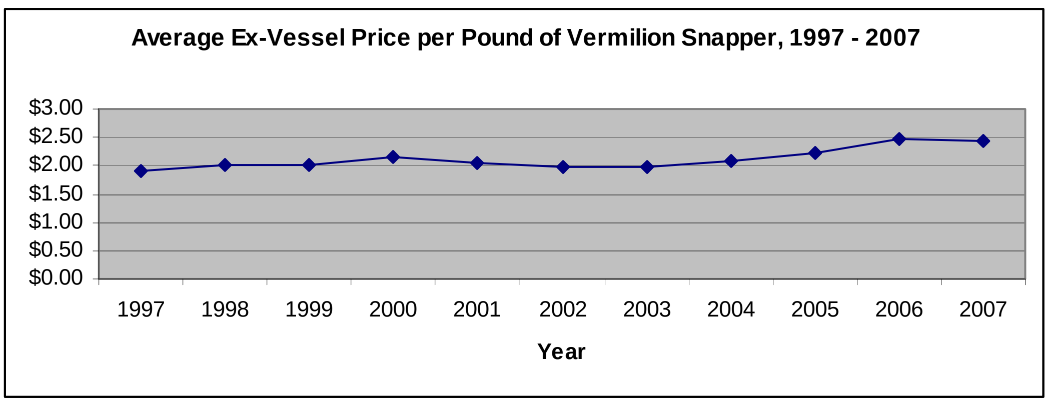

Figure 5.3.4.14.2. Average Ex-Vessel Price per Pound of Vermilion Snapper, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

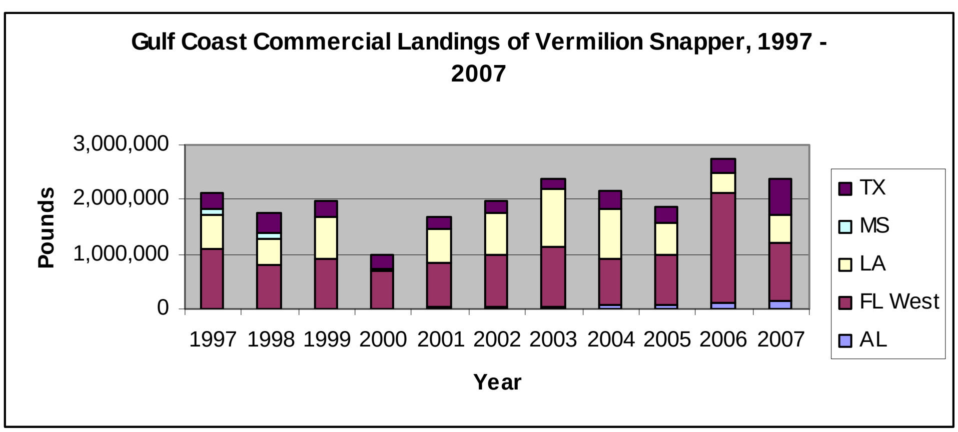

Figure 5.3.4.14.3. Gulf Coast Commercial Landings of Vermilion Snapper, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

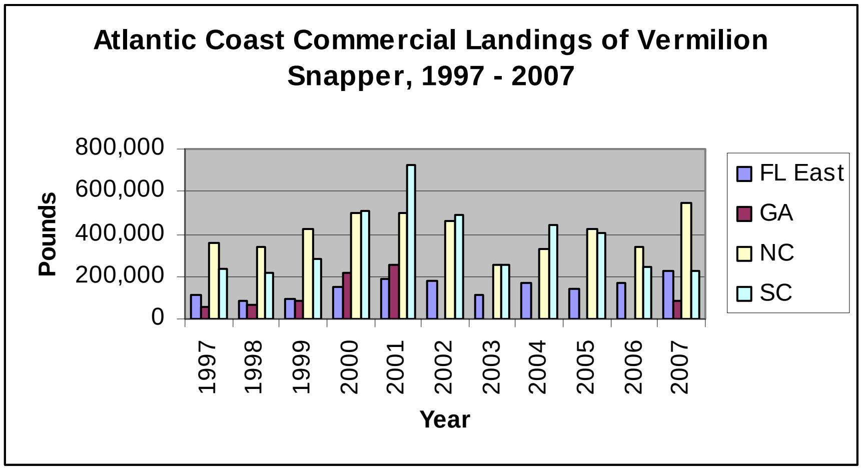

Figure 5.3.4.14.4 Atlantic Coast Commercial Landings of Vermilion Snapper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Additional information regarding the South Atlantic commercial fishery for vermilion snapper and relevant South Atlantic fishing communities is found in the October 8, 2008 Final Snapper Grouper Amendment 16 (Gag and Vermilion Snapper), which can be obtained online at
sero.nmfs.noaa.gov/sf/pdfs/**South**%20**Atlantic**%20**Amendment**%2016%20FAQ.pdf

Along Florida's west coast counties, Okaloosa led commercial landings of vermilion snapper from 2005 through 2007 with 44 percent of the counties' combined annual landings of vermillion snapper, followed by Bay County with 27 percent, Escambia with 23 percent, Franklin with 3 percent and Pinellas with 1 percent. Vermilion snapper landings represent a significant amount of Okaloosa, Bay and Escambia Counties' annual landings of finfish. In 2007, commercial landings of vermilion snapper represented 32 percent of Okaloosa County's commercial landings of finfish. Similarly, vermilion snapper landings represented 30 percent of Escambia County's finfish landings and 14 percent of Bay County's finfish landings for that year. Demographic information for these three counties is found in previous tables. Additional information regarding the fishery and relevant fishing communities can be found in the Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment (March 2004), obtained on line at www.gulfcouncil.org/Beta/GMFMCWeb/ downloads/Final%20EFH%20EIS.pdf.

5.3.4.15 Yellowedge Grouper (*Epinephelus flavolimbatus*)

Yellowedge grouper is found in the western Atlantic from North Carolina to Brazil, Gulf of Mexico and Caribbean Sea. It is also called yellowfinned grouper and is a solitary species. Hence, it is an incidentally caught species.

From 1997 through 2007, average annual commercial landings of yellowedge grouper were 988,861 pounds with a value of about $2.5 million. The largest amount of landings during that time period was about 1.3 million pounds in 2000 (Figure 5.3.4.15.1). The average ex-vessel price per pound began at $2.21 per pound and rose over $3 in 2007 to $3.12 per pound (Figure 5.3.4.15.2).

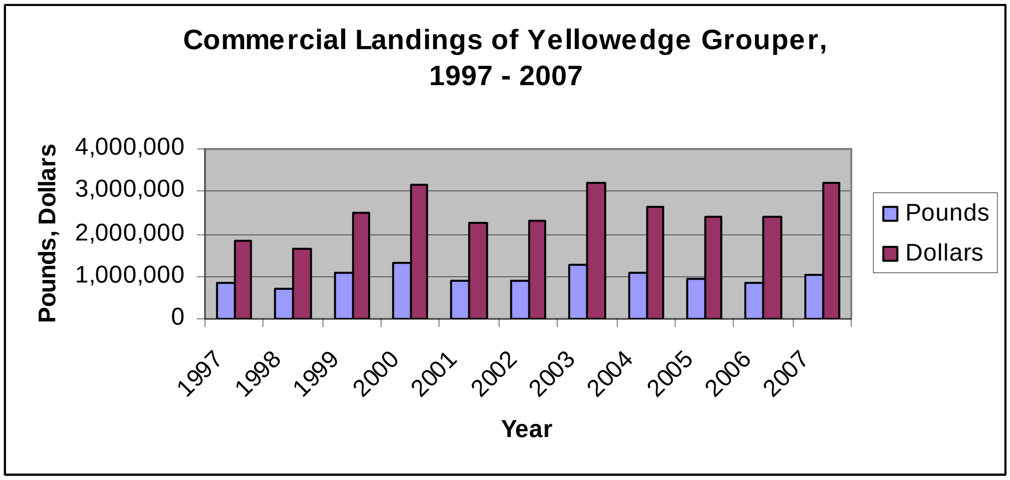

Figure 5.3.4.15.1. Commercial Landings of Yellowedge Grouper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

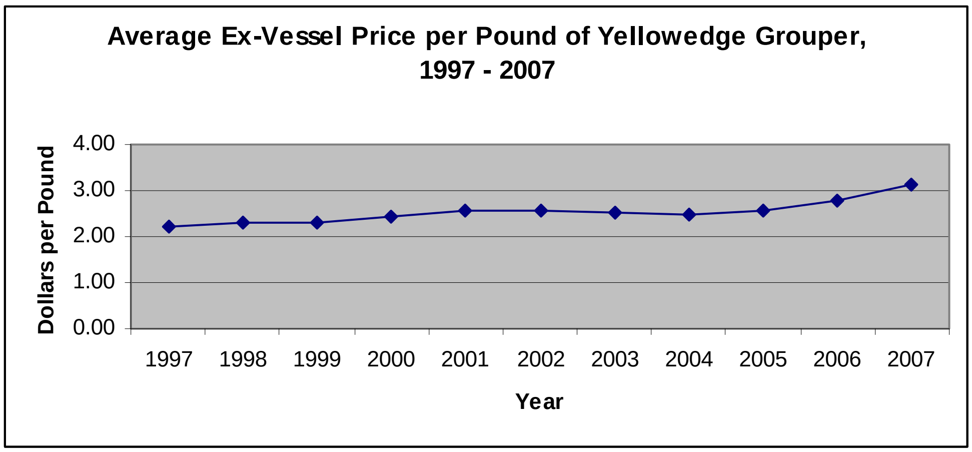

Figure 5.3.4.15.2. Average Annual Ex-Vessel Price per Pound of Yellowedge Grouper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

From 1997 through 2007, Gulf coast landings represented about 99 percent of the nation's commercial landings of yellowedge grouper. Florida's west coast dominates Gulf coast landings, representing 73 percent of annual commercial landings of yellowedge grouper, followed by Texas with 14 percent, Louisiana with 11 percent and Alabama with the remaining 2 percent. Among the Florida counties, Pinellas County and Bay County rank one and two respectively, in commercial landings.

For more information regarding the description of the yellowedge grouper fishery and related fishing communities, see the Environmental Impact Statement for Final Reef Fish Amendment 30B, which is available at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20Amendment%2030B%2010_10_08.pdf

Grouper is imported into the U.S. both fresh and frozen. From 1996 to 2007, imports of grouper ranged from about 6,615.6 million to 13,774.5 million pounds (Figure 5.3.4.15.3). In 2007, national commercial landings of groupers totaled 6.5 million pounds, which is 0.06 percent of the total pounds of fresh and frozen grouper imported that year. To put this into a visual perspective with imports for that year (Figure 5.3.4.15.4). Commercial landings are too small to appear on the chart.

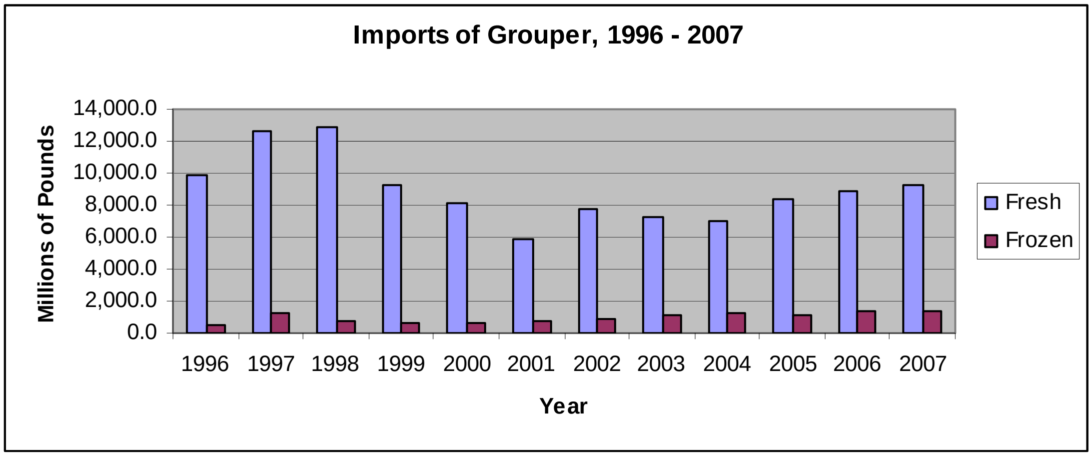

Figure 5.3.4.15.3. U.S. Imports of Grouper, 1996 – 2007. *Source:* NMFS, Foreign Trade Data.

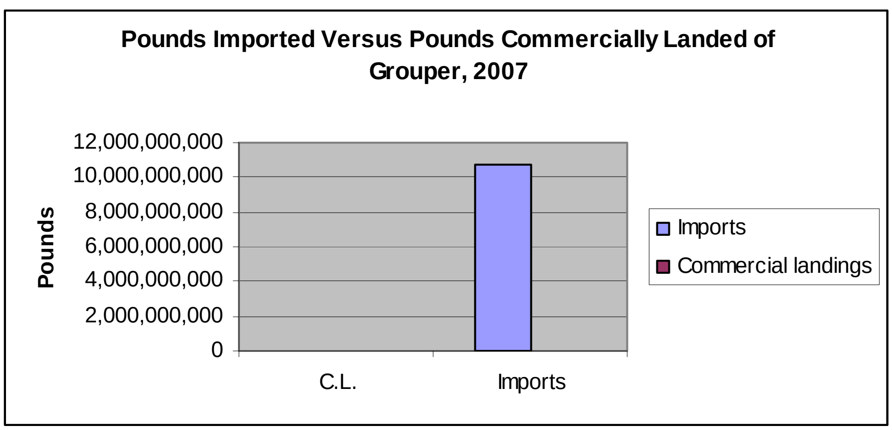

Figure 5.3.4.15.4 Pounds Imported Verses Pounds Commercially Landed of Grouper, 2007. *Source:* NMFS, Accumulated Landings System and Foreign Trade Data.

Grouper are products of aquaculture. According to the FAO, *Epinephelus* species are cultured in Brazil, China, Indonesia, Korea, Saudi Arabia, Singapore, Taiwan, and Thailand. Together, in 2006 they produced 140.6 million pounds of grouper (Figure 5.3.4.15.5). China is the largest producer and in 2006, produced about 105.9 million pounds.

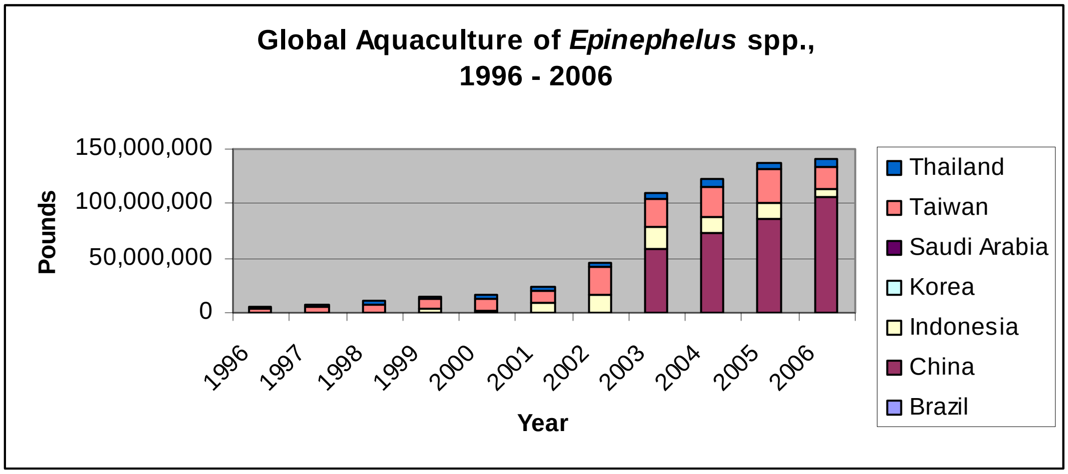

Figure 5.3.4.15.5. Global Aquaculture Production of Epinephelus spp., 1996 – 2006. *Source:* FAO.

5.3.4.16 Red Grouper (*Epinephelus morio*)

Red grouper is found in the western Atlantic from Massachusetts to Brazil and in the Gulf of Mexico. It is a shallow water grouper. According to FL-Seafood.com, it substitutes for amberjack, snapper, dolphinfish, catfish, tilefish and shark.

Annual commercial landings of red grouper ranged from about 4.8 million pounds to about 7.4 million pounds from 1997 through 2007, averaging 6.5 million pounds (Figure 5.3.4.16.1). During the same time, the average ex-vessel price per pound increased from $1.82 in 1997 to $2.54 in 2007 (Figure 5.3.4.16.2).

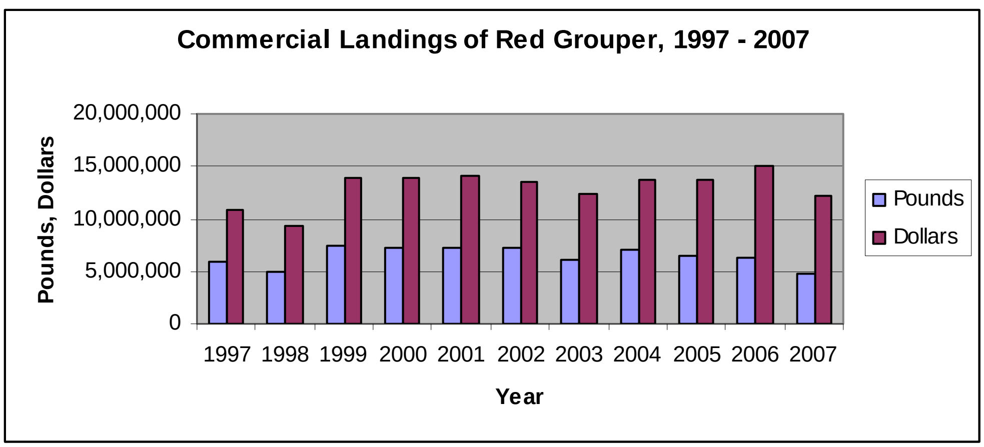

Figure 5.3.4.16.1. Commercial Landings of Red Grouper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

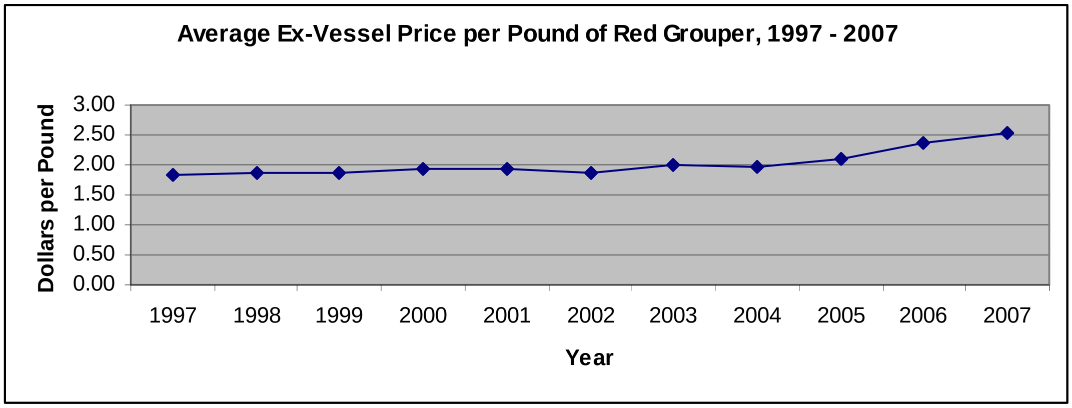

Figure 5.3.4.16.2. Average Ex-Vessel Price per Pound of Red Grouper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

Gulf landings of red grouper dominate national landings, representing 96 percent of annual landings. From 1997 through 2007, Gulf commercial landings occurred in Florida, Louisiana, and Alabama; however, Florida's west coast accounts for 99.9 percent of those annual landings. Among Florida counties with red grouper commercial landings, Pinellas County accounted for an average of 45 percent of Florida's annual landings from 2006 through 2007, followed by Manatee County with 12 percent of the landings, Franklin County with 12 percent, Bay County with 8 percent and Clay County with 5 percent. Red grouper commercial landings represent a significant portion of these counties commercial finfish landings. In 2007, Pinellas County's red grouper commercial landings represented 37 percent of its commercial finfish landings for that year. Also, Manatee County's commercial red grouper landings represented 22 percent of its commercial finfish landings, Franklin County's red grouper landings represented 41 percent of its finfish landings, Bay County's red grouper landings represented 9 percent of its finfish landings, and Clay County's commercial red grouper landings represented 10 percent of its commercial finfish landings for that year. This suggests the red grouper fishery is especially important to these five counties.

For more information regarding the description of the red grouper fishery and related fishing communities, see the Environmental Impact Statement for Final Reef Fish Amendment 30B, which is available at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20Amendment%2030B%2010_10_08.pdf.

5.3.4.17 Warsaw Grouper (*Epinephelus nigritus*)

Warsaw grouper is a deepwater grouper found in the western Atlantic from Massachusetts to Brazil and into the Gulf of Mexico.

Commercial landings of Warsaw grouper varied from 89,641 pounds to 252,317 pounds from 1997 through 2007, averaging 152,858 pounds with a value of $289,896 during that time period (Figure 5.3.4.17.1). During the same time, the average ex-vessel price per pound, the average ex-vessel price per pound rose from $1.73 to $2.24 (Figure 5.3.4.17.2).

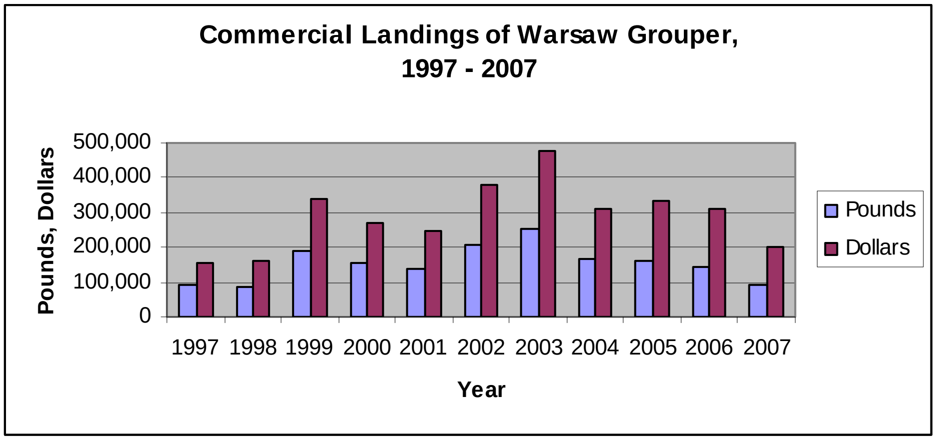

Figure 5.3.4.17.1. Commercial Landings of Warsaw Grouper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

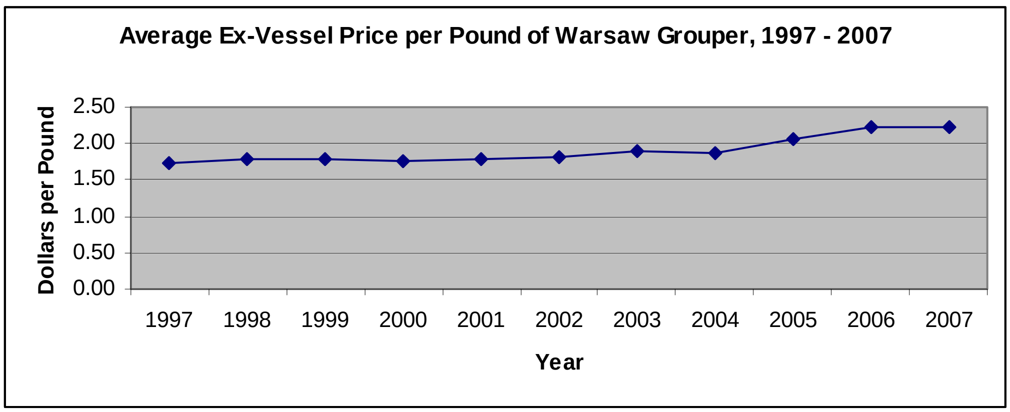

Figure 5.3.4.17.2. Average Ex-Vessel Price per Pound of Warsaw Grouper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

Annual Gulf coast commercial landings of Warsaw grouper represent on average 99.8 percent of annual national landings from 1997 through 2007. Within the Gulf, Louisiana's annual landings account for 42 percent of annual Gulf commercial landings, followed by Texas with landings that represent 32 percent of Gulf landings, Florida's west coast with 25 percent and Alabama with one percent.

For more information regarding the description of the Warsaw grouper fishery and related fishing communities, see the Environmental Impact Statement for Final Reef Fish Amendment 30B, which is available at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20Amendment%2030B%2010_10_08.pdf.

5.3.4.18 Yellowfin Grouper (*Mycteropera venenosa*)

Yellowfin grouper is found in the western Atlantic Ocean from Massachusetts to Brazil and Gulf of Mexico. Like Warsaw grouper, it is a deepwater grouper.

Yellowfin grouper is incidentally caught and is a minor commercial species. From 1997 to 2007, commercial landings averaged less than 10,000 pounds per year with a value of $21,693 (Figure 5.3.4.18.1). During the same period, the average ex-vessel price per pound rose from under $2 to over $3 (Figure 5.3.4.18.2).

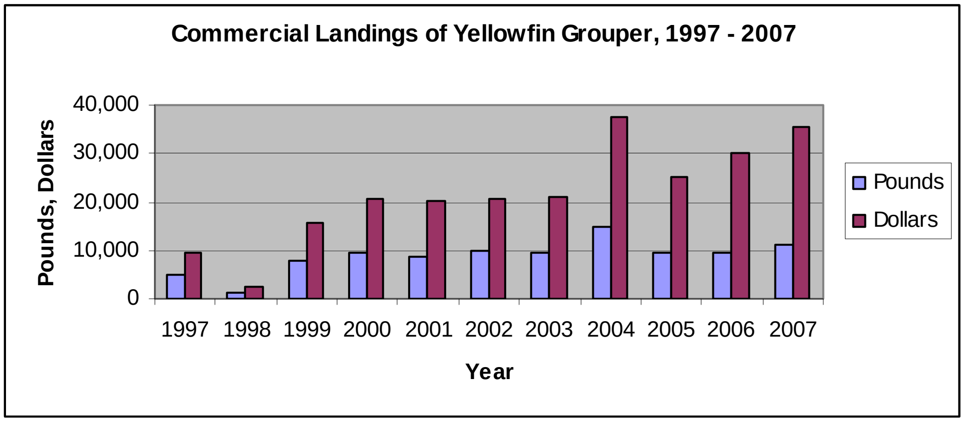

Figure 5.3.4.18.1. Commercial Landings of Yellowfin Grouper, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

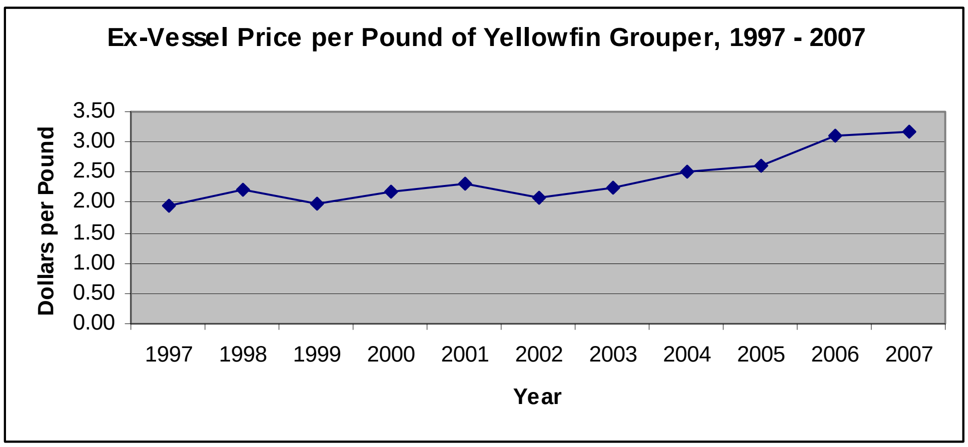

Figure 5.3.4.18.2. Average Ex-Vessel Price per Pound of Yellowfin Grouper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

For more information regarding the description of the yellowfin grouper fishery and related fishing communities, see the Environmental Impact Statement for Final Reef Fish Amendment 30B, which is available at http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20Amendment%2030B%2010_10_08.pdf.

5.3.4.19 King Mackerel (*Scomberomorus cavalla*) & Cero (*Scomberomorus regalis*)

King mackerel is found in the western Atlantic from Massachusetts to Brazil and into the Gulf of Mexico. This species prefer outer reefs and coastal waters. It is marketed fresh or frozen as fillets. Cero mackerel is found in the western Atlantic from Massachusetts to

Brazil and Gulf of Mexico. It is also known as cero. It is marked fresh, smoked and frozen. One is a substitute for the other.

In 1998, the first year of the king mackerel permit moratorium, there were 2,172 commercial permits[4]. That number has declined to 1,740 active permits in 2003. The number of vessels with federal permits for commercial fishing for king mackerel declined at an average annual rate of 4.5 percent from 1998 through 2003.

Commercial landings of king mackerel increased substantially from 1997 through 2007, both in weight and value (Figure 5.3.4.19.1). During this same time, the average ex-vessel price per pound also rose as dramatically (Figure 5.3.4.19.2).

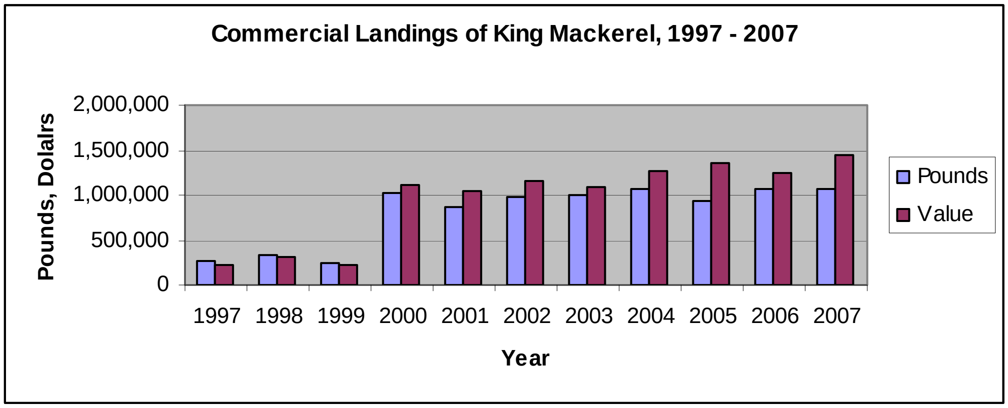

Figure 5.3.4.19.1. Commercial Landings of King Mackerel, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

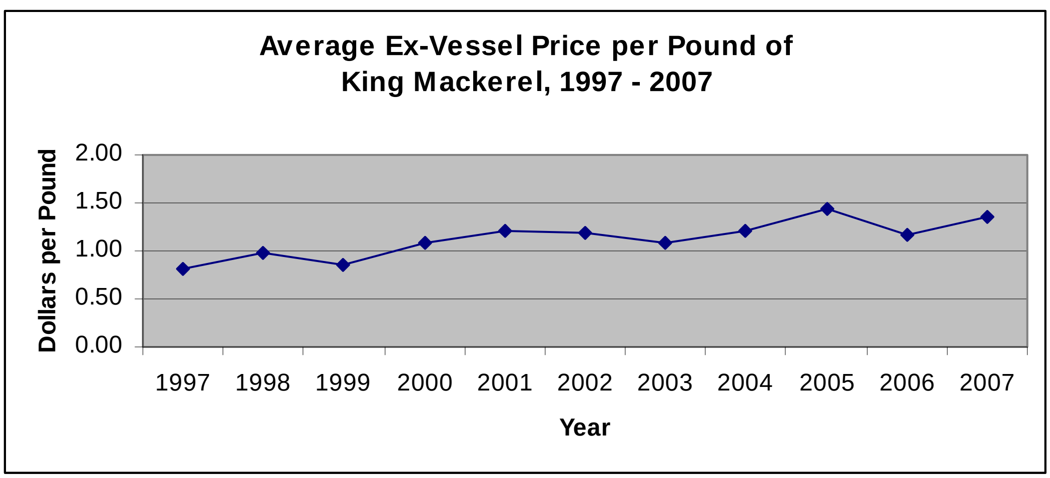

Figure 5.3.4.19.2. Average Ex-Vessel Price per Pound of King Mackerel Grouper, 1997 – 2007, not deflated. *Source:* NMFS, Accumulated Landings System.

4 Since the *CMP FMP* is a joint management plan between the Gulf and South Atlantic Fishery Management Councils, the number of permits referenced in this section refers to the total for the two areas.

Annual commercial landings of king and cero mackerel declined from 1997 to 2002 then slightly increased to 2007 (Figure 5.3.4.19.3).

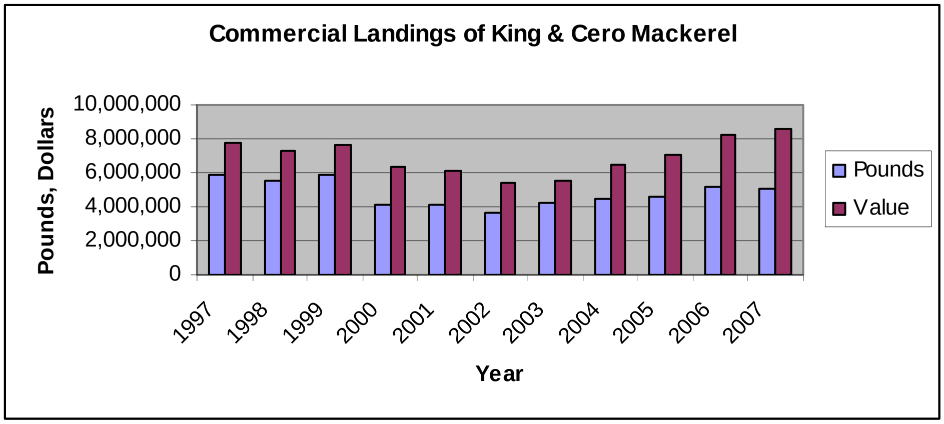

Figure 5.3.4.19.3. Commercial Landings of King & Cero Mackerel, 1997 – 2007. ***Source:*** **NMFS, Accumulated Landings System.**

Louisiana, North Carolina and Texas have the largest share of annual landings. Additional information regarding the description of the fishery and related fishing communities can be found in the Environmental Impact Statement for Final Amendment 15 to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico (January 19, 2005), which is available online at www.safmc.net/Portals/6/Library/FMP/Mackerel/MackAmend15.pdf.

Mackerel is the product of aquaculture in Korea and has been in Spain. Spain began production in 2002 but ceased its production after 2003. Korea began commercial production in 2005 with about 1.8 million with a value of $710,000 and increased it to about 4.1 million pounds with a value of $1.9 million in 2006 (FAO, FIGIS).

5.3.4.20 Spanish Mackerel (*Scomberomorus maculatus*)

Spanish mackerel occurs in the western Atlantic from Massachusetts to Brazil and in the Gulf of Mexico. It is marketed as fresh or frozen as fillets.

Commercial landings of Spanish mackerel showed a general increasing trend from 1997 to 2007, increasing from 3.8 million pounds in 1997 to 4.8 million pounds in 2007. During that same time, the price per pound rose from $0.54 to $0.80 (Figure 5.3.4.20.1).

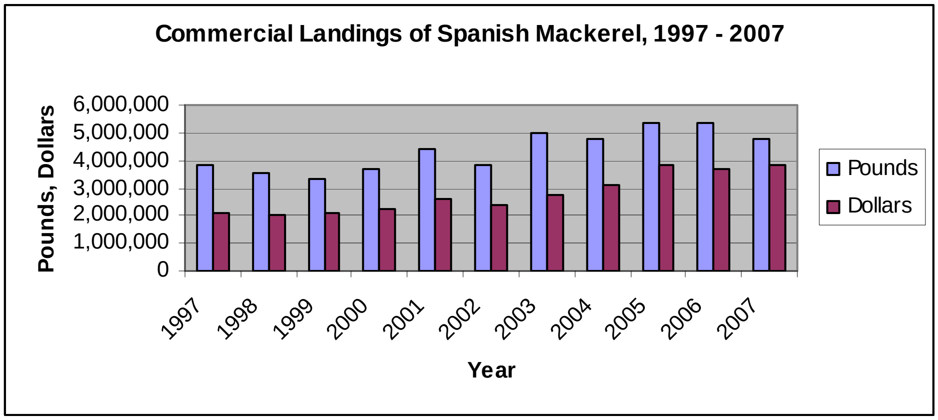

Figure 5.3.4.20.1. Commercial Landings of Spanish Mackerel, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Atlantic coast commercial landings dominate national commercial landings of Spanish mackerel, although Florida's west coast does make up a significant portion of national landings.

Additional information regarding the description of the fishery and related fishing communities can be found in the Environmental Impact Statement for Final Amendment 15 to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico (January 19, 2005), which is available online at www.safmc.net/Portals/6/Library/FMP/Mackerel/MackAmend15.pdf.

5.3.4.21 Little Tunny Tuna (*Euthynnus alletteratus*)

Little tunny tuna is found in the western Atlantic from Massachusetts to Brazil, Gulf of Mexico and Caribbean Sea. It also occurs in the Mediterranean Sea and Black Sea. It is also known as little tunny. Its flesh is darker and stronger tasting than other large tunas, and it is marketed fresh, dried, canned, smoked and frozen. Ciguatera poisoning has been reported from its consumption.

Annual commercial landings of little tunny from 1997 through 2007 averaged 781,155 pounds with an average value of $264,189. Three years during the period, commercial landings exceeded a million pounds, but otherwise have been under that value (Figure 5.3.4.21.1). The average ex-vessel price was $0.33 per pound.

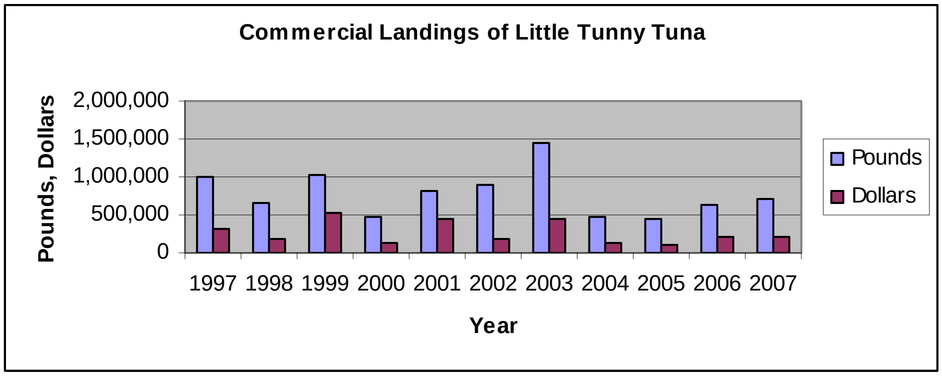

Figure 5.3.4.21.1. Commercial Landings of Little Tunny Tuna, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Additional information regarding the description of the fishery and related fishing communities can be found in the Environmental Impact Statement for Final Amendment 15 to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico (January 19, 2005), which is available online at www.safmc.net/Portals/6/Library/FMP/Mackerel/MackAmend15.pdf.

Tuna is the product of aquaculture in Libyan Arab Jamahiriya, Tunisia, Mexico, Cyprus, Oman, Turkey, Croatia, France, Greece, Italy, Portugal, Spain and Oceania. Atlantic bluefin tuna is grown in Africa, Asia and Europe. Pacific bluefin tuna is farmed in Mexico, and yellowfin tuna is grown in Mexico and Oman. Southern bluefin tuna is farmed in Oceania. Collectively these countries have produced over 32 million pounds in 2006 with a value over $163 million (Figure 5.3.4.21.2).

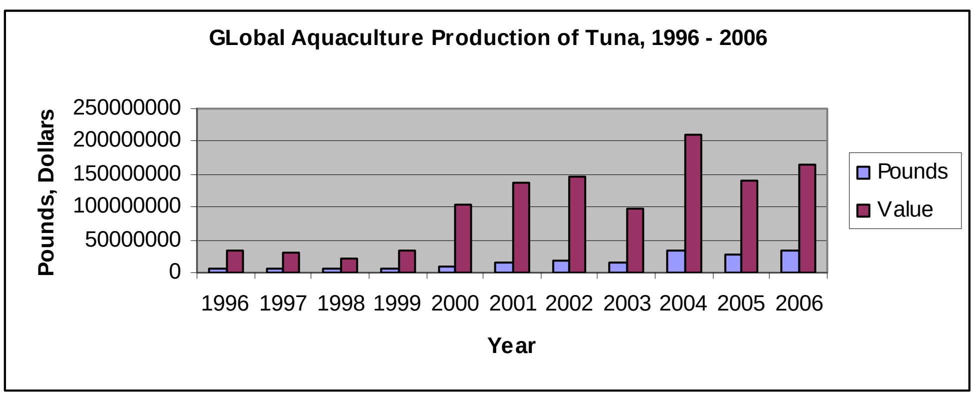

Figure 5.3.4.21.2. Global Aquaculture Production of Little Tunny Tuna, 1997 – 2007. *Source:* FAO, FIGIS.

5.3.4.22 Bluefish (*Pomatomus saltatrix*)

Bluefish is found in the western Atlantic from Nova Scotia to Florida and throughout the Gulf of Mexico. It is also found throughout the world. It travels in large schools, which makes it amenable to a directed fishery. Its meat is dark and oily, making it a less prized fish for consumption. Its substitutes are Spanish and king mackerel and mullet.

Commercial landings of bluefish have not significantly changed over the period from 1997 through 2007 (Figure 5.3.4.22.1).

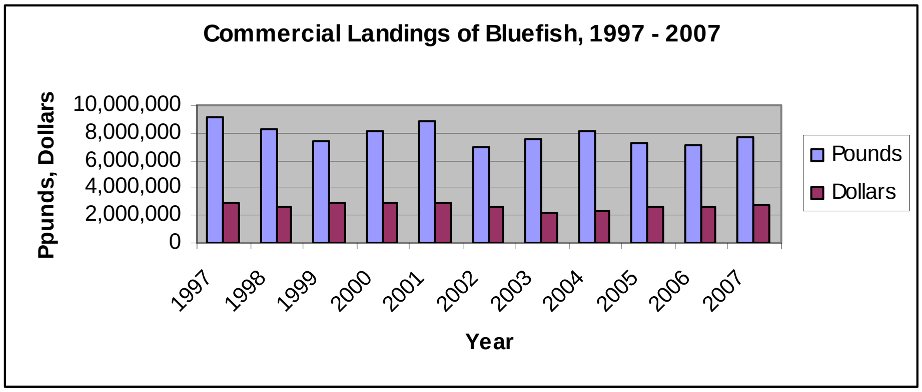

Figure 5.3.4.22.1. Commercial Landings of Bluefish, 1997 – 2007. *Source:* NMFS, Accumulated Landings System.

Gulf coast landings account for about 2 percent of annual bluefish landings, with 98 percent on the Atlantic coast. Additional information regarding the description of the fishery and related fishing communities can be found in the Environmental Impact Statement for Final Amendment 15 to the Fishery Management Plan for Coastal Migratory Pelagic Resources in the Atlantic and Gulf of Mexico (January 19, 2005), which is available online at www.safmc.net/Portals/6/Library/FMP/Mackerel/MackAmend15.pdf.

There are no reports of aquaculture of bluefish.

5.3.5 U.S. Seafood Trade Deficit

From 1998 through 2007, annual U.S. commercial landings ranged from about 9.2 billion to 9.7 billion pounds, averaging 9.4 billion pounds with a value of about $3.6 billion (Figure 5.3.5.1).

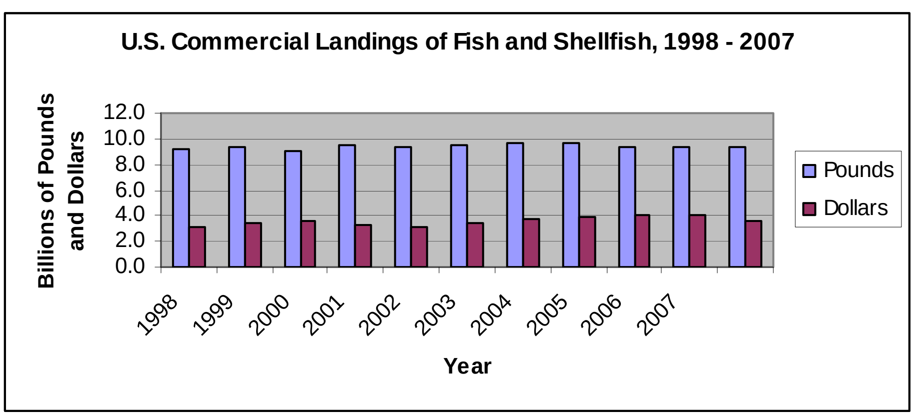

Figure 5.3.5.1. U.S. Commercial Landings of Fish and Shellfish, 1998 – 2007. *Source:* Fisheries of the United States.

U.S. commercial landings of fish and shellfish are used for human consumption, bait, animal consumption, and processed into meal, oil, solubles and shell products. During the above 10-year period, an average of about 79 percent of annual U.S. commercial landings was for human food.

A portion of these landings are exported. In 2006, almost 3 billion pounds of edible fishery products with a value of about $4.2 billion were exported and the year after about 2.9 billion pounds with a value of $4.3 billion. Similarly, in 2006, at least 0.41 million pounds of nonedible products were exported with a value of $13.4 million and the year after another 0.35 million pounds of nonedible products with a value of $15.7 million were exported. This illustrates that the bulk of U.S. exports, by pounds, are of edible seafood products.

The U.S. is a major importer of fishery products. From 1998 through 2007, the U.S. imported seafood products with an average annual value of $21.6 billion, of which about $10.9 billion of that average came from about 4.6 billion pounds of edible products. About 51 percent of annual U.S. imports of fishery products by value were edible during the above 10-year time period. In 2006, the U.S. imported 5.4 billion pounds of edible fishery products with a value of about $13.3 billion and the following year imported about 5.3 billion pounds of edible products with a value of about $13.7 billion.

Net exports is the difference between the value of products exported and the value of products imported, although the volume of products exported versus imported is also useful information. In 2006, the U.S. exported about $4.2 billion of edible fishery products and imported $13.3 billion of edible fishery products, which by volume are almost 3 billion pounds exported and 5.4 billion pounds imported. Because the value of exports is less than the value of imports for that year, there is said to be a seafood trade deficit of $9.1 billion. Similarly, in 2007, the U.S. imported more edible fishery products than it exported and there was a seafood trade deficit of $9.4 billion (Figure 5.3.5.2). In 2007, while 2.9 billion pounds of edible fishery products were exported, another 5.3 billion pounds were imported, a difference of 2.4 billion pounds.

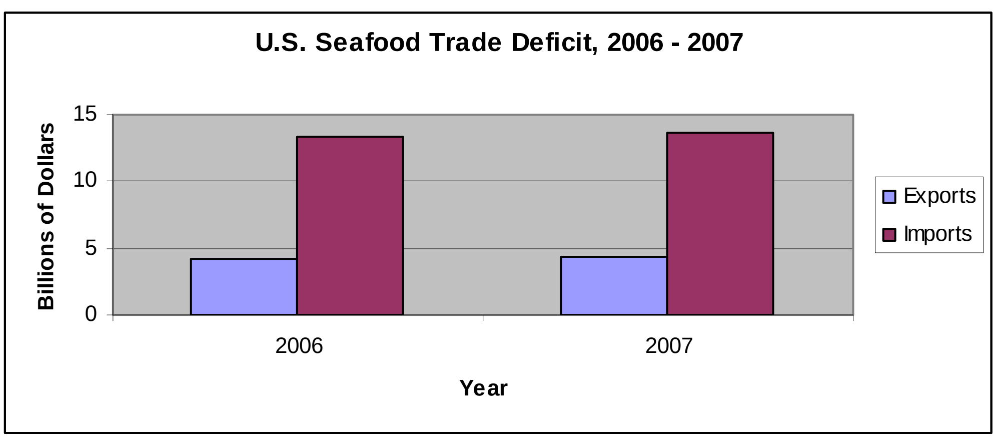

Figure 5.3.5.2. U.S. Seafood Trade Deficit, 2006 and 2007. ***Source:*** **Fisheries of the United States.**

5.3.6 Characteristics and Economic Feasibility of Operations that May Operate in the Gulf of Mexico

The following description of potential offshore aquaculture operations is largely based on NOAA Aquaculture Program (2008), Forster (1996), Hoagland et al. (2004), and Posadas and Bridger (2004). Because an aquaculture fishery currently does not exist, any description of a fishery is speculative. The intent of this section is to describe potential operations based on current examples of offshore aquaculture under the proposed regulatory framework in this FMP.

This FMP proposes to allow the culture of Council managed finfishes, spiny lobster, and stone crabs. No sessile invertebrates are proposed for culture. Therefore, aquaculture operations in the Gulf are all expected to use net pens, cages, or other enclosed structures for grow-out of allowable species. Cages and net pens vary widely in size and volume. SeaStation™ cages, which are manufactured by Ocean Spar Technologies, Inc, in Seattle, Washington, may be used in the Gulf and currently range in size from 600 to 6,000 m^3. These cages are diamond shaped, may be submerged or float at the surface, and have been successfully used to culture finfish off Puerto Rico, Hawaii, and New Hampshire. Posadas and Bridger (2004) estimated that an operation would operate 6 to 12 3,000 m^3 cages; although the number and size of cages will vary depending on the maximum production capacity of the operation (no individual, corporation, or other entity can produce more than 20 percent of OY, which is equivalent to 12.8 million pounds). An operation using six 3,000 m^3 cages could produce 400 to 800 thousand pounds of fish annually, depending on productivity levels (22 to 44 pounds/m^3), whereas an operation using twelve 6,000 m^3 cages could produce 1.6 to 3.2 million pounds annually (Table 4.9.1). Other cages that could be proposed for use by offshore aquaculture operations include, but are not limited to the Aquapod™ developed by Ocean Farm Technologies Inc., Bridgestone sea cages, and various floating net pens/cages. Appendix F provides illustrations of various cages that may be used for offshore aquaculture. For more information about some of these cage types visit the following websites:

SeaStation – www.oceanspar.com
Aquapod – www.oceanfarmtech.com
UNH Open Ocean Aquaculture Project – http://ooa.unh.edu/finfish/finfish_cages.html

To ensure proper clearance between cages and the seafloor, operations are expected to be located at depths of 25 m or greater. However, the location of a facility will depend on siting considerations summarized in Action 6. In order to reduce operating costs related to vessel transit and transport, operations will likely seek areas near major ports that are relatively close to shore. It is expected that operations will likely develop in the central and western Gulf due to more immediate access to deeper water (i.e., the shelf in the eastern Gulf is broad and distances are much longer to get to water deep enough for aquaculture operations), access to oil and gas platforms, and numerous fishing ports. The MMS recently proposed regulations that would allow alternative uses for oil and gas platforms, such as aquaculture.

Costs and returns from offshore finfish cage culture operations were estimated by two authors contributing to the NOAA edited offshore economics study including a generic model by Knapp (2008a) and models of cod and salmon farming by Jin (2008) based on information from the University of New Hampshire cod project and existing salmon farming operations. Others have also estimated prepared production and cost models for offshore aquaculture including Jin et al. (2005), Kam et al. (2003), Lipton and Kim (2007), Forster (1996), Posadas (2004); and Ryan (2004). All of these studies concluded that offshore finfish aquaculture could be economically feasible under certain production, cost, and revenue assumptions based on technology now in use in New Hampshire, Hawaii, Puerto Rico, and in Europe.

Posadas and Bridger (2004), for example, estimated initial start up costs for a six-cage operation would be 2.89 million dollars. The initial fixed investment included $330,000 for onshore support facilities, such as trucks, fish transport vehicles, buildings, and land. Cages and net cleaners were estimated to cost $960,000 and aquaculture service vessels were estimated to cost $1.6 million dollars. Posadas and Bridger (2004) presumed operations would rely on an aquaculture support vessel, which would serve as a mobile offshore support structure for operations. Initial investment costs as estimated by Posadas and Bridger (2004) could be greatly reduced if operations instead use oil and gas platforms as support structures for their operation and rely on hatcheries owned by other companies. Both offshore oil and gas platforms and aquaculture support vessels could serve as quarters for crew and storage for feed and supplies. Transport vessels will be necessary to transport fingerlings to offshore facilities for stocking, as well as transporting cultured organisms to port after harvest. Action 1 would also allow permittees to develop hatcheries offshore, although operations during start up are likely to rely on onshore hatchery facilities.

Total annual variable and fixed costs for a six-cage operation were estimated to be $2.3 million dollars (Posadas and Bridger 2004). Variable costs were estimated to be $1.4 million dollars, while fixed costs were estimated to be $0.9 million dollars. Major variable costs included: fuel and oil, repair and maintenance, fingerlings, feed, labor, insurance, and supply boats. Major fixed costs included: depreciation, farm management, interest, and insurance on stocks and equipment.

Formulated feed will be used to culture fish and invertebrates in pens. Feeds will be made from fishmeal and oil, and vegetable-based fats, proteins, and carbohydrates. Soybeans and other food sources could also be used for feed and are currently being researched as a potential substitute for feeds made of fishmeal and fish oil. Feeding will most likely be conducted using automatic feeders. Juvenile fish may be kept in smaller nursery pens either within or separate from cages used to culture larger, sub-adult fish. Once the smaller, juvenile fish grow large enough they will be released into the grow-out cages. The length of time for grow-out will vary by species, time of stocking, and the location of the operation. Once fish are ready for market, fish will be corralled and removed for transport to the dealer. Fish must be sold at a permitted dealer located in the U.S.

5.4 Description of the Economic and Social Environment - Wild Stocks

5.4.1 Commercial Fishery

The annual dockside value of the Gulf commercial production has fluctuated between $600 and $800 million, though occasionally it has reached $900 million. Product comes from both state and federal waters and includes both product for human consumption (e.g., reef fish and shrimp) and industrial use (e.g., menhaden). The most valuable commercially harvested species is shrimp, generally accounting for well in excess of one-half of the total. Other commercially important species (groups) include stone crab, blue crab, oysters, spiny lobsters, reef fish, coastal pelagics, and menhaden.

Many species (families) are managed under the auspices of the GMFMC. Management of other species is under the purview of each of the respective Gulf states. This section of the FMP briefly provides a description of the economic and social environment of some of the more economically relevant species.

In total, there are seven GMFMC plans. They are: (1) The *Red Drum Fishery Management Plan* (RDFMP) which was implemented in December 1986, (2) The *Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico*, which was approved in June 1983, (3) The *Fishery Management Plan for Coastal Migratory Pelagic Fisheries* (*CMP FMP*), which was prepared cooperatively by the Gulf and South Atlantic Councils, was implemented in February 1983, (4) The *Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters,* which was implemented in 1981, (5) The *Fishery Management Plan for the Stone Crab Fishery of the Gulf of Mexico (SCFMP)*, originally developed in response to competing gear use between stone crab and shrimp fishermen, was implemented in 1979, (6) The *Spiny Lobster Fishery Management Plan for the Gulf and South Atlantic (SLFMP)*, which was implemented in July 1982, and (7) The *Fishery Management Plan for Corals and Coral Reefs (CCRFMP)* was submitted for Secretarial approval in April 1982 and was implemented in 1984. The GMFMC is proposing to amend five of these plans through this FMP. Fishery management plans for coral and shrimp are not being amended, because regulations already exist for live rock and it is impractical that shrimp will be cultured offshore given the success of existing onshore aquaculture facilities.

In 2007, there were a total of 945 federal reef fish permits and 1,514 coastal migratory pelagic permits (Table 5.3.1.1). Other commercial fisheries currently permitted include: shrimp, red snapper, shark, spiny lobster, and swordfish. There are also permits required for charter and other recreational for-hire vessels in the reef fish and coastal pelagic fishery.

Given that the majority of offshore production, at least in the near future, will likely be finfish species, with cobia, red drum, and snapper species being prime candidates, the analysis focuses primarily on management plans associated with these species. However, some attention is also devoted to species in the remaining two management plans.

A full description of all fisheries associated with the GMFMC FMPs is provided in detail in the EIS for the Generic Essential Fish Habitat Amendment (GMFMC 2004), while

Section 5.4.3 describes Gulf fishing communities. Much of the language used in the description of the fisheries was taken from previous Council plan amendments.

Table 5.3.1-1. Federal Permit Type as of October 2007 (NOAA Fisheries Service)

Type of Permit	Number
Shrimp	1848
Commercial Migratory Pelagic	1514
Reef Fish	945
Red Snapper	612
Commercial Spiny Lobster (non-Florida/tailing)	132/299
Charter/Headboat for Coastal Pelagics	1348
Charter/Headboat for Reef Fish	1356
Swordfish (directed/incidental/handgear)	180/80/82
Shark (directed/incidental)	132/283

5.4.1.1 Red Drum

The RDFMP, when implemented in December, 1986, prohibited the directed commercial harvest from the EEZ for 1987 but did provide for an incidental catch allowance for commercial net and shrimp fishermen. The Council prepared Amendment 1 to the RDFMP which was implemented in October, 1987. The amendment continued the prohibition of a directed commercial EEZ fishery. Since implementation of Amendment 2 in 1988, retention and possession of red drum from the EEZ has been prohibited.

While the commercial harvest of red drum in the EEZ is prohibited, only Mississippi allows commercial harvests from state waters. Since 2000, production from state waters has averaged 25,000 pounds annually with an associated dockside value of about $35,000. The states of Texas and Florida stock red drum fingerlings and fry into their coastal waters from their hatcheries in stock restoration projects. Red drum is a good candidate for offshore aquaculture because of their rapid growth rate and existing production in land-based U.S. hatcheries.

5.4.1.2 Reef Fish

5.4.1.2.1 Permits and Landings

The Reef Fish FMP for the Gulf was established in November 1984 to help rebuild declining reef fish stocks. In 1990, Amendment 1, to the Reef Fish FMP, established a commercial reef fish permit. Anyone wishing to harvest any reef fish as part of the commercial fishery or possess more than a bag limit was required to hold a valid reef fish permit for their vessel (50 CFR 622.4(a)(2)(v)). Amendment 4 was implemented in 1992 and created a three-year moratorium on the issuance of new commercial reef fish permits. Amendment 9 extended the moratorium until December 31, 1995. Amendment 11 further extended the moratorium until December 31, 2000. Amendment 17 extended the commercial reef fish permit moratorium for another 5 years, through December 31, 2005. Amendment 24, implemented in August, 2005, established a permanent limited access system. Of particular relevance, the recently implemented Amendment 26 established an IFQ program for the red snapper fishery.

Reef fish permits are required to commercially harvest reef fish species. Reef fish that are harvested may only be sold to buyers holding a valid permit to purchase reef fish. The holders of the harvesting permits define the universe of vessels that may legally harvest reef fish to be sold commercially.

The number of commercial reef fish permits has declined due to non-renewal of permits from approximately 2,200 in 1992 to approximately 1,145 as of July 2004 (GMFMC 2004). Permit data indicate that 908 of those permits were assigned to vessels that were only permitted to fish reef fish commercially. The remaining 237 permits were assigned to vessels that can fish reef fish as commercial vessels or as charter vessels or headboats.

The state of residence of each of the permit holders and the number of permits held are presented in Table 5.4.1.2.1.1. Information in that table shows that 933 of the permits owners (81.5 percent) list Florida as owner's address. Texas is listed as the owner's state on 80 permits (7 percent). Louisiana is listed as the owner's state on 61 (5.3 percent) permits, Alabama on 37 (3.2 percent) permits, Mississippi on 16 (1.4 percent) permits, and the other states account for the 18 (1.6 percent) remaining permits.

Reef fish commercial fishermen that may be directly impacted by successful offshore aquaculture of reef fish species are those approximately 1,056 individuals that currently hold a commercial reef fish permit. Other fishermen could be indirectly impacted if (a) reef fish fishermen change their seasonal fishing patterns and increase effort for other species or (b) there is strong cross-price flexibility between reef fish and other harvested species in the Gulf.

Gulf-wide average commercial harvests and ex-vessel values by species group are presented in Table 5.4.1.2.1-2. Averages were computed for the 1995-2003 period. Landings are expressed in pounds whole weight. Data were obtained from the NOAA Fisheries Service web site maintained by the Fisheries Statistics and Economics Division. Shallow water groupers and snappers constituted more than 85 percent of the commercial landings for the period considered. Total yearly reef fish ex-vessel values were, on average, in excess of $40 million.

Data for the 9-year period discussed in this section indicated that, red, vermilion and yellowtail snappers, gag and red groupers and, greater amberjack accounted for most of the commercial reef fish landings. Together, these species represented 85 percent of total reef fish landings. Gulf-wide average commercial landings by reef fish species, ex-vessel values, nominal and real prices are presented in Table 5.4.1.2.1.3. Red grouper, the species with the largest average yearly landings, accounted for 30 percent of the Gulf reef fish landings. Red snapper and gag, which are second and third in poundage landed, accounted for 22 percent and 12 percent of the landings, respectively.

Table 5.4.1.2.1.1: Number of Commercial Reef Fish Permits for the Gulf of Mexico by Owner's State of Residence

Owners' State	Commercial Permit Only	Commercial and Charter/Headboat Permits	Total
FL	736	197	933
TX	57	23	80
LA	55	6	61
AL	29	8	37
MS	16		16
DE	1		1
GA	3	1	4
IN	1		1
MA	1		1
MD		1	1
MO	1		1
NJ	2		2
NY	3		3
OH	1		1
SC	1		1
TN	1	1	2
Total	**908**	**237**	**1,145**

Source: NOAA Fisheries Service Reef Fish Permit Database, July 2004.

Table 5.4.1.2.1.2: Gulf-wide Average Commercial Landings and Ex-Vessel Values by Species Group (1995-2003)

SPECIES GROUP	LANDINGS		VALUE	
	(lbs)	(%)	($)	(%)
Shallow Water Groupers	9,223,362	44.94	18,724,722	46.61
Snappers	8,694,078	42.36	17,088,708	42.54
Deep Water Groupers	1,401,087	6.83	3,103,882	7.73
Amberjack & Other Reef Fish	1,205,672	5.87	1,258,074	3.13
TOTAL	20,524,199	100.00	40,175,386	100.00

Source: NOAA Fisheries Service Fishery Statistics (http://www.st.nmfs.gov/st1/index.html).

The vast majority of the harvest of several reef fish species was from the Florida west coast. For example, over 99 percent of the red grouper, 96 percent of the black grouper, and 80.5 percent of the scamp harvested were attributed to the Florida west coast according to data from the NOAA web site. On average, red snapper was the most expensive species in the snapper complex. Nominal and real red snapper prices were $2.06 and $2.14 per pound, respectively. At $2.48 per pound, the highest reef fish average real price was for scamp. The average real price for red grouper, the species with the highest average harvest, was $1.93 per pound.

5.4.1.2.2 Vessel Characteristics

In terms of 2001-03 annual averages from logbook-reported data, 1,050 vessels landed 19.2 MP gutted weight (GW) of Gulf reef fish with a real ex-vessel value of $44.6 million. Median reef fish landings were 5,705 pounds per vessel. The median vessel was 37 feet long, derived 98 percent of its gross revenues from reef fish harvests, had 275 to 300 horsepower engines, took 12 trips per year, and spent about 31 days at sea annually.

Averages computed for vessels using longlines indicated that 166 longliners harvested 6.5 MP GW of reef fish and had gross revenues estimated at $15.5 million. The median vessel length for this fleet was 43 to 45 feet, had 3-person crews (including the captain) and 228 to 240 horsepower engines, and spent between 113 to 121 days at sea annually. Median longline vessels took 14 trips per year. The annual gross revenue per vessel for all reef fish landed was between $96,000 and $102,000.

An average of 899 vessels using handlines took 15,613 trips a year and spent 43,463 days at sea annually. The average annual reef fish harvest of the handline fleet was 11.6 mp GW. The median handline vessel was 35 to 36 feet long, had 280 to 300 horsepower engines, had 2 person crews, and spent 33 to 35 days away from port. Gross revenues were between $12,000 and $13,000 per vessel.

Waters (2002) provided participation rates by gear and state and reported that of the vessels with commercial reef fish permits, 782 vessels in Florida and 207 in other Gulf States indicated they landed reef fish using vertical lines in 2000. For the longline sector, 155 vessels in Florida and 33 in other Gulf States indicated landing reef fish using this gear in 2000. An additional 55 vessels, all of which are in Florida, reported landing reef fish using fish traps.

Table 5.4.1.2.1.3: Gulf-wide Average Commercial Landings, Values, and Ex-Vessel Prices by Species (1995-2003).

Snappers	Landings (lbs)	Nominal Value($)	Price ($/lb) Nominal	Real
Red Snapper	4,491,230	9,258,348	2.06	2.14
Vermilion Snapper	1,916,805	3,517,124	1.83	1.91
Yellowtail Snapper	1,458,229	2,880,761	1.98	2.05
Gray Snapper	364,122	617,822	1.70	1.76
Mutton Snapper	205,909	359,718	1.75	1.81
Silk Snapper	110,769	226,429	2.04	2.12
Other	147,013	228,505	1.55	1.61
Total	8,694,078	17,088,708	---	---
Deep Water Groupers				
Yellowedge Grouper	933,542	2,206,240	2.36	2.46
Snowy Grouper	195,850	392,642	2.00	2.08
Warsaw Grouper	139,754	248,610	1.78	1.85
Other	131,942	256,390	1.94	2.02
Total	1,401,087	3,103,882	---	---
Shallow Water Groupers				
Red Grouper	6,129,500	11,409,603	1.86	1.93
Gag	2,416,492	5,751,162	2.38	2.47
Black Grouper	359,879	814,534	2.26	2.35
Scamp	301,630	720,169	2.39	2.48
Other	15,861	29,254	1.84	1.92
Total	9,223,362	18,724,722	---	---
Other Reef Fish				
Greater Amberjack	1,025,994	1,037,913	1.01	1.05
Other	179,678	220,161	1.23	1.27
Total	1,205,672	1,258,074	---	---

Waters (1996) reported results from a survey of the Gulf commercial reef fish fishery that divided the vessels into high volume and low volume depending on whether or not they landed enough pounds to be in the top 75 percent of all vessels with a particular gear type in the fishery. The survey included vessels that reported using multiple types of gear. "Fishermen that primarily used fish traps for reef fishes tended to cite the use of fish traps, stone crab traps, rods and reels and gill nets, among others. Respondents with vertical hooks and lines in the eastern Gulf used bandit reels, electric reels and rods and reels. Respondents that primarily used bottom longlines for reef fishes also tended to cite experience with vertical hook and line gear" (Waters 1996). The survey asked vessel owners to report on their two most important kinds of trips for reef fish, even if non-reef fish alternative contributed more to the annual revenues of the boat. Comparisons were drawn between high volume and low volume boats within each category and between those in the northern Gulf and the eastern Gulf.

In the northern Gulf, catches differed by gear with vessels using vertical lines catching primarily snapper (red and vermilion) and vessels using bottom longlines catching primarily yellowedge grouper. Vessels in the eastern Gulf primarily caught groupers using bottom longlines, vertical lines, and fish traps. The vessels with vertical lines in the northern Gulf were longer on average (50 feet) than those in the eastern Gulf (38 feet). Longline vessels averaged about 42-44 feet in length and vessels using fish traps averaged about 38 feet. The average horsepower across all gear types was about 280 hp, the lowest with the longline vessels and the highest with vessels using fish traps. High volume longline vessels had the highest fuel capacity out of a range of 32-6,000 gallons. The average fuel capacity was 689 gallons.

Survey respondents reported having lived an average of 25 years in their current county or parish of residence; the overall average age of respondents was about 47 years with the mode at the 40-49 age group; 141 (72 percent) graduated from high school or had more than 12 years of formal education (Waters 1996). Household size ranged from 1-9 persons with an average of 3 persons. Household incomes ranged from less than $10,000 to more than $150,000 with approximately 50 percent of the respondents citing household incomes of $30,000 or less. Respondents averaged approximately 44 percent of household income from commercial fishing for reef fishes, 21 percent from other types of commercial fishing and 35 percent from all other sources including incomes earned in non-fishing jobs held by other household members, pensions, investments and other sources. The respondents had an average of 19 years experience at fishing, with 13.6 years of that experience in the positions they held at the time of the survey. Only 5 of the 196 respondents reported seasonal employment in other jobs. Typically, respondents from high volume vessels earned between 69-75 percent of household income from commercial fishing while respondents from low volume vessels earned 25-39 percent of household income from commercial fishing, except for bottom longlining vessels (Waters 1996).

Waters (1996) also reported annual gross receipts per vessel in the reef fish fishery, as summarized by the following information:

High-volume vessels using vertical lines:	
Northern Gulf:	$110,070
Eastern Gulf:	$ 67,979
Low-volume vessels using vertical lines:	
Northern Gulf:	$ 24,095
Eastern Gulf:	$ 24,588
High-volume vessels using bottom longlines:	
Both areas:	$116,989
Low-volume vessels using bottom longlines:	
Both areas:	$ 87,635
High-volume vessels using fish traps:	$ 93,426
Low-volume vessels using fish traps:	$ 86,039

When combined with cost information, these figures translate into the following results for net income (defined as gross receipts less routine trip costs; the numbers in parenthesis represent the percent to gross receipts) (Waters 1996):

High-volume vessels using vertical lines:		
Northern Gulf:	$28,466	(26)
Eastern Gulf:	$23,822	(35)
Low-volume vessels using vertical lines:		
Northern Gulf:	$ 6,801	(28)
Eastern Gulf:	$ 4,479	(18)
High-volume vessels using bottom longlines:		
Both areas:	$25,452	(22)
Low-volume vessels using bottom longlines:		
Both areas:	$14,978	(17)
High-volume vessels using fish traps:	$19,409	(21)
Low-volume vessels using fish traps:	$21,025	(24)

5.4.1.2.3 Dealers and Processors

Approximately 227 dealers possess permits to buy and sell reef fish species (NOAA Fisheries Service 2004). Based on mail address data, most of these were located in Florida (146), with 29 in Louisiana, 18 in Texas, 14 in Alabama, 5 in Mississippi and 15 out of the Gulf States region. More than half of all reef fish dealers are involved in buying and selling grouper. These dealers may hold multiple types of permits.

Average employment information per reef fish dealer is not known. Although dealers and processors are not synonymous entities, Keithly and Martin (1997) reported total employment for reef fish processors in the Southeast at approximately 700 individuals, both part and full time. It is assumed that all processors must be dealers, yet a dealer need not be a processor. Further, processing is a much more labor-intensive exercise than dealing. The profit profile for dealers or processors is not known.

Based on the NOAA Fisheries Service annual processor survey, 29 firms were engaged in the processing of snapper and/or grouper in the Gulf in 1996. Reported production of snapper and grouper by these 29 firms totaled 2.30 million pounds valued at $12.3 million. In 2005, the number of reported processors equaled 21 and output of processed grouper and snapper product totaled 1.5 million pounds. These numbers would indicate that only a small portion of the harvested reef fish product is processed (at least in the Gulf).

5.4.1.2.4 Imports

During the 15-year period ending in 2005, Gulf commercial snapper landings (all species combined) ranged from 7.1 million pounds (1991) to 9.4 million pounds (1997) and averaged 8.6 million pounds annually. Imports of fresh snapper products during this period increased from 10.8 million pounds to 27.5 million pounds and averaged more than 20 million pounds annually. Imports of frozen snapper products ranged from about 1.5 million pounds to three million pounds prior to 2000 but have since increased to 12.7 million pounds in 2005. Hence, as indicated, domestic production is but a fraction of total imports of a similar product.

Since 1991, the dockside price of the domestic product has consistently exceeded the price of the imported fresh product by $0.25 to $0.50 per pound with no trend of an increasing or decreasing differential. On a deflated basis, the price differential has ranged from about $0.16 per pound to $0.37 per pound and with no distinguishable trend.

The observed price differential between the domestic and imported fresh snapper product can be the result of any number of factors. First, the mix of snapper species constituting the domestic product may vary from that of the imported product. Second, the seasonality of the domestic product compared to the imported product may account for some of the price differential. Third, the domestic product may simply be of higher quality. If the issue is one of quality, then one is led to conclude that the imported product does not represent a perfect substitute for the domestic product. However, if the price differential reflects seasonality or a different product mix, then one cannot rule out that the imported product is a perfect substitute for the domestic product.

Like fresh snapper, fresh grouper imports are also large, equaling 8.4 million pounds in 2005. Unlike fresh snapper; however, imports of fresh grouper have not risen steadily during the 15-year period ending in 2005. Rather, they trended upwards during the early-to-mid 1990’s before reaching a maximum of about 13 million pounds in 1998. After declining in subsequent years, they once again increased to the noted 2005 level. Imports of frozen grouper are relatively minor, averaging less than one-million pounds annually in recent years.

As indicated in Table 5.4.1.2.1.2, Gulf commercial grouper landings (shallow water and deep water, combined) have averaged about 10.6 million pounds annually during the nine-year period ending in 2003. This is about 15 percent above imports of the fresh product during the same period. While the price of the domestic grouper product exceeded the price of the comparable imported product by a sizeable amount in earlier years, the price differential has tended to narrow over time and there is currently little price differential between the two products.

5.4.1.3 Coastal Migratory Pelagics

Managed species under the CMP FMP include king mackerel, Spanish mackerel, and cobia. The FMP treated king and Spanish mackerel as unit stocks in the Atlantic and Gulf. The FMP established allocations for the recreational and commercial sectors harvesting these stocks, and the commercial allocations were divided between net and hook-and-line fishermen.

Since its implementation, the CMP FMP has been amended numerous times and there have been some changes (additions) to identified problems as well as objectives. Two of the more relevant objectives added (Amendment 5 and Amendment 6 to the CMP FMP) (GMFMC 1990, 1992) include (1) to minimize waste and bycatch in the fishery and (2) to optimize the social and economic benefits of the coastal migratory pelagic fishery. The rationale for this last objective was to provide a goal to enhance economic benefits to all groups.

While detailed analyses of the amendments are beyond the scope of this document, there are a number of salient features addressed in these amendments that merit some attention. First, many of the amendments were enacted in response to allocation and/or gear issues. For example, Amendment 2 prohibited the use of purse seines on overfished stocks. Amendment 3, which was approved in 1990, prohibited drift gill nets for coastal pelagics and purse seines for the overfished groups of mackerels. Amendment 5 further refined gear usage by requiring that the Gulf migratory group of king mackerel could only be taken by hook-and-line or with run-around gill nets. In addition, and of particular relevance to this amendment, actions taken in Amendment 5 limited cobia take to two per day per fisherman. As such, commercial harvests of cobia, as presented in a subsequent section, tend to be relatively minor.

Though direct control of effort was not seriously considered when the CMP FMP was first developed, more attention has been given to this issue over time. While the permit process was established under Amendment 1 to the CMP FMP, income requirements were relatively lax; proof that a minimum of ten percent of earned income was derived from commercial fishing activities. The somewhat unrestrictive criteria established under Amendment 1 would suggest that it had only a minor impact on restricting effort. The prohibition of purse seines on overfished stocks (Amendment 2) was an additional attempt to limit commercial effort though, as noted, the action was treated primarily as an allocation issue. Furthermore, the action only limited effort in one small segment of the commercial fishing sector. The first all-inclusive attempt to restrict effort in the commercial sector can be traced to Amendment 8. As noted in Amendment 8, available effort exceeded that needed to optimally harvest available TAC.

In response to the excessive and expanding level of effort, Amendment 8 established a moratorium on all commercial king mackerel permits until no later than October 15, 2000, with a qualification date for initial participation of October 16,1995. The purpose of this moratorium was to provide stability and prevent speculative entry into the fishery while the Councils developed a limited access or limited entry program. The amendment was also intended to reduce overfishing of the Gulf group king mackerel and aid in the recovery of the stock. More recently, Amendment 15 created a permanent limited access program in the fishery.

5.4.1.3.1 Permits and Landings

As noted, three species – king mackerel, Spanish mackerel, and cobia- are included in the *CMP FMP*. No permit is required to harvest cobia. In 1998, the first year of the king mackerel permit moratorium, there were 2,172 commercial permits[5]. That number has declined to 1,740 active permits in 2003. The number of vessels with federal permits for commercial fishing for king mackerel declined at an average annual rate of 4.5 percent from 1998 through 2003.

Since 1995, Gulf commercial landings of king mackerel have averaged 2.3 million pounds annually. The dockside value of this production has averaged $1.06 per pound. Examined on a deflated basis, the dockside price of king mackerel has gradually been declining over the past decade. In 1995, for example, the deflated price averaged $0.66 per pound. By 2005, it had fallen to $0.53 per pound (1982-84 Consumer Price Index).

Ex-vessel prices of king mackerel, the U.S. market, and estimated imports of king mackerel and possible substitute species have been described and analyzed using econometric models (Easley et al. 1993; Vondruska and Antozzi 1999; Vondruska 1999). The model results indicate that demand for king mackerel is relatively price elastic for the U.S. market as a whole. That is, compared with any given percentage change in market supply, the expected percentage change in ex-vessel price is much smaller, holding other factors constant.

Gulf commercial landings of Spanish mackerel have averaged approximately one-million pounds per year since 1995 with an associated dockside value of approximately one-half million dollars. Overall, commercial landings of Spanish mackerel have fallen sharply since the mid-1990s due to, at least in part, the "Florida net ban" (as it is commonly referred to) that went into effect on July 1, 1995. Nets conducive to the harvesting of Spanish mackerel were prohibited at this point in time.

As noted, Amendment 5 to the CMP FMP limited the harvest of cobia to two per fishermen per day. Hence, Gulf commercial harvests of this species are relatively minor. Average annual landings during 1995-04 have averaged 175 thousand pounds annually. Since 2000, landings have averaged about 130 thousand pounds annually. Dockside value since 2000 has averaged approximately $260 thousand indicating an average price per pound of approximately $2.00.

5 Since the *CMP FMP* is a joint management plan between the Gulf and South Atlantic Fishery Management Councils, the number of permits referenced in this section refers to the total for the two areas.

5.4.1.3.2 Vessel Characteristics

As noted, the number of vessels that had active federal permits to fish commercially for king mackerel declined by 20 percent from 2,172 in 1998 to 1,740 in 2003 (data for July 15 of each year).[6] Only about half of these permitted vessels had logbook-reported nominal landings of king mackerel (at least one pound of harvest) in each respective year, varying from 1,066 vessels in 1998 to 951 vessels in 2003. The 951 vessels in 2003 harvested approximately 4.5 million pounds of king mackerel (from the Gulf and South Atlantic), valued at $6.19 million in gross revenues, and received $9.57 million in gross revenues from sales of all logbook reported landings on the trips that harvested king mackerel.

The median harvest per vessel for vessels with active permits and nominal landings of king mackerel ranged from 941 to 1,324 pounds of king mackerel per vessel per year during 1998 through 2003. It should be noted that these amounts are annual medians (50^{th} percentiles) and not averages; e.g., in 1998, half of the 1,066 vessels landed between 1 pound and 941 pounds, while the other half landed more than 941 pounds. Medians are used for comparison rather than averages since vessel performance is not normally distributed. At the lower end of the annual frequency distributions of vessels respecting pounds landed, 25 percent of the vessels landed only 144 to 238 pounds or less per year (25^{th} percentiles), or roughly 14 to 24 individual fish per year assuming an average of 10 pounds each per fish. The 25 percent of vessels at the upper end of the annual frequency distributions landed more than 3,791 to 5,219 pounds per year (75^{th} percentiles). Hence, there is substantial difference in vessel performance and averages may not adequately represent fleet performance. The annual producer surplus for this fishery under the limited access program established under Amendment 15 to the CMP FMP was estimated to be $142,650 to $380,400 at the time that the program was being considered.

For all vessels, the median length was 31 feet; half of the vessels were 25 to 39 feet long. Overall, the median number of trips per year for king mackerel was 6 to 7 trips and 20 to 22 trips per year for all logbook-reported landings of fish. The median percentage of king mackerel revenues to all logbook-reported landings ranged from 22 percent to 33 percent of annual gross revenues, or $10,663 to $12,183.

There is very little information on fishermen, fishing-dependent businesses, or communities that depend on the king and Spanish mackerel fisheries. Mackerel fisheries are open only part of the calendar year, or mackerel are only available seasonally to some communities; therefore most fishermen participate in other fisheries as well, and the communities they live in or support are not specifically "mackerel communities". Areas where king mackerel play an important role in the community include Monroe County, Florida, Dare County, North Carolina, and Lafourche Parish, Louisiana.

---

6 Since the early 1990s, fishermen have completed and submitted FMP-mandated logbooks for commercial fishing trips for Gulf reef fish, Atlantic snapper-grouper, shark, and, since 1998, king and Spanish mackerel.

5.4.1.3.3 Processing

There is apparently very little processing of king and Spanish mackerel conducted in the Gulf. According to NOAA Fisheries Service processor survey data, less than three Gulf based establishments have been engaged in king and/or Spanish mackerel processing activities since 1998.

5.4.1.3.4 Imports

The U.S. Department of Customs does not differentiate the various types of mackerel that are exported to the United States. Imports of fresh product from Latin American countries (i.e., those countries likely to be exporting similar mackerel products); however, appear to be very limited (less than one-million pounds annually). Imports of frozen mackerel product from Latin American countries have fallen in the one million to four million pound range in recent years.

5.4.1.4 Spiny Lobster

Spiny lobsters are primarily harvested along the southern coast of Florida. Pounds landed in the Gulf, with few exceptions, generally fall in the 4.0 million to 6.5 million pound range.[7] Lobster pots represent the predominant gear used in the harvest of spiny lobster.

Imports dominate the U.S. supply (i.e., domestic production and imports) of spiny lobster. In 2004, for example, imports of spiny lobster (converted to a live-weight basis) equaled 95 million pounds, which equated to about 95 percent of the total supply. Since the mid-1990s, annual imports have fluctuated from about 75 million pounds to 95 million pounds with no clear trend. The domestic dockside price during this period has generally fallen in the $4.00 to $5.00 with no apparent trend and the dockside value of the Gulf harvested product has averaged approximately $20 million annually since 2000.

The commercial spiny lobster fishery has been dominated by the use of traps since the 1960s. Overall, the number of fishermen holding trap certificates fell from 3,766 in 1992-93 to 2,235 in 2001; or by about 40 percent (unpublished data provided by the Florida Fish and Wildlife Commission). The size of the average operation between 1993 and 1999; however, increased from approximately 196 to 252 certificates while the maximum number of certificates held by any individual increased from 3,674 to 5,631 (Milon et al. 1998).

5.4.1.5 Stone Crab

Harvests of wild stocks have varied since 1989-90. The largest landings (3.5 million pounds of claws) occurred in 1997-98. Landings in 2004-05 were about 3.0 million

---

7 The primary fishing area for spiny lobster is the Florida Keys. Given the physical characteristic of this area, some discussion of the landings data is warranted. Specifically, all product landed in Monroe County, the primary landings port, is considered to be landed in the Gulf even though Monroe County traverses both the Gulf and South Atlantic Coasts.

pounds. For the past decade (1995-96 to 2004-05 fishing seasons), the Gulf coast fishers have declawed approximately 10.5 million crabs during each seven-month fishing season.

The number of traps used to harvest stone crab has increased from an estimated 15,000 in the 1962-63 fishing season to 1.6 million traps in the 2001-02 season. The number of commercial trips also increased from 19,000 in the 1985-86 season to a maximum of 38,000 trips in the 1996-97. The number of traps fished has declined since 1996-97.

Stable landings after 1989-90 and the three-fold increase in the number of traps suggests that the current level of landings is all that can be harvested under current environmental conditions, regulations, and fishery practices

It takes 3-4 years before females reach legal claw size. Hence, offshore aquaculture of stone crab will likely entail a long period prior to seeing any positive return on investment.

5.4.1.6 Menhaden

The following discussion is largely summarized from Vaughan et al. (2007). Management of the Gulf menhaden fishery is through interstate agreement through the GSMFC. Purse-seining of menhaden is prohibited off Florida and Alabama. The remaining Gulf States regulate harvest of Gulf menhaden in their territorial waters. Since the mid-1980s, both the number of reduction plants and the number of purse-seine vessels has significantly declined. Historically, as many as 14 reduction plants operated along the Gulf coast. As of 2004, only four reduction plants are in operation, and a single company owns three of the four plants. Similarly, the number of vessels peaked at around 80 vessels in the 1970s-1980s, and has declined since to 42 as of 2004. Most of the annual Gulf menhaden catch is from Louisiana (~92 percent). In more recent years, the percent of menhaden landings used for bait has increased, but still represents only a small fraction of the total overall landings. Most landings are processed and used for fish meal, oils, pet food, and fertilizer.

5.4.2 Recreational Fishing

Total expenditures for marine recreational fishing activities in the Gulf during 2001 were estimated at more than $ 2 billion by one survey, while another survey estimated those expenditures during 1999 at more than $ 4 billion (U.S. FWS and U.S. Census Bureau 2001; Steinback et al. 2004). The highest expenditures on recreational fishing in 2001 occurred in West Florida, followed by Louisiana, Texas, Alabama, and Mississippi (U.S. FWS and U.S. Census Bureau 2001).

The recreational fishery of the Gulf includes private individuals, rental boats, charter vessels, head boats and party boats. The private recreational sector in the Gulf is surveyed through the Marine Recreational Fisheries Statistics Survey (MRFSS) except for the state of Texas. Outside research on the charter and head boat sector provides much of the descriptive data, whereas the MRFSS survey is generally used to describe the private angling sector.

In the Gulf states, about 3.3 million in-state anglers took almost 23 million trips and caught over 167 million fish in 2003. This tally of anglers and trips does not include anglers and trips taken solely in Texas for all fishing modes or solely through head boats for all Gulf states. More than 70 percent of anglers were from Florida, with the rest coming from Louisiana, Alabama and Mississippi, in that order. Florida accounted for a large percentage (70 percent) of the trips, followed in order by Louisiana, Alabama, and Mississippi. The most commonly caught non-bait species were spotted seatrout, red drum, gray snapper, white grunt, sand seatrout, sheepshead, red snapper, king mackerel, and Spanish mackerel (NOAA Fisheries Service 2004).

The typical angler in the Gulf region is 44 years old, male (80 percent), white (90 percent), employed full time (92 percent), with a mean annual household income of $42,700. The mean number of years fished in the state was 16 years for Gulf anglers. The average number of fishing trips taken in the 12 months preceding the interview was about 38 and these were mostly (75 percent) one-day trips where expenditures on average were less than $50. Seventy-five percent of surveyed anglers reported they held a saltwater license, and 59 percent of them owned boats used for recreational saltwater fishing. Those anglers who did not own their own boat spent an average of $269 per day on boat fees (Holiman 1999) when fishing on a party/charter or rental boat. About 76 percent of these anglers who did not own their own boat were employed or self-employed and about 23 percent were unemployed, mostly due to retirement (Holiman 2000).
For-hire vessels are currently under a moratorium on the issuance of new for-hire federal permits to fish for reef fish or coastal migratory pelagics. A total of 3,340 permits were issued under the moratorium, and they are associated with 1,779 vessels. Of these vessels, 1,561 have both reef fish and coastal migratory pelagics permits, 64 have only reef fish permits, and 154 have only coastal migratory pelagics permits. About one-third of Florida charter boats targeted three or less species, two-thirds targeted five or less species and 90 percent targeted nine or less species. About 40 percent of these charter boats did not target particular species. The species targeted by the largest proportion of Florida charter boats were king mackerel (46 percent), grouper (29 percent), snapper (27 percent), dolphin (26 percent), and billfish (23 percent). In the eastern Gulf, the species receiving the most effort were grouper, king mackerel and snapper. About one-fourth of Florida headboats targeted three or less species, three-fourths targeted four or less species and 80 percent targeted five or less species. About 60 percent of headboats did not target any particular species. The species targeted by the largest proportion of Florida headboats are snapper and other reef fish (35 percent), red grouper (29 percent), gag grouper (23 percent), and black grouper (16 percent). In the eastern Gulf, the species receiving the most effort were snapper, gag and red grouper.

The majority of charter boats in Alabama, Mississippi, Louisiana, and Texas reported targeting snapper (91 percent), king mackerel (89 percent), cobia (76 percent), tuna (55 percent), and amberjack. The species receiving the largest percentage of effort by charter boats in the four-state area were snapper (49 percent), king mackerel (10 percent), red drum (6 percent), cobia (6 percent), tuna (5 percent), and speckled trout (5 percent). The majority of headboat/party boat operators reported targeting snapper (100 percent), king mackerel (85 percent), shark (65 percent), tuna (55 percent), and amberjack (50 percent). The species receiving the largest percentage of total effort by headboats/party boats in the four-state area were snapper (70 percent), king mackerel (12 percent), amberjack (5 percent), and shark (5 percent) (Sutton et al. 1999).

5.4.2.2 Private Anglers

There were over 20.4 million marine recreational fishing trips in the Gulf during 2000, excluding Texas (GMFMC 2004). Most of those trips were made in Florida (72 percent) with Louisiana second (18 percent) and both Alabama and Mississippi with 5 percent. There were over 2.6 million participants who caught a total of 149 million fish. The species that were most commonly sought on fishing trips were red snapper, white grunt, dolphin, black sea bass, spotted sea trout, and red drum. Most often, the catch came on trips where individuals fished primarily in inland waters (64 percent) or in the state territorial sea (27 percent). Descriptions of private angler fishing appear in the appendices for the EFH FEIS under the description of each state's fishing communities (GMFMC 2004).

5.4.2.3 Charter, Head and Party Boats

Charter boats are generally defined as for-hire vessels with a fee charged on a small group basis. Head boats and party boats also operate on a for-hire basis but with a per-person base fee charged. Charter boats are usually smaller, carrying six or fewer passengers. Party boats are larger and will carry as many passengers as possible to maximize income. They usually operate on a schedule and require a minimum number of passengers in order to make a trip. In their recent study of the Charter/Head boat sector for the Gulf States of Alabama, Mississippi, Louisiana, and Texas, Sutton et al. (1999) estimated there to be 430 charter vessel operators and 23 party boat operators in the four-state area. Over the past ten years there has been an increase in size and capacity of both charter and party vessels. Since 1987 charter vessels have more than doubled in number from 210-430 and the number of passenger-trips have tripled from 95,000 to 318,716. The state with the largest increase in number of passenger-trips was Mississippi with a 300 percent increase, Alabama was next with an increase of 165 percent, since 1987. Party boats have decreased in number since 1987 from 26 to 23. However, the number of passenger-trips, as with charter vessels, has tripled from 37,148 to 117,990. This increase may be attributed to the increase in size of vessels. Sutton et al. (1999) estimated the impact of the charter industry on local economies for the four states in their study in 1997 to be $42.5 million in direct output, $15.6 million in income and 996 jobs.

The charter industry has raised concerns over certain aspects of the above study, specifically certain costs for repair and targeting behavior. The Gulf SEP has also provided the GMFMC with a critique of the methodology and assumptions made in the report. However, the purpose here is to describe prior research for comparison and discussion purposes only. Holland et al. (1999) estimated there to be 615 charter and head boats on Florida's Gulf coast and approximately 230 in the Florida Keys. Major ports in Florida on the Peninsula Gulf - Naples and Ft. Myers (and Ft. Myers Beach); on Florida's Panhandle Gulf - Destin, Panama City (and Panama City Beach) and Pensacola; and in the Florida Keys - Key West, Marathon and Islamorada. In their sample, most charter boat operators in Florida (90 percent) operate full-time charter businesses and have been in business for an average of 16 years. The majority (95 percent) lives near their homeport and has lived in their home county for more than 10 years. Head boat operators also were full time had been in business on average 22 years. Like their charter boat counterparts they too lived near their homeport and almost all had lived in their county for more than ten years.

5.4.3 Fishing Communities

A "fishing-dependent community" is defined in the MSFCMA, as amended in 1996, as "a community which is substantially dependent on or substantially engaged in the harvesting or processing of fishery resources to meet social and economic needs, and includes fishing vessel owners, operators, and crew and United States fish processors that are based in such community" (MSFCMA section 3(16)). In addition, the National Standard Guidelines define a fishing-dependent community as a social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational, or subsistence fishing or on directly related fisheries-dependent service and industries (for example, boatyards, ice suppliers, tackle shops)(50 CFR §600.345(b)(3).

The literature on fishing-dependent communities addresses three areas: identification of the communities, selection of variables appropriate for assessment and the assessment method itself. Community identification and selection criteria can be very complex or very simple. A simple first level approach would involve examining social and demographic variables at the county level where some fishing activity occurs. A more complex approach involves attempting to gather data and information on as small an entity as possible that qualifies as a fishing community. As the definition of community moves farther from traditional economic or political entities, less official data are available and more field research is required to complete the baseline profile and include relevant social and cultural value data.

Jacob et al. (2001) developed a protocol for defining and identifying fishing-dependent communities in accordance with National Standard 8. The project used central place theory to identify communities. A central place is where services, goods and other needs are met for the residents in the central place, as well as for those in surrounding hinterlands. It differs from using an administrative unit such as county boundaries, which may distort smaller communities or locality data as it is aggregated. The authors believed central place theory works well for defining and identifying fishing-dependent communities or localities as it provides a geographic basis for including multiplier effects that capture forward and backward linkages. In most fishing-dependent communities, forward linkages include those businesses that handle the fish once it is brought to the dock, such as fish houses, wholesalers, exporters, and seafood shops and restaurants. Backward linkages are the goods and services fishermen depend upon such as boat building and repair; net making and repair; marinas; fuel docks; bait, tackle and other gear vendors. Using their protocol of defining fishing-dependent communities, the authors initially determined five communities as commercially fishing-dependent and seven communities as recreationally fishing dependent. Further investigations resulted in validating five communities as commercially fishing dependent. The authors expressed little confidence in the data used and indicators developed based on such data to confirm the other communities as recreationally fishing-dependent communities. The five commercially fishing-dependent communities in Florida are: Steinhatchee, Apalachicola, Panama City, Ochopee/Everglades City, and Panacea.

The Generic Essential Fish Habitat Amendment (GMFMC 2004) provides more extensive characterization of fishing-dependent communities throughout the Gulf coasts. The fishing communities included in the characterizations are: (1) Alabama: Fairhope, Gulf Shores, Orange Beach, Bayou La Batre, and Dauphin Island; (2) Florida: Pensacola, Gulf Breeze, Ft. Walton Beach, Destin, Panama City, Panama City Beach, Port St. Joseph, Apalachicola, East Point, Carabelle, St. Marks, Horseshoe Beach, Cedar Key, Yankeetown, Inglis, Crystal River, Homosassa, New Port Richey, Tarpon Springs, Clearwater, Madeira Beach, St. Petersburg, Tampa, Cortez, Matlacha, Bokeelia, Ft. Myers Beach, Naples, Marco Island, Everglades City, Key Largo, Islamorada, Marathon, Big Pine Key-Summerland Key, and Key West; (3) Louisiana: Venice, Empire, Grand Isle, Golden Meadow, Cutoff, Chauvin, Dulac, Houma, Delcambre, Morgan City, and Cameron; (4) Mississippi: Pascagoula, Gautier, Biloxi, and Gulfport; and, (5) Texas: Port Arthur, Galveston, Freeport, Palacios, Port Lavaca, Seadrift, Rockport, Port Aransas, Aransas Pass, Brownsville, Port Isabel, and South Padre Island.

Holland et al. (1999) identified the following areas as major activity centers for charter boats in Florida: Miami, Fort Lauderdale, Key West, Marathon, Islamorada, Naples, Ft. Myers, Ft. Myers Beach, Panama City, Panama City Beach, Destin and Pensacola. They also identified the following as major activity centers for headboats in Florida: Miami, Key West, Marathon, Islamorada, Ft. Myers, Ft. Myers Beach, Clearwater, Destin, Panama City and Panama City Beach. Sutton et al. (1999) identified the following areas as major activity centers for charter boats in the rest of the Gulf: South Padre Island, Port Aransas, and Galveston-Freeport in Texas; Grand Isle-Empire-Venice in Louisiana; Gulfport-Biloxi in Mississippi; and, Orange Beach-Gulf Shores in Alabama. They also identified the following areas as major activity centers for headboats in the rest of the Gulf: South Padre Island, Port Aransas, and Galveston-Freeport in Texas and Orange Beach-Gulf Shores in Alabama.

The communities that will be affected as a result of developing offshore aquaculture in the Gulf are difficult to project at this time. There is no information available that describes where firms will be located, where their supplies will be purchased, where employees will be hired or live, where the offshore facilities will be located, or how social conditions will change. Until the firms develop their infrastructure, discussions of the communities that will be impacted are based upon conjecture.

To provide discussion in this document, five communities have been selected that represent different attributes that may interrelate with the aquaculture industry. Additional information regarding demographics of the communities can be obtained from reports developed by Impact Assessment, Inc. These reports are available on the NOAA Southeast Region web site at http://sero.nmfs.noaa.gov/publications/publications.htm.

The first community selected was Galveston, Texas. Galveston was selected for two reasons, (1) because it is important to the red snapper fishery and (2) it is close to the major metropolitan area of Houston. Red snapper is discussed in this amendment one of the primary candidates for offshore aquaculture production in the Gulf. Houston, being a major city, would provide a substantial market for fresh production. If a quality product is produced, Houston restaurants and fish sellers have the potential to create a strong demand for the local production.

Port Fourchon, Louisiana, is the second community that will be discussed. Port Fourchon was selected because it is the main staging area for offshore oil and gas production in the Gulf. If the offshore aquaculture industry utilizes oil and gas structures, Port Fourchon may be a logical location to base the shore support industry.

Bayou La Batre, Alabama, was selected because it is one of the primary commercial harvesting towns for shrimp. While this FMP would prohibit shrimp from being cultured offshore, Bayou La Batre possesses the infrastructure to support offshore aquaculture.

Panama City, Florida, was selected as the fourth community. It is moderately sized community that has a diverse economic base comprised of a local military base, tourism, commercial fishing, and recreational fishing. Panama City also is home to some fish processing facilities. Future research could consider the interactions between processors of wild stocks and species raised using aquaculture.

The final community discussed is Madeira Beach, Florida. Madeira Beach is an important location for the Gulf grouper fishery. It is also the location from where one offshore aquaculture application has been submitted.

Each of these communities will be discussed in terms of their social and economic characteristics. The reports used to provide this information were developed for NOAA Fisheries Service to identify fishing communities associated with the fishing industry by Impact Assessment, Inc (2005). All of the information for the various communities is taken directly from those reports. Summary statistics and demographics for each community are provided in Tables 5.4.3-1 to 5.4.3-14.

Galveston, Texas, is an incorporated community with a population of 57,247 reported in the 2000 census. "Galveston is a 32-mile-long, two-mile-wide barrier island located directly west of the Gulf of Mexico and east of mainland Galveston County. Houston is approximately 50 miles north. The University of Texas Medical Branch is the leading employer" (Galveston, Texas Chamber of Commerce). Tourism, commercial and recreational fishing, and various maritime industry at the Port of Galveston are also highly significant in economic terms.

Galveston Island was once home to Karankawa tribes, who hunted and fished in the area's resource-rich bays and sounds. The first non-indigenous settlement was established in 1817 by pirate Jean Laffite (Texas Online 1998). Galveston was incorporated in 1839 (McComb 2002).

Galveston's economy initially revolved around its port, with cotton as the principal export product. The area grew steadily until an outbreak of yellow fever killed approximately 75 percent of Galveston's population between 1867 and 1873. Another major setback occurred in 1900 when the Galveston hurricane flooded the island and 6,000 people died (McComb 2002). The population steadily increased over the course of the 20th century in large part in associated with immense growth around Houston.

The year 2000 census enumerated 57,247 residents, a three percent decline from 1990. During that ten year period, employment in several major industries such as agriculture, forestry, fishing and hunting, mining, and manufacturing underwent some measure of decline. Jobs in the both the management and government sectors accounted for over 67 percent of jobs held by residents during the period. Many residents now work in tourism related services, such as those provided by the numerous dockside inns and hotels that serve visitors along the Galveston waterfront.

Both commercial and recreational fishing services and infrastructure are available in the area. For instance, eight public boat ramps provide convenient access to the Gulf and back bays, and several docks and marinas, ocean sightseeing tours, and charter fishing services provide 109 amenities for visitors. A highly productive shrimp and bottom fish fleet is also based here, with numerous commercial fishing vessels mooring along the waterfront. A number of seafood dealers and retailers, and boat builder and brokers are located in Galveston as well. As of 2003, three Galveston residents held Gulf shrimp permits Impact Assessment, Inc. 2005).

The total combined commercial landings of all species in Galveston during 2002 were 5,491,872 pounds. These landings had an ex-vessel value of $13,476,895. There were a total of 75 commercial fishing license holders (56 state and 19 federal) in 2000. A total of 2,551 persons held State saltwater licenses to fish recreationally.

Table 5.4.3-1. Galveston Demographics

Factor	1990	2000
Total population	59,070	57,247
Gender Ratio M/F (Number)	28,539/30,531	27,649/29,598
Age (Percent of total population)		
Under 18 years of age	24.7	23.4
18 to 64 years of age	61.9	62.9
65 years and over	13.4	13.7
Ethnicity or Race (Number)		
White	36,315	33,582
Black or African American	17,161	14,592
American Indian and Alaskan Native	144	243
Asian	1,387	1,839
Native Hawaiian and other Pacific Islander	N/A	42
Some other race	4,063	5,571
Two or more races	N/A	1,378
Hispanic or Latino (any race)	12,649	14,753
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	13.7	10.3
Percent high school graduate or higher	70.0	74.4
Percent with a Bachelor's degree or higher	21.1	23.7
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	19.8	26.5
And Percent who speak English less than very well	7.6	11.2
Household income (Median $)	20,825	28,895
Poverty Status (Percent of pop. with income below poverty line)	24.2	22.3
Percent female headed household	16.3	16.9
Home Ownership (Number)		
Owner occupied	10,136	10,399
Renter occupied	14,021	13,443
Value Owner-occupied Housing (Median $)	57,200	73,800
Monthly Contract Rent (Median $)	309	531
Employment Status (Population 16 yrs and over)		
Percent in the labor force	62.7	59.7
Percent of civilian labor force unemployed	9.0	10.1
Occupation** (Percent in workforce)		
Management, professional, and related occupations	N/A	35.2
Service occupations	N/A	24.2
Sales and office occupations	N/A	24.0
Farming, fishing, and forestry occupations	1.8	0.3
Construction, extraction, and maintenance occupations	N/A	8.3
Production, transportation, and material moving occupations	N/A	8.0
Industry (Percent in workforce)		
Agriculture, forestry, fishing and hunting	1.5	0.3
Mining (includes the offshore oil/gas industry workforce)	1.0	0.5

Manufacturing	5.7	4.1
Percent government workers	32.1	31.5
Commuting to Work (Workers 16 yrs and over)		
Mean travel time to work (minutes)	N/A	19.1
Percent worked outside of county of residence	5.5	9.5

**Differences in the types of data the U.S. Census Bureau used to generate Occupation and Industry percentages in 1990 and 2000 preclude comparisons between those census years.

Table 5.4.3-2. Fishing Infrastructure and Services Observed in Galveston in 2003.
***Source:* Impact Assessment, Inc. 2005.**

Infrastructure or Service	**Quantity**
Air fill stations (diving)	1
Boat yards/ Boat builders (recreational/commercial)	1
Churches with maritime theme	1
Docking facilities (commercial)	8
Fishing Gear, Electronics, Welding, and other repair	5
Fishing associations (recreational/commercial)	2
Fish processors, Wholesale fish house	3
Fisheries research laboratories	1
Fishing monuments	0
Fishing pier	20
Hotels/Inns (dockside)	~20
Marine railways/haul out facilities	0
Museums—fishing/marine-related	0
Net makers	1
NOAA Fisheries Service or state fisheries office (port agent, etc.)	1
Public boat ramps	8
Recreational docks/marinas	5
Bait & Tackle/fishing supplies	20
Recreational Fishing Tournaments	Numerous
Sea Grant Extension office	1
Seafood restaurants	~20
Seafood retail markets	8
Trucking operations	0
Site-seeing/pleasure tours	10
Charter/Head Boats	12
Commercial Boats	25

Table 5.4.3-3. Primary Fishing-related Businesses Listed for Galveston in 2003.
***Source:* Impact Assessment, Inc. 2005.**

Type of Business	**Frequency**
Boat Builder/Broker	10
Boat Builder/Broker; Marina	1
Boat Rentals & Pier	9
Boat Rentals & Pier; Retail Seafood Dealer	1
Marina	13
Processor; Retail Seafood Dealer	1
Retail Seafood Dealer	6
Retail/Wholesale Seafood Dealer	3
Wholesale Seafood Dealer	2
Total	*46*

Port Fourchon, Louisiana's population is over-estimated in the 2000 U.S. Census (1,266). "The community is located in the far southern portion of Lafourche Parish where Bayou Lafourche meets the Gulf of Mexico. Port Fourchon is an industrial center for deepwater petroleum exploration and development in the Gulf. It is also very likely the largest single concentration of offshore petroleum support facilities in the lower-48. The Louisiana Offshore Oil Port (LOOP), the nation's only super port, is located 19 miles southeast. Constructed by a group of major oil and pipeline companies, LOOP is the central point of distribution for supertankers in the Gulf region.

While extensive offshore petroleum support facilities and vessel operations dominate the landscape and local economy, Port Fourchon is also a harbor for several deep sea charter boats and offshore shrimp trawlers. The offshore trawlers are docked at two locations near the southern and northern ends of the port near a small marina. As is the case for Leeville, secondary source data for Port Fourchon are sparse at best. This is due in large part because there is no permanent residential area here. Vessels are kept here, and captains operate from the area but live elsewhere.

There are many fish camps fronting Bayou Terellon along Route 3090 near Port Fourchon; these are almost entirely recreational/weekend dwellings. A great deal of fishing occurs in the adjacent bayous and canals. There are also a growing number of upscale camp settlements west of the junction of Highway 1 and Route 3090. Various offshore sports fishing vessels are docked along the canal here.

Year 2000 census figures do not accurately portray the resident population of Port Fourchon in that census-delineated tracts for this area include part of the populations of Grand Isle and Leeville. In reality, there are few permanent residents here; many persons who moor their vessels here live north of the port in communities along Bayou Lafourche, or as far away as Houma" (Impact Assessment, Inc. 2005).

There was no fishing-related businesses listed for Port Fourchon in 2003, nor was there any information on commercial landings or value in 2000. No commercial fishing licenses were reported as being held by persons with a physical address in Port Fourchon in 2000. A total of 483 recreational State saltwater fishing licenses were sold in the community during 2000.

Table 5.4.3-4. Port Fourchon Demographics

Factor	1990	2000
Total population	1,372	1,266
Gender Ratio M/F (Number)	653/608	640/626
Age (Percent of total population)		
Under 18 years of age	28.2	23.1
18 to 64 years of age	63.8	61.4
65 years and over	8.0	15.5
Ethnicity or Race (Number)		
White	1,175	1,124
Black or African American	1	7
American Indian and Alaskan Native	68	106
Asian	14	0
Native Hawaiian and other Pacific Islander	N/A	0
Some other race	3	5
Two or more races	N/A	24
Hispanic or Latino (any race)	8	9
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	49.0	18.5
Percent high school graduate or higher	34.6	47.6
Percent with a Bachelor's degree or higher	1.4	3.2
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	44.8	38.7
And Percent who speak English less than very well	13.5	7.5
Household income (Median $)	18,935	19,062
Poverty Status (Percent of population with income below poverty line)	32.3	21.4
Percent female headed household	7.4	6.8
Home Ownership (Number)		
Owner occupied	333	408
Renter occupied	76	58
Value Owner-occupied Housing (Median $)	33,100	48,950
Monthly Contract Rent (Median $)	222	334
Employment Status (Population 16 yrs and over)		
Percent in the labor force	51.5	47.8
Percent of civilian labor force unemployed	2.1	4.2
Occupation** (Percent in workforce)		
Management, professional, and related occupations	N/A	12.0
Service occupations	N/A	15.8
Sales and office occupations	N/A	31.6
Farming, fishing, and forestry occupations	7.8	4.9
Construction, extraction, and maintenance occupations	N/A	10.6
Production, transportation, and material moving occupations	N/A	24.9

Industry** (Percent in workforce)		
Agriculture, forestry, fishing and hunting	6.4	6.2
Mining (includes the offshore oil/gas industry workforce)	7.7	8.9
Manufacturing	3.6	5.1
Percent government workers	12.7	2.2
Commuting to Work (Workers 16 yrs and over)		
Mean travel time to work (minutes)	40.0	18.8
Percent worked outside of county of residence	15.4	14.1

**Differences in the types of data the U.S. Census Bureau used to generate Occupation and Industry percentages in 1990 and 2000 preclude valid comparisons for those census years.

Table 5.4.3-5. Fishing Infrastructure and Services Observed in Port Fourchon in 2003

Factor	**Quantity**
Commercial Vessels	-
Trawls	30-40
Skimmers	0
Butterfly	0
Crabbers	0
Oyster	0
Other Commercial	3-5 Charter boats, 50-60 oil field support vessels
Recreational Vessels	-
Freshwater	0
Saltwater	0
Infrastructure and Services -	-
Marinas	1
Seafood Docks/Dealers	1
Commercial Ship/Boat Repair	0
Commercial Ship/Boat Builders	0
Net Makers/Dealers	0
Commercial Marine Supply	2
Seafood Transport	2
Air Fill Stations (diving)	0
Fishing Pier	0

Source: Impact Assessment, Inc. 2005.

Bayou La Batre, Alabama, is an incorporated community with a population of 2,313 reported in the 2000 U.S. Census. "Bayou La Batre is located along State Highway 188 in southern Mobile County. It is adjacent to the body of water of the same name. The bayou empties into Mississippi Sound, providing easy access to several major ship channels and the Gulf of Mexico. Bayou La Batre is some 25 miles south of Mobile and approximately 22 miles east of the Pascagoula-Moss Point, Mississippi Metro area. The Gulf of Mexico is about 17 miles south, accessible via Portersville Bay and the Mississippi Sound.

Bayou La Batre was founded in the 1780's by a Frenchman named Joseph Bosarge. "La Batre" refers to a strategic battery built by the French during that period. Following the introduction of rail service in the late 1800s, the area developed as a resort town (Howell 2003). A hurricane so devastated the area in 1906 that commercial fishing became the only source of income. Residents subsequently established a lengthy history of involvement in the harvest, processing, and distribution of seafood.

The year 2000 census enumerated 2,313 persons in Bayou La Batre, a decline from the 1990 count of 2,456. Most residents were employed in manufacturing industries or sales occupations in 2000. The commercial fishing and processing industries are vital to the local economy. Shrimp, oysters, crabs, and finfish are primary products. The commercial fishing industry here reportedly generates direct and indirect revenue of nearly $80 million per year, with an approximate annual ex-vessel value of nearly $30 million. According to the Auburn University Marine Extension and Research Center (2001), Bayou La Batre was ranked 10th in value of landings for all U.S. ports in 2000. Fishery participants from Bayou La Batre also produce the majority of Alabama seafood landings; shrimp accounts for 90 percent of landed seafood value. Crews for hundreds of shrimp vessels work out of and deliver product to Bayou La Batre. Local processing activities include cleaning, heading, picking, shucking, grading, breading, packaging, frozen storage, and transportation. Much of the seafood processed in Bayou La Batre's processing plants is trucked in from out-of-state. These plants employ approximately 1,500 year-round workers and 800 seasonal workers. An additional number of packing houses and wholesale seafood dealers employ many year-round and seasonal workers. There are also at least a dozen marine supply shops and marine electronics firms in Bayou La Batre (Bayou La Batre Chamber of Commerce). Shipbuilding is Bayou La Batre's other major industry. Oil supply boats, work boats, barges, shrimp boats, tugs, cruisers, and casino boats are among the vessels built in Bayou La Batre (Bayou La Batre Chamber of Commerce).

There is a small downtown business district at the intersection of Shell Belt Road and State Road 188. Shell Belt Road is the address of many fishing-related industries, such as seafood processors, fish houses, and boat building yards. Numerous shrimp vessels are docked nearby. There are no bars, hotels, or non-fishing related businesses located on the bayou. A NOAA Fisheries Service port agent has an office in town. A population of persons of Vietnamese ancestry is involved in all facets of the local seafood industry. Many settled in the community with the help of the Catholic Church after the end of the Vietnam War. The local fishing fleet here ranges from small bay boats that fish for shrimp and finfish to large Gulf vessels (called "steel slabs") that make extended trips throughout the Gulf and Southeast Atlantic. There are small seafood dealers that handle shrimp, crab, oysters, and finfish and large-scale processors that ship specialty products worldwide. All types of support businesses from net manufacturers to marine electronics dealers are located here. A blessing of the fleet" and a "Miss Seafood Contest" are held here each year. According to one fishery specialist, the recent rise in fuel prices and the increase in imports and subsequent drop in price for domestic shrimp have forced Alabama shrimp fishermen to adjust their annual fishing pattern. In the past, fishing trips would be made during the off-season even though shrimp were not as abundant since the trips were still economically feasible. That is no longer the case, and many vessels remain tied to the dock during the off-season - returns can no longer cover operating costs.

In 2000, 24 processors were located in Bayou La Batre, average of 30 employees were employed by each that year. Some 36 million pounds of seafood valued at over $123 million were produced that year. A large federally-permitted shrimp fleet is based in Bayou La Batre, and many vessels from around the region are moored here" (Impact Assessment, Inc. 2005).

Commercial landings reported for Bayou La Batre during 2003 were 4,615,977 pounds and were valued at $7,744,316 ex-vessel. A total of 45 commercial fishing permits were held by persons with an address in the community (35 state permits and 10 federal Permits).

Table 5.4.3-6. Bayou La Batre Demographics. ***Source:*** **Impact Assessment, Inc. 2005.**

Factor	1990	2000
Total population	2,456	2,313
Gender Ratio M/F (Number)	1,201/1,255	1,159/1,154
Age (Percent of total population)		
Under 18 years of age	34.3	29.9
18 to 64 years of age	54.7	59.0
65 years and over	11.0	11.2
Ethnicity or Race (Number)		
White	1,605	1,213
Black or African American	250	237
American Indian and Alaskan Native	3	6
Asian	595	770
Native Hawaiian and other Pacific Islander	N/A	10
Some other race	3	22
Two or more races	N/A	55
Hispanic or Latino (any race)	67	44
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	30.0	24.0
Percent high school graduate or higher	45.2	54.9
Percent with a Bachelor's degree or higher	6.0	7.4
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	26.3	29.1
Percent who speak English less than very well	18.0	15.8
Household income (Median $)	15,775	24,539
Poverty Status (Percent of population with income below poverty line)	36.1	28.2
Percent female headed household	15.6	17.6
Home Ownership (Number)		
Owner occupied	537	501
Renter occupied	234	268
Value Owner-occupied Housing (Median $)	35,200	45,800

Monthly Contract Rent (Median $)	164	366
Employment Status (Population 16 yrs and over)		
Percent in the labor force	54.2	53.7
Percent of civilian labor force unemployed	9.7	11.1
Occupation** (Percent in workforce)		
Management, professional, and related occupations	N/A	14.1
Service occupations	N/A	18.3
Sales and office occupations	N/A	20.7
Farming, fishing, and forestry occupations	8.6	5.2
Construction, extraction, and maintenance occupations	N/A	10.8
Production, transportation, and material moving occupations	N/A	30.9
Industry** (Percent in workforce)		
Agriculture, forestry, fishing and hunting, (and mining)	11.6	8.4†
Manufacturing	23.4	21.9
Percent government workers	9.0	7.7
Commuting to Work (Workers 16 yrs and over)		
Mean travel time to work (minutes)	N/A	23.9
Percent worked outside of county of residence	12.2	9.5

**Differences in the types of data used to generate Occupation and Industry percentages in 1990 and 2000 preclude valid comparisons between those census years.

Table 5.4.3-7. Fishing Infrastructure and Services Observed in Bayou LaBatre in 2003. *Source:* Impact Assessment, Inc. 2005.

Infrastructure or Service	Quantity
Air fill stations (diving)	0
Boat yards/ Boat builders (recreational/commercial)	0
Churches with maritime theme	2
Docking facilities (commercial)	Several
Fishing Gear, Electronics, Welding, and other repair	0
Fishing associations (recreational/commercial)	0
Fish processors, Wholesale Fish House	50
Fisheries research laboratories	0
Fishing monuments/ festivals	1
Fishing pier	1
Hotels/Inns (dockside)	0
Marine railways/haul out facilities	Several
Museums—fishing/marine-related	0
Net makers	2
NOAA Fisheries Service or state fisheries office (port agent, etc.)	2
Public boat ramps	1
Recreational docks/marinas	0
Bait & Tackle/fishing supplies	0
Recreational Fishing Tournaments	0

Sea Grant Extension office	0
Seafood restaurants	2
Seafood retail markets	0
Trucking operations	3
Site-seeing/pleasure tours	0
Charter/Head Boats	3
Commercial Boats	~300

Table 5.4.3-8. Primary Fishing-related Businesses Listed for Bayou La Batre in 2003. *Source:* Impact Assessment, Inc. 2005.

Type of Business	**Frequency**
Boat Builder/Broker	12
Boat Builder/Broker; Marina	3
Boat Rentals & Pier	1
Fish Hatchery	1
Marina	1
Processor	5
Processor; Retail/Wholesale Seafood Dealer	4
Processor; Wholesale Seafood Dealer	2
Retail/Wholesale Seafood Dealer	1
Wholesale Seafood Dealer	9

Panama City, Florida, is an incorporated community with a population of 36,417 reported in the 2000 U.S. Census. "Panama City is located on St. Andrews Bay just inland from the Gulf in the central panhandle region. The city is typically accessed by U.S. Highway 98 and State Highway 22. Tallahassee is nearly 100 miles to the southwest. Local and visiting fishing vessels access the Gulf through the channel at St. Andrew Bay, roughly two miles from the waterfront.

The town was named in 1906 under the leadership of developer G.M. West, and incorporated in 1909. Development focused on the waterfront, where numerous piers, a post office, and the city jail were built. In 1908, the Atlanta and St. Andrew Bay Railroad connected Panama City with cities to the north. In 1913, Panama City became the seat of Bay County.

The year 2000 census enumerated 36, 417 persons in Panama City, up from 34,378 in 1990. More than 6,700 residents are employed at neighboring Tyndal Air Force Base. The U.S. Navy maintains a 648-acre Coastal Systems Station in the area, and employs approximately 2,200 persons, many of whom reside in Panama City. Many residents are employed in positions associated with regional commerce and government. There are numerous commercial and recreational fishing businesses in Panama City. At least 100 commercial and charter vessels moor at various harbors. Several wholesale fish houses handle a wide variety of finfish and shellfish, and there are numerous bait and tackle shops, ship stores, boat builders and dealers, fishing piers, and marinas where charter fishing is offered. There were nine active processors in 2000, employing a total of 55 persons on average that year. In short, there is considerable infrastructure for both commercial and recreational fishing," (Impact Assessment, Inc. 2005).

Commercial landings reported for Panama City during 2002 were 1,972,052 pounds and were valued at $3,869,807 ex-vessel. A total of 264 commercial fishing permits were held by persons with an address in the community (125 state permits and 139 federal Permits). A total of 1,352 State saltwater licenses were held by persons that reported Panama City as their address on the license.

Table 5.4.3-9. Panama City Demographics. ***Source:*** **Impact Assessment, Inc. 2005.**

Factor	1990	2000
Total population	34,378	36,417
Gender Ratio M/F (Number)	16,094/18,284	17,683/18,734
Age (Percent of total population)		
Under 18 years of age	24.5	23.0
18 to 64 years of age	58.5	61.1
65 years and over	17.0	15.9
Ethnicity or Race (Number)		
White	25,954	26,819
Black or African American	7,500	7,813
American Indian and Alaskan Native	215	231
Asian	583	564
Native Hawaiian and other Pacific Islander -- 28 Some other race	126	274
Two or more races	–	688
Hispanic or Latino (any race)	460	1,060
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	12.1	6.7
Percent high school graduate or higher	70.3	79.2
Percent with a Bachelor's degree or higher	16.7	18.9
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	5.3	7.2
Percent who speak English less than very well	1.9	2.0
Household income (Median $)	26,629	31,572
Poverty Status (Percent of population with income below poverty line)	19.6	17.2
Percent female headed household	23.0	15.4
Home Ownership (Number)		
Owner occupied	8,193	8,565
Renter occupied	5,860	6,254
Value Owner-occupied Housing (Median $)	49,800	75,800
Monthly Contract Rent (Median $)	279	526
Employment Status (Population 16 yrs and over)		
Percent in the labor force	58.6	56.4
Percent of civilian labor force unemployed	8.0	5.8
Occupation** (Percent in workforce)		
Management, professional, and related occupations	--	32.2
Service occupations	--	20.8

Sales and office occupations	--	27.7
Farming, fishing, and forestry occupations	1.5	0.4
Construction, extraction, and maintenance occupations	--	8.6
Production, transportation, and material moving occupations	--	10.4
Industry** (Percent in workforce)		
Agriculture, forestry, fishing and hunting	1.5	0.5†
Manufacturing	7.7	7.0
Percent government workers	20.4	18.6
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	12.5	13.7
Percent using public transportation	0.2	0.7
Mean travel time to work (minutes)	--	18.6
Percent worked outside of county of residence	1.8	3.3

**Differences in the types of data the U.S. Census Bureau used to generate Occupation and Industry percentages in 1990 and 2000 preclude valid comparisons between those census years.

Table 5.4.3-10. Fishing Infrastructure and Services Observed in Panama City in 2003. *Source:* Impact Assessment, Inc. 2005.

Infrastructure or Service	**Quantity**
Air fill stations (diving)	Several
Bars/clubs (dockside or in town)	Several
Boat yards/ Boat builders (recreational/commercial)	Several
Churches with maritime theme	None observed
Docking facilities (commercial)	0
Fishing Gear, Electronics, Welding, and other repair	0
Fishing associations (recreational/commercial)	0
Fish processors, Wholesale Fish House	6
Fisheries research laboratories	0
Fishing monuments	0
Fishing pier	0
Hotels/Inns (dockside)	0
Marine railways/haul out facilities	0
Museums—fishing/marine-related	0
Net makers	0
NOAA Fisheries Service or state fisheries office (port agent, etc.)	0
Public boat ramps	8
Recreational docks/marinas	15+
Bait & Tackle/fishing supplies	15+
Recreational Fishing Tournaments	Several
Sea Grant Extension office	0
Seafood restaurants	10+
Seafood retail markets	20+
Trucking operations	0
Site-seeing/pleasure tours	0

Charter/Head Boats	100+
Commercial Boats	100+

Table 5.4.3-11. Primary Fishing-related Businesses Listed for Panama City in 2003. *Source:* Impact Assessment, Inc. 2005.

Type of Business	**Frequency**
Boat Builder/Broker	44
Boat Builder/Broker Boat Rentals & Pier	1
Boat Builder/Broker Diving & Fishing Equipment	1
Boat Builder/Broker Marina	13
Boat Rentals & Pier	15
Boat Rentals & Pier Marina	1
Marina	17
Retail Seafood Dealer	19
Retail/Wholesale Seafood Dealer	2
Wholesale Seafood Dealer	4
Total	117

Madeira Beach, Florida, is an incorporated community with a population of 4,511 reported in the 2000 U.S. Census. "Madeira Beach is located on a barrier island just west of St. Petersburg and north of John's Pass on Florida's central west coast. The town is one of several beachfront communities in the area with both a well-established population of year-round inhabitants, and a range of services and attractions suitable for tourists and seasonal residents.

Madeira Beach incorporated in 1947. According to Wilson and McCay (1998) offshore fishing in Madeira Beach began as bandit reel fishing for grouper in the 1960's. There were two fish houses supported primarily by charter fishing and a small commercial operation. It was during the early 1970's that two vessels began experimenting with long line fishing, but were initially unsuccessful. Later, several vessels began using long lines successfully for swordfish, but as swordfish stocks began to diminish in the Gulf, they were forced to expand their fishing territory to the eastern seaboard. It was on return trips that these vessels began to experiment with long lines in deeper water, thereby discovering an abundance of tilefish and yellow edge grouper. Reportedly, 95 percent of the fishing fleet in Madeira Beach was using long lines (Wilson and McCay 1998). There were four fish houses in Madeira Beach at the time, dealing primarily in grouper, but also swordfish, shark, and other species. Approximately 100 vessels were working from the area during the latter part of the 20th century.

The year 2000 census enumerated 4,511 persons, up from 4,225 in 1990. The community is undergoing change, as waterfront property values rise and condominium development ensues. The town is sometimes referred to as the "Grouper Capital of the World" as the majority of snapper-grouper in the U.S. is landed here. The fish is an important recreational catch as well. Lucas (2001) reported an estimated 87 long line and 48 bandit reel vessels call Madeira their homeport. Moreover, she found that most captains and crew lived nearby, with over 40 captains living in Madeira, and the rest within 30 minutes away. Overall direct employment, related to vessels and fish houses, was approximately 441 persons in 2000. These numbers are likely less today than in the past, as the number of fish houses and vessels have decreased.

With regard to recreational fishing, there are four marinas, including a public marina with over 90 slips. Many residents own their own boat and fish in the Gulf. Support industries do exist, as there are several bait and tackle shops, recreational boat yards, and other related businesses. The community continues to hold the Seafood Festival in October" (Impact Assessment, Inc. 2005).

Commercial landings reported for Madeira Beach during 2002 were 935,201 pounds and were valued at $1,686,739 ex-vessel. A total of 264 commercial fishing permits were held by persons with an address in the community (15 state permits and 26 federal Permits). A total of 125 state saltwater licenses were held by persons that reported Madeira Beach as their address on the license.

Table 5.4.3-12. Madeira Beach Demographics. *Source:* Impact Assessment, Inc. 2005.

Factor	1990	2000
Total population	4,225	4,511
Gender Ratio M/F (Number)	2,156/2,069	2,376/2,135
Age (Percent of total population)		
Under 18 years of age	8.7	8.2
18 to 64 years of age	65.7	69.8
65 years and over	25.6	22.0
Ethnicity or Race (Number)		
White	4,160	4,378
Black or African American	10	12
American Indian and Alaskan Native	7	14
Asian	32	26
Native Hawaiian and other Pacific Islander	--	2
Some other race	16	30
Two or more races	--	49
Hispanic or Latino (any race)	105	107
Educational Attainment (Population 25 and over)		
Percent with less than 9th grade	4.2	2.6
Percent high school graduate or higher	83.8	87.3
Percent with a Bachelor's degree or higher	19.5	22.2
Language Spoken at Home (Population 5 years and over)		
Percent who speak a language other than English at home	4.5	6.8
Percent who speak English less than very well	1.5	2.0
Household income (Median $)	24,748	36,671
Poverty Status (Percent of population with income below poverty line)	8.4	9.8
Percent female headed household	5.3	5.3
Home Ownership (Number)		
Owner occupied	1,290	1,454
Renter occupied	940	1,074
Value Owner-occupied Housing (Median $)	111,400	171,000

Monthly Contract Rent (Median $)	392	555
Employment Status (Population 16 yrs and over)		
Percent in the labor force	58.5	61.5
Percent of civilian labor force unemployed	2.7	4.4
Occupation** (Percent in workforce)		
Management, professional, and related occupations	--	30.4
Service occupations	--	22.1
Sales and office occupations	--	28.9
Farming, fishing, and forestry occupations	1.4	0.7
Construction, extraction, and maintenance occupations	--	10.6
Production, transportation, and material moving occupations	--	7.2
Industry** (Percent in workforce)		
Agriculture, forestry, fishing and hunting	1.4	0.0†
Manufacturing	7.5	7.0
Percent government workers	8.2	4.5
Commuting to Work (Workers 16 yrs and over)		
Percent in carpools	8.7	14.7
Percent using public transportation	2.2	1.6
Mean travel time to work (minutes)	--	23.1
Percent worked outside of county of residence	10.6	16.0

**Differences in the types of data the U.S. Census Bureau used to generate Occupation and Industry percentages in 1990 and 2000 preclude valid comparisons between those census years.

Table 5.4.3-13. Fishing Infrastructure and Services Observed in Madeira Beach in 2003. *Source:* Impact Assessment, Inc. 2005.

Infrastructure or Service	**Quantity**
Air fill stations (diving)	2
Boat yards/ Boat builders (recreational/commercial)	3
Churches with maritime theme	1
Docking facilities (commercial)	4
Fishing Gear, Electronics, Welding, and other repair	4 (2com/2 rec)
Fishing associations (recreational/commercial)	1 (com)
Fish processors, Wholesale Fish House	5
Fisheries research laboratories	0
Fishing monuments/ festivals	1
Fishing pier	0
Hotels/Inns (dockside)	Many
Marine railways/haul out facilities	0
Museums—fishing/marine-related	0
Net makers	0
NOAA Fisheries Service or state fisheries office (port agent, etc.)	0
Public boat ramps	2
Recreational docks/marinas	4
Bait & Tackle/fishing supplies	5

Recreational Fishing Tournaments	0
Sea Grant Extension office	0
Seafood restaurants	Many
Seafood retail markets	2
Trucking operations	1
Site-seeing/pleasure tours	7+
Charter/Head Boats	3+
Commercial Boats	40

Table 5.4.3-14. Primary Fishing-related Businesses Listed for Madeira Beach in 2003. ***Source:*** **Impact Assessment, Inc. 2005.**

Type of Business	**Frequency**
Boat Builder/Broker	3
Boat Rentals & Pier	10
Boat Rentals & Pier- Marina	1
Marina	3
Processor- Wholesale Seafood Dealer	1
Retail/Wholesale Seafood Dealer	1
Total	19

5.5 Administrative Environment

5.5.1 Federal Management

5.5.1.1 NOAA Fisheries Service

NOAA Fisheries Service is one of the primary agencies responsible for permitting aquaculture activities within the EEZ. NOAA Fisheries Service and the Council have already implemented a FMP for the culture of live rock and have developed a draft Code of Conduct for Responsible Aquaculture. There is also the possibility that national legislation authorizing offshore aquaculture permits in the EEZ could be approved in the future.

Section 10.0 describes NOAA Fisheries Service authority under the Fish and Wildlife Coordination Act, the ESA of 1973, the EFH provisions of the MSFCMA, the NEPA, and the MMPA of 1972,

5.5.1.2 Gulf of Mexico Fishery Management Council

Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. As marine aquaculture operations constitute fishing under the MSFCMA (C.F.R. § 229.2 1999), the Councils have the authority to make recommendations to NOAA Fisheries Service about management of marine aquaculture in the EEZ. Councils may develop fishery management plans to address conservation and management of marine species in need of federal management. Offshore aquaculture legislation proposed in 2007 would have excluded aquaculture from the definition of "fishing" and given fishery management councils a consultative role in the issuance of permits.

5.5.1.3 U.S. Army Corps of Engineers

The ACOE is responsible for issuance of Section 10 permits for offshore aquaculture facilities. Section 10 of the Rivers and Harbors Act (33 U.S.C 403) prohibits the creation of structures not authorized by Congress that obstruct navigable waters of the United States. The ACOE permitting process (Title 33 CFR Section 322) is designed to assess the environmental effects of a structure and any operations associated with the structure, including effects on navigable waters of the United States. NOAA Fisheries Service may provide comments to the ACOE regarding impacts to marine resources of proposed activities and can recommend methods for avoiding such impacts.

5.5.1.4 U.S. Environmental Protection Agency

The Clean Water Act authorizes water quality and pollution research, provides grants for sewage treatment facilities, sets pollution discharge and water quality standards, addresses oil and hazardous substances liability, and establishes permit programs for water quality, point source pollutant discharges, ocean pollution discharges, and dredging or filling of wetlands or waters of the United States. Under Section 318 of the Clean Water Act, the EPA asserts its jurisdiction to require point source pollution discharge permits for marine aquaculture operations in the open ocean. Title 40 CFR Parts 122-124 implement the EPA's NPDES Program. Water quality and effluent standards and criteria for the NPDES are described in 40 CFR, Parts 125, 129, 133, 136, 400-471, and 503. The EPA also published a final rule on August 23, 2004 (69 F.R. 162) establishing Clean Water Act effluent limitations, guidelines, and new point source pollution standards for concentrated aquatic animal production facilities, including facilities that produce 100,000 pounds or more per year of aquatic animals in net pens or submerged cage systems.

5.5.1.5 Minerals Management Service

The MMS has authority to lease sites for minerals development on the Outer Continental Shelf (OCS); however, transfer of structure ownership from oil and gas lessees to other parties may be regulated. MMS is currently developing regulations under the authority of the Energy Policy Act of 2005 that would apply to alternate uses of oil and gas platforms. The Energy Policy Act of 2005 gives the Secretary of the Interior authority to issue a lease, easement, or right-of-way on the OCS for activities that use energy facilities for other (non-energy related) authorized marine-related purposes, such as aquaculture. The MMS published a final Programmatic Environmental Impact Statement in November 2007 which assesses the impacts of allowing the use of energy facilities for non-energy related purposes. A final record of decision to approve and establish an Alternative Energy and Alternative Use Program was published in December 2007. On July 9, 2008 (73 FR 39376), MMS published proposed regulations for their Alternative Energy and Alternative Use Program. The *Federal Register* notice states the following regarding offshore aquaculture: “In the first example, an individual seeks to use an existing oil and gas platform in the Gulf of Mexico to conduct certain offshore aquaculture activities. Offshore aquaculture activities on the OCS are not currently authorized by any other statutory authority. Therefore, MMS may authorize the use of an existing facility for offshore aquaculture activities using an Alternate Use Rights of Use Easement.”

5.5.1.6 U.S. Coast Guard

The USCG is responsible for the regulation and enforcement of various activities in the navigable waters of the U.S. The USCG requires structures be marked with lights and signals to ensure compliance with private aids to navigation (33 C.F.R. 66.01). Title 33 C.F.R. 64 also requires the marking of structures, sunken vessels, and other obstructions for the protection of maritime navigation.

5.5.1.7 U.S. Food and Drug Administration

The FDA has jurisdiction over drugs to treat or prevent parasites or diseases of fish, anesthetize aquatic species, or regulate the reproduction of aquatic species. The FDA also regulates therapeutic agents by setting tolerance levels allowed for human consumption and regulates harvest and marketing of shellfish under the National Shellfish Sanitation Program.

The FDA Center for Veterinary Medicine (CVM) approves new animal drugs and animal feeds that may be used in the production of aquaculture fish and shellfish. The FDA requires scientific evaluation of a drug’s effectiveness and safety for humans and the environment before approval.

5.5.1.8 U.S. Fish and Wildlife Service

Under the authority of the Fish and Wildlife Coordination Act (16 USC 661) the USFWS may review activities that are authorized, permitted or funded by the federal government and make recommendations to the responsible agencies regarding the interests of fish, wildlife and their habitats. The agency also has regulatory responsibilities under the Endangered Species Act of 1973, the MBTA and the MMPA of 1972.

The Lacey Act (16 USC 701) and later amendments, particularly those of 1981 (16 USC 3371-3378) govern the interstate transportation and importation of fish and wildlife and their parts and have some relevance to the introduction of non-native species. The regulations implementing the Act at 50 CFR 16.3 generally prohibit the import into the U.S. of live or dead fish, mollusks or crustaceans unless a permit is obtained from the USFWS at the port of entry (50 CFR 16.13). Permits are generally granted for most species to be imported and held in captivity, except those which have been determined to be injurious. The regulations prohibit the release of imported species into the wild unless done so by a state fisheries agency or persons the agency has authorized to do so. The only species that are strictly prohibited from import are those that have been listed as injurious. The injurious species list currently consists of the walking catfish (family Clariidae), mitten crabs (*Eriocheir* spp.), zebra mussels (*Dreissena* spp.), numerous species of snakeheads (*Channa* and *Parachanna* spp.), silver carp *(Hypophthalmichthys molitrix)*, and largescale silver carp *(Hypophthalmichthys harmandi)*.

The USFWS and NOAA co-chair the federal Aquatic Nuisance Species Task Force, which was established under the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (16 USC 4701) to develop a program of prevention, monitoring, control, and study of aquatic nuisance species. Amendments to the Act authorized the USFWS and NOAA to issue rules and regulations to implement the program as recommended by the Task Force.

5.5.2 State Management

The states may comment on federally proposed regulations under the Coastal Zone Management Act.

5.5.2.1 Alabama

The Alabama Marine Resources Division (AMRD) of the Alabama Department of Conservation and Natural Resources manages Alabama's marine fisheries resources. The AMRD can lease bottoms for culture of oysters and other organisms.

5.5.2.2 Florida

Chapter 597, Florida Aquaculture Policy Act, Florida Statutes, was amended in 1996 to require all Florida aquaculturists to obtain an annual Aquaculture Certificate of Registration. Regulations were amended again in 1998 to require that certified aquaculturists abide by aquaculture Best Management Practices (BMPs) formulated to preserve environmental integrity. Commercial aquaculturists cannot sell their products unless they possess an Aquaculture Certificate of Registration and include their Certificate number on business related invoice, bill of lading, and receipts.

The Florida Department of Agriculture and Consumer Services (DACS) is responsible for BMP development, revision, and farmer compliance. The BMPs are dynamic and subject to revisions driven by technological advancements. The BMPs are a component of Chapter 5L-3, Aquaculture Best Management Practices, Florida Administrative Code, and published by DACS in the form of a manual: http://www.floridaaquaculture.com/bad/bad_bmp.htm. DACS adopted the first *Aquaculture Best Management Practices Manual* in 2000 and the fourth and current edition was adopted in May 2007.

Florida aquaculturists following the BMPs must meet the minimum standards necessary for protecting and maintaining offsite water quality and wildlife habitat. Farms certified through this program as being in compliance with the BMPs are presumed to be in compliance with state ground and surface water standards. The Florida Department of Environmental Protection is not authorized to institute proceedings against any certified facility to recover costs or damages associated with ground or surface water contamination or the evaluation, assessment, or remediation of contaminated ground or surface water.

Florida BMPs were developed and may be created or revised through stakeholder technical advisory committees consisting of farmer, state agency, extension, and environmental group representatives invited by the DACS. Subsequent BMPs are subjected to DACS review and comment before being submitted to normal state agency rule making processes that include public comment and legislative review.

The *Aquaculture Best Management Practices Manual* contains the following topics: federal permitting; construction; compliance monitoring; shipment, transportation, and sale; water resources; non-native and restricted non-native species; health management; mortality removal; preventing wildlife depredation; chemical and drug handling; marine shrimp; sturgeon culture; shellfish culture; live rock culture; aquatic plants; aquatic animal welfare; and marine net pens and cages. The format is a brief description of the issue followed by a bulleted list of prescriptive and general BMPs.

DACS has created and supported several BMP educational and outreach activities. In concert with the University of Florida, Department of Fisheries and Aquatic Sciences, periodic BMP workshops are held and the agencies jointly developed and installed educational signage that illustrates and describes BMPs at four University of Florida operated aquaculture demonstration and research facilities (shellfish, food and bait fish, shrimp, and ornamental fish and aquatic plants). The DACS also publishes a free newsletter, *Florida Aquaculture*, which provides farmers, agencies, legislators and other interested parties notification of BMP development or revision. There are no state dedicated funds to assist farmers with BMP implementation other than technical guidance. The DACS enforces and verifies BMP implementation through unannounced farm inspections. Farms that do not implement or maintain the BMPs are violating state law and are subject to written notice, fines, suspension/revocation of the Aquaculture Certificate of Registration, and potential misdemeanor charges.

Florida has accepted delegation of the Clean Water Act responsibilities from the EPA. Concentrated Aquatic Animal Production facilities in the state that exceed EPA's warm water species production and discharge threshold of 100,000 pounds live weight must acquire a NPDES permit from the Florida Department of Environmental Protection (in Florida parlance an Environmental Resource Permit) as well as an annual Aquaculture Certificate of Registration and abide by appropriate BMPs.

According to the Florida Agricultural Statistics Service, in 2005, there were 710 active aquaculture operations, and in 2003, 544. Altogether, Florida aquaculture producers reported sales of $75 million in 2003 and $95.5 million in 2003. They produced tropical fish, aquatic plants, clams (including clam seed), oysters, shrimp, other fish (hybrid striped bass, koi, largemouth bass, bream, and carp), alligators, catfish, tilapia, other aquatics (crawfish, eels, snails, turtles, crabs, and frogs), and live rock.

Tropical fish are produced in ponds and tanks, and the more prominent species include ornamental favorites, such as guppies, mollies, swordtails, variatus, platies, tetras, gouramies, goldfish, cichlids, barbs, and tropical catfish. Aquatic plants are produced in vats and water surface acres, and include plants for water gardens and aquariums, farm-produced plants used in wetlands restoration, and watercress. Clams, oysters, and live rock are grown in operations that lease state-owned sovereignty submerged land.

5.5.2.3 Louisiana

Louisiana has no regulations for the permitting of offshore aquaculture. As the state entity with the authority and responsibility to manage fisheries in the state, the LDWF would regulate offshore aquaculture as it relates to biological, enforcement, sociological and economic issues of fisheries and the coastal environments that support those fisheries. LDWF currently has authority to permit mariculture in the coastal zone of the state on privately owned property and water bottoms under R.S. 56.579.1. The Platforms for Mariculture Task Force, consisting of state agencies, developed a report in 2005 to the Louisiana Governor examining the economic feasibility of using non-productive oil and gas platforms for sites for aquaculture.

The Louisiana Legislature enacted the "Louisiana Aquaculture Development Act of 2004", (La. R.S. 3:559.1 et seq). It defines "aquatic livestock" as finfish and crawfish produced, raised, managed, or harvested within or from any private, constructed impoundment that has no inlet from or outlet to any public waters as a segment of agriculture. The Louisiana Aquaculture Coordinating Council (LACC) was established within the Louisiana Department of Agriculture and Forestry under the Act. The LACC provides a regulatory framework for the orderly development and maintenance of a modern aquaculture segment of Louisiana's agriculture industry and for the promotion of aquaculture and aquaculture products.

During the Regular 2008 Legislative Session, the Louisiana Legislature passed a resolution indicating their opposition to offshore aquaculture in the Gulf.
During the 2008 Legislative Session, the Legislature also passed HB 488 (Act 280), which requires that marine biologists from Louisiana State University (LSU-Baton Rouge), the Louisiana University Marine Consortium (LUMCON), and the LDWF review an aquaculture project to be located in state offshore waters prior to permitting of the project by the state.

5.5.2.4 Mississippi

The Mississippi Aquaculture Act of 1988 designates the Mississippi Department of Agriculture and Commerce as the agency responsible for issuing cultivation permits for facilities located "in whole or in part, in the Mississippi Sound, the Gulf, or bays or estuaries thereof at such time that such facility complies with all state and federal requirements to protect marine resources" (Miss. Code Ann. § 79-22-17 (1999)). The Mississippi Secretary of State, "upon recommendation of the Mississippi Department of Marine Resources and the Mississippi Department of Environmental Quality may lease waters as provided by Section 29-1-107, Mississippi Code of 1972" (Miss. Code Ann. § 79-22-23(1)). The Mississippi Department of Marine Resources is "authorized to develop a marine aquaculture lease management program and may adopt such rules and regulations as may be necessary to implement the marine aquaculture lease management program and to regulate the growth of aquaculture" (Miss. Code Ann. § 79-22-23(1)). "The Commission on Wildlife, Fisheries, and Parks and the Commission on Marine

Resources may promulgate regulations which specify design criteria to protect the resources within their jurisdiction and to prevent the release of undesirable species from an aquaculture facility into the environment" (Miss. Code Ann. § 79-22-15(5)).

5.5.2.5 Texas

The Texas Aquaculture Code authorizes the Texas Department of Agriculture (TDA) and TPWD to adopt rules to carry out the duties of each agency with respect to aquaculture. TDA is the lead agency in charge of regulating aquaculture within the state of Texas and its coastal waters under Texas Agriculture Code § 12 Chapter 134 et seq.

TPWD has regulatory authority over the transport of aquatic products into or within state territory including its coastal zone (TPWD Code § 47.018). TPWD is also charged with establishing the rules and regulations governing the introduction of any aquatic product into public waters (TPWD Code § 66.015) and may lease state bottoms for aquaculture. TPWD Code § 57.251-259 describes TPWD's regulations for offshore aquaculture in Texas state waters of the Gulf. TPWD regulations include: definitions, general regulatory provisions for offshore aquaculture facilities, permit application and renewal requirements (as well as reasons for denial), regulations for amending permits, reporting and recordkeeping requirements, prohibited acts, and violations and penalties.

5.5.3 Existing opportunities for public comment on aquaculture-related activities

5.5.3.1 Clean Water Act - Administered by EPA

Under Section 318 of the Federal Water Pollution Control Act (commonly known as the Clean Water Act), the EPA asserts its jurisdiction to require point source pollution discharge permits for marine aquaculture operations in the open ocean.

Implementing regulations at 40 CFR 124.10 describes procedures for public notice of permit actions and public comment periods under the Clean Water Act. Public notice must be made of the preparation of a draft permit, and at least 30 days are to be allowed for public comment. The regulations state "all persons, including applicants, who believe any condition of a draft permit is inappropriate or that the director's tentative decision to deny an application, terminate a permit, or prepare a draft permit is inappropriate" must submit information to the RA within the public comment period. The RA must notify each person who has submitted written public comments of the final permit decision.

5.5.3.2 Magnuson-Stevens Fishery Conservation and Management Act - Administered by NOAA Fisheries Service

Implementing regulations for the Magnuson-Stevens Fishery Conservation and Management Act describe the procedure for issuance of an EFP (50 CFR 600.745(b)). Public comment is solicited as follows: "If the Regional Administrator or Director determines that any application warrants further consideration, notification of receipt of the application will be published in the *Federal Register* with a brief description of the proposal, and the intent of NOAA Fisheries Service to issue an EFP. Interested persons will be given a 15- to 45-day opportunity to comment and/or comments will be requested during public testimony at a Council meeting" (50 CFR 600.745(b)). If actions in the subject FMP established a new aquaculture permitting system, then aquaculturists would not apply for an EFP and this opportunity for public comment on proposed activities would not be applicable.

5.5.3.3 Rivers and Harbors Act - Administered by ACOE

Implementing regulations for Section 203 of the Rivers and Harbors Act of 1899 (33 CFR 325.2(d)) state public notice of a permit application will be issued within 15 days of receipt of all required application information. A 15 to 30 day comment period on the proposed permit begins the date of publication of the public notice. This comment period can be extended up to an additional 30 days if deemed warranted by the district engineer.

5.5.3.4 Energy Policy Act of 2005 - Administered by MMS

The Energy Policy Act of 2005 gives the Secretary of the Interior authority to issue a lease, easement, or right-of-way on the OCS for activities that use facilities for other (non-energy related) authorized marine-related purposes, such as aquaculture. The MMS published a final PEIS in November 2007 which assesses the impacts of allowing the use of energy facilities for non-energy related purposes. The MMS made a final decision on this action in December 2007. On July 9, 2008, the MMS published a proposed rule addressing alternative energy and alternative uses for energy structures. The public comment period for this rule ends September 8, 2008.

6.0 Environmental Consequences

6.1 General Description of the Marine Aquaculture Environment

6.1.1 Impacts of Marine Aquaculture on Local Wildstocks

The rapid development of marine aquaculture around the world has raised concerns over the possible genetic and ecological impact of escaped fish on natural populations. Potential effects include genetic alteration and reduced fitness, competition for food and space, introduction or spread of diseases and parasites, and predation on native stocks.

There is some information available on the intentional release of marine fish species for purposes of stock enhancement and of shellfish species for commercial production and habitat restoration. In addition, there is some information on escapes from salmon farms. However, there is little data available on accidental releases (escapees) as applied to marine finfish species in aquaculture. Intentional releases for stock replenishment or stock enhancement may have positive or negative effects on natural populations by increasing stock size and abundance. Similarly, the effects of accidental releases by species or number may or may not have negative effects. The effect depends on the genetic state of the escaped cultured fish as well as the numbers and mean individual size of the escaped population.

For fishes, whether marine, anadromous or freshwater, the natural genetic variation is partitioned geographically across the range of the species. This universal feature of genetic stock structure in natural fish populations is the need to respond to environmental variability and is generally believed to be important to the long-term survival and fitness of populations within species. These locally adaptive features of fish populations are at risk from interbreeding with fish escaping from aquaculture facilities that are of non-local origin, or local indigenous stocks that have undergone artificial selection or domestication (Youngson et al. 2001).

Fishery management in the United States and abroad is based on knowledge of stock structure within a species, and protection of stocks by managing harvest. Today, identifying population structure is essential for good fisheries management and such information is required in order to assess the impact of escaped aquaculture fish. Large-scale population genetic analysis of marine fish stock structure has accelerated in recent years with the advent of allozyme, microsatellite, and mitochondrial DNA polymorphism technology, and at least some genetic stock structure information exists for most finfish species presently in culture.

Naturalization of introduced non-native species that results in invasion and competition with native fauna and flora is recognized as a primary threat to global biodiversity (Wilcove et al. 1998; Bax et al. 2001; D’Antonio et al. 2001; Olenin 2002). Non-native species have also been shown to be a primary causal factor in the loss of biodiversity of United States biota. The introduction and naturalization of non-native species is believed to be the second most detrimental loss of biodiversity after habitat degradation and loss.

Nationwide, about 400 of the 958 (42 percent) species listed as threatened or endangered under the Endangered Species Act are considered to be at risk primarily because of competition with and predation by non-indigenous species.

Invasion of the nation's coastal ecosystems by marine non-native species is accelerating (Grosholz and Ruiz 1996) and species that become invasive have the potential to cause economic damage as well as ecological harm. In marine ecosystems, invasive species have the potential to change community structure, food web dynamics, genetic structure, and in general modify ecosystem processes (Verlaque and Fritayre 1994; Vitousek et al. 1997; Shiganova 1998; Grosholz et al. 2000; Semmens et al. 2004). These fundamental biological changes in ecosystem services can result in degraded habitat, transmission of disease, and ultimately the loss of species through replacement of native species or stocks by the invader.

Most introduced species do not become invasive and documented negative effects of introductions are infrequent. Classification of an introduced species as invasive requires that the non-native species introduction is followed by successful colonization and becomes economically harmful (Williamson and Fitter 1996). However, the unpredictability of the ultimate geographic distribution of a NIS and the potential ecological damage to native biota is cause for concern for a non-native species escaping from aquaculture facilities.

The introduction and naturalization of non-indigenous marine finfish species through human activities may be intentional or inadvertent. Common marine pathways for inadvertent introductions are the dumping of ballast water from distant sites, the aquarium trade (Courtenay and Robins 1973; Courtenay and Stauffer 1990), culture-based fisheries, and purposeful introductions of a species for creating recreational or commercial fisheries. Aquaculture is also a recognized pathway for both purposeful and inadvertent introduction of non-native species in aquatic ecosystems.

Froese and Pauly (2002) list 1,145 successful finfish introductions worldwide, with 241 of these being marine species. Freshwater fishes appear to be the most invasive and problematic of the introduced finfish species (Zaret and Paine 1973; Goldschmidt et al. 1993). Anadromous fish species, although not as widely introduced as freshwater species, have been successfully introduced into North and South America, and elsewhere. Other examples are the successful introductions of anadromous striped bass and alewives from the eastern United States to the west coast where they have become established in the states of California, Oregon, and Washington.

Fewer marine species are reported to be introduced. Of these, successful introductions of tropical marine fish species have been rarely reported (Semmens et al. 2004). Fewer marine introductions may not represent a lower potential for naturalization, but rather the lower frequency of attempts to make purposeful introductions.

Between 1955 and 1961 the Hawaiian Islands Division of Fish and Game released 11 species of non-native marine groupers (Serranidae) and snappers (Lutjanidae) to enhance near-shore fisheries of the Hawaiian Islands (Randall 1987). Of these, the peacock grouper *Cephalophis argus*, the blacktail snapper *Lutjanus fulvus*, and the bluestriped snapper *Lutjanus kasmira* became naturalized, and have now established self-sustaining populations.

Anecdotal information from the tropical western Atlantic indicates that 13 species were intentionally introduced to Bermuda for commercial and game fishing in the 1920s. Of those, queen angelfish *Holacanthus ciliaris*, grey angelfish *Pomacanthus arcuatus*, and mutton snapper *Lutjanus analis* have become established (Walford and Wicklund 1973; REEF 2002). In both Hawaii and Bermuda, when significant propagule pressure was applied through intentional or unintentional introductions, exotic fishes have established self-sustaining populations.

Since 1999 divers have reported 16 non-native marine fish species from 32 locales off the east coast of the United States (REEF Fish Survey), and all of the observed non-native species have been imported in the marine aquarium trade (Semmens et al. 2004). The red lionfish *Pterois volitans* has apparently become established in marine waters of the southeastern United States (Whitfield et al. 2002). The largest set of intentional marine fish introductions were carried out in the temperate coastal and inland seas of Russia (Baltz 1991). Sixteen species became established, with ecologically and economically devastating results including harm to valuable fisheries, parasite introductions, and the endangerment and extinction of native species (Baltz 1991).

In the past, introductions of Turbot *Psetta maxima,* have been carried out in the former USSR (FAO 1997), in Iran (Coad 1995), and in Chile for aquaculture purposes (FAO 1997; Pérez et al. 2003), but with no successful recapture or establishment of breeding populations. However, self-sustaining populations of Turbot were successfully introduced in waters around New Zealand (Muus and Nielsen 1999). Experimental releases of cultured fry for stock enhancement purposes have been performed in Spain (Iglesias and Rodriguez-Ojea 1994), Denmark (Nicolajsen 1993; Støttrup and Paulsen 1998), and Norway (Bergstad and Folkvord 1997).

6.1.1.1 Escapement

With relatively few exceptions, marine fish presently used for aquaculture purposes in the U.S. are genetically and phenotypically close to their wild conspecifics, having been collected directly from wild populations as eggs or juveniles, or derived from wild broodstock which are spawned in captivity. While these practices minimize the immediate risks to the genetic makeup of local populations, large scale aquaculture programs inevitably require continuous and dependable supplies of juveniles which can only be obtained from hatcheries.

Several factors merit consideration when evaluating the likely ecological, environmental, and genetic impacts cultured fish may have should they escape. Among them are the following: natural population genetic structure and phenotypic variability of the stock; the size of the stock relative to the estimated number and frequency of escapement; the type of breeding program to be used, including selection of the founding stock; and the likelihood that unintentional genetic drift (domestication) related to hatchery practices will occur. Also, the economic imperative to improve stock performance (growth rate, disease resistance) through selective breeding may decrease the genetic diversity of farmed strains compared with their wild counterparts. Natural mating of farmed fish and wild fish conspecifics has been documented, leading to alterations in the local genetic structure (Perez-Enriquez et al. 2001; Alarcon et al. 2004). However, these changes are not necessarily deleterious even when farmed fish greatly outnumber their wild counterparts.

6.1.1.2 Genetic Diversity

One outcome of introducing closely related species is the potential for interspecific hybridization leading to endogenous selection against hybrids through loss of fitness, and reduced population size of the contributing species (Barton and Hewitt 1985; Campton 1987; Gardner 1997; Rao and Lakshmi 1999). The prevailing view has been that natural hybridization is an evolutionary dead end, because hybrids could generally never do better than parental types (Barton and Hewitt 1985).

Recently, natural hybridization has been documented in more marine species (Roques et al. 2001) along with the view that narrow hybrid zones between species have little consequence on the genetic integrity of the parental species (Barton 1979; Barton and Hewitt 1985, Barton and Hewitt 1989; Hewitt 1988). It has been suggested that introgressive hybridization may sometimes be a rich source of genetic variability important to the evolution of new species (Arnold 1992; Martin and Cruzan 1999). Although the first hybrid generation may be more robust and superior in some aspects to either parent species, reduced fitness can be a long-term result, a phenomenon referred to as outbreeding depression. This may occur due to loss of adaptation to specific habitats and disruption of coadapted gene complexes, potentially resulting in reductions in growth, survival, fertility, thermal tolerance, or homing (Leary et al.1995). Nevertheless, an example of natural hybridization and naturally occurring ocean hybrid zones are still rare, and controversial. The genetic consequences of hybridization is unknown. Therefore, the consequences of hybridization between escaped farmed fish and closely related natural species are still generally unknown and should be avoided.

6.1.1.3 Competition

Extinctions of long-term resident species resulting from the introduction of predators or pathogens into spatially-restricted environments such as islands or lakes, or by habitat alterations are well documented in the scientific literature. For example, predation by brown tree snakes *(Boiga irregularis),* introduced to Guam in the Mariana Islands during the last half of the twentieth century, caused the extirpation or serious reduction of most of the island's 25 resident bird species (Wiles et al. 2003). A community of over 400 fish species occupying Lake Victoria (Africa) collapsed to three co-dominant species in just 11 years following a staggered series of irruptions in the population of Nile perch *(Lates niloticus)*, an introduced species. The extirpation of fish species at virtually all trophic levels may have further intensified eutrophication of the lake by decoupling the internal nutrient cycling and export system (Kaufman 1992). These habitat alterations have furthermore decreased the range (and population size) of the few native species that remain.

While intertrophic interactions such as those cited above clearly can have profound ecological effects, including extirpation or extinction, competition between species at the same trophic level (controphic interactions) are often limited to changes in the dominance-abundance of a community (Davis 2003). To illustrate, the construction of the Suez Canal in 1869 permitted a sudden, large scale mixing of the formerly isolated marine biota of Mediterranean Sea and Red Sea. As described by Mooney and Cleland (2001), the introduction of over 250 species, 34 new genera, and 13 new families into the Mediterranean Sea has resulted in only one documented extinction. Niche displacement through competitive interactions among congeners has occurred, with native Mediterranean species adjusting their foraging depth distributions to accommodate the colonizing species (Golani 1993). Nevertheless, some co familiar indigenous species have nearly disappeared from local catches, having been replaced by Red Sea species that occupy similar habitats (Golani 1998).

Deleterious changes in marine fish assemblages resulting from aquaculture development (and the corresponding introduction of non-native species) have been suggested, but not confirmed, by scientific studies. Conversely, a long-term study (1984-2001) comparing icthyofauna of the sandy shore of the Northern Red Sea assessing fish assemblages before the commencement of marine aquaculture, during the buildup phase (<100 tonnes per annum), and during full production (2000 tonnes per annum) found no significant change in number of individuals, number of species, biomass per sample, or cumulative number of species (Golani and Lerner 2007).

6.1.2 Aquatic Animal Health

6.1.2.1 Infectious Disease Interactions between Wild and Farmed Fish

Like terrestrial animals and humans, aquatic animals, such as fish, mollusks, and crustaceans, can become sick due to infectious diseases. Disease is a complex process that involves a pathogen (a disease-causing agent such as virus, bacteria, or parasite), a susceptible host (fish or shellfish), a sufficient number or “dose” of pathogens to overcome the immune system of the aquatic animal in order to cause disease, and an aquatic environment that favors the pathogen and/or stresses the susceptible host. Wild and cultured aquatic animals are known to experience stress due to a variety of causes, such as higher than normal densities, and this may increase their susceptibility to infection.

Water moves freely between farmed fish in cages/pens and the open marine environment. Outbreaks of infectious diseases have been observed in farmed fish. Further, escapes have occurred from farms where diseases are occurring. There is evidence to suggest in specific regions of the world in select species there is a risk of pathogen transmission from farmed aquatic animals to wild populations (to be discussed later in this section). Likewise, pathogens are commonly transferred from wild reservoirs to farmed animals. Both wild and farmed aquatic animals are constantly exposed to pathogens in the aquatic environment. These pathogens are part of the natural fauna and although wild marine organisms typically serve as carriers of these pathogens, disease actually occurs only when the pathogen overcomes its host's immune system; for example, humans are frequent carriers of *Streptococci* in their throats and influenza in their noses, but unless their immune systems are compromised in some way, they do not become sick.

Experience with commercial production of non-salmonid marine fish in hatcheries and open ocean systems in the U.S. are limited, though operations in New Hampshire, Hawaii and Puerto Rico are increasing the existing knowledge base. On the other hand, warm water marine aquaculture has been practiced for many years in many countries in Asia and Europe and the U.S. has over forty years of experience working with salmon in open water marine pens. At commercial salmon hatcheries, juveniles are reared in fresh water typically from springs or wells which minimize exposure to serious pathogens. Before transfer to saltwater, some states (Washington and Maine) require the fish to be free of certain pathogens. Other states, such as Texas and Florida, require that transfers of fish are carried out under the auspices of a permit issued by the State. Conditions can then be placed in these permits that would require pre-transfer inspections for disease. This measure for disease prevention is incorporated into this FMP.

After transfer to marine pens, fish may be exposed to pathogens already existing in the environment. Because of the relatively high fish densities that are typical in cages or pens it is possible for pathogens to spread through the captive population and multiply sufficiently to cause an outbreak of disease. The trigger for these outbreaks may be alterations in environmental conditions (e.g. temperature), or perhaps handling during farm operations. There are no data to indicate that diseases that have occurred in marine fish farms in North America have been a pathway for the introduction of foreign or exotic diseases. Further, studies have shown that within a few meters of a marine net-pen experiencing a disease outbreak levels of certain pathogens shed are rapidly diluted – possibly to doses that are insufficient to initiate infections in healthy wild or farmed fish (Rose et al. 1989).

A more detailed exam of the risks posed by farmed aquatic animals to wild populations in the Gulf of Mexico must be considered. This analysis should take into consideration the pathogen types (virus, bacteria, and parasites), knowledge of episodes in comparable species and settings, and the likelihood that disease outbreaks will impact specific wild populations. While most of the scientific literature on this topic is related to salmon aquaculture and may not apply to the Gulf of Mexico, there is experience with marine aquaculture in Hawaii, Puerto Rico, and the Mediterranean Sea –regions where water temperatures and species reared are more comparable to those that might be reared in the Gulf of Mexico.

The most likely infection by a viral pathogen in fish farmed in the Gulf of Mexico would be from those in the *Nodavirus* family. This type of virus causes retinopathy and encephalopathy and has negatively impacted marine aquaculture operations in the Mediterranean region. This virus has a global distribution in the wild and has been found to infect both wild and farmed fish. There is a paucity of information in regards to farmed-wild interactions with this virus; however, there is information on the interactions of infectious hematopoietic necrosis virus (IHNV) that indicate amplification from aquaculture facilities appears to have no impact on wild populations (LaPatra and Foott 2006).

Two bacterial pathogens naturally-occurring in the Gulf of Mexico that has the potential to cause infection in fish farms are from the *Listonella* and *Photobacterium* families. While *Listonella* (vibrio-type bacteria) are wide-spread in wild populations and cause disease in farms, vaccines have been proven in preventing this disease. There is no evidence of transfer from farmed to wild populations. Likewise, *Photobacteriem* are widely distributed in the wild and have caused significant outbreaks in both situations (Snieszko et al. 1964; Hawke et al. 2003). There is an absence of epidemiological information that indicates farmed to wild pathogen transmission.

The most compelling information in regards to the potential for fish farms to amplify pathogens that impact wild populations is in the area of parasitic organisms, specifically, *Lepeoptheirus salmonis* (sea lice) in salmon. Sea lice are akin to fleas on a dog and are observed on farmed and wild salmon and other non-salmon fish hosts (Jones et al. 2006). Though these lice are normal fauna in marine systems, at certain times of the year when juvenile anadromous salmonids migrate from freshwater streams through restricted fjords or estuaries occupied by salmon farms on their way to the open ocean, the potential exists for lice shed from farms to infect the wild out-migrating fish. Data from Ireland and Norway suggest that lice from Atlantic salmon farms have negatively impacted sea trout and char (Tully et al. 1999; Bjorn et al. 2001; Bjorn and Finstad 2002). On the other hand, no evidence of lice transfer from farmed fish to wild fish was found by McVicar et al. (1993) who noted sea trout had been in decline in Scotland since the 1950's due to causes other than disease. Other authors have found no link between farms and intensity of lice in wild populations and subsequent declines in wild populations in Scotland or the east coast of Canada (MacKenzie et al. 1998; Carr and Whoriskey 2004). More recent studies in western Canada (Krkosek et al. 2005; Morton et al. 2005) suggest that salmon farms in British Columbia have shed sea lice to the extent of causing significant infections in wild juvenile Pacific salmon. These authors have further postulated that the marine salmon farms are responsible for depressions in the wild Pink salmon *Oncorhynchus gorbuscha,* populations in the Broughton Archipelago. These assertions were made without data on the actual prevalence of sea lice on the salmon farms and with little consideration of resident wild salmon or alternative hosts such as wild non-salmonid marine species serving as a source of infection. Subsequent published reports provide data that demonstrate wild three-spine stickleback *Gasterosteus aculeatus*, a non-salmon marine species in large numbers, are natural reservoirs for sea lice (Jones et al. 2006) and reside in the vicinity of salmon farms. Other studies suggest that levels of lice fluctuate significantly year to year due to climatic conditions, currents, and salinity of seawater

(Brooks 2005), and that wild salmon populations and farmed salmon can and continue to coexist successfully in the marine waters of British Columbia, Canada (Beamish et al. 2006). These most recent scientific studies appear to refute the conclusions of Morton et al. (2005) and Krkosek et al. (2005).

While it is highly unlikely to have salmon sea lice occur in the Gulf of Mexico, other kinds of ecto-parasites occur in the wild in the Gulf of Mexico and may infect the farmed fish. Scenarios experienced in Ireland and Norway are not likely to occur in the Gulf with comparable parasites due to the fact that the farms in the Gulf will not be located in fjords where the space/parasite interaction is highly restricted. Nevertheless, ongoing fish health monitoring (as directed in this FMP) needs to occur and severe infections will need to be treated with appropriate and approved pesticides. Sea lice control programs in Maine and Canada have demonstrated that farmers can significantly reduce infections on farmed fish – reduced to levels such that there is no significant disease impact on either wild or farmed fish. It will be a requirement on any permits issued that such disease monitoring and control programs will occur on any fish farm in the Gulf of Mexico.

Disease outbreaks also occur in populations of wild aquatic animals. Significant disease events have been observed when large numbers of wild fish aggregate, such as at spawning time, or when there are stressful environmental conditions like prolonged elevated water temperatures in the summer; for example, an outbreak of viral hemorrhagic septicemia, a naturally-occurring disease in marine waters, caused significant mortality in wild pilchard and herring in the northeast Pacific Ocean (Traxler et al. 1999).

The transfer of pathogens from one geographic region to another via the intentional or natural movement of fish or shellfish is possible. One example is the white spot syndrome virus (WSSV) in live shrimp transferred from Asia to South America. This introduction was caused by illegal movements of shrimp and improper health inspections prior to legal shipments. Another example is the accidental introduction by the government of Norway of the ectoparasite, *Gyrodactylus salaris,* from the Baltic Sea region in Sweden to Norway. This introduction occurred due to inadequate health inspections prior to transfer of the juvenile salmon. Although the United States currently has regulations restricting some pathogens from entering the country, those regulations focus primarily on pathogens that infect salmon species. The USDA also has in place import regulations governing the movement of fish species that are susceptible to viral hemorrhagic septicemia virus (VHSV) and spring viremia of carp virus (SVCV). In recent years the U.S. Departments of Agriculture (Animal and Plant Health Inspection Service (APHIS), Commerce (National Marine Fisheries Service), and Interior (US Fish and Wildlife Service) have been tasked with developing a National Aquatic Animal Health Plan (NAAHP). A final draft of the NAAHP has been completed and is to be published in the *Federal Register* for public comment in January or February, 2009. The NAAHP gives guidance on how to address issues of importation of all aquatic species and associated pathogens of concern, although, with the aforementioned exceptions, specific importation regulations have not yet been developed.

Escape of farmed fish from marine net-pens is well documented. However, the ability of such escapees to spread disease to wild aquatic animals is thought to be limited because many of the farmed fish quickly become easy victims of predators. Should escapees be carrying a disease agent (pathogen), the likelihood of their being the principal source of an outbreak in wild fish is remote because: (i) Any pathogens they carry are likely those to which the wild fish are routinely exposed and have developed natural immunity; (ii) escapees are unlikely to generate enough infection pressure (dose) to result in disease in a healthy wild stock; and (iii) environmental factors play a larger role in triggering a disease event than the presence of a pathogen (Amos and Appleby 2001; Amos and Olivier 2002).

In summary, the risk of transfer of pathogens from farmed fish to wild aquatic animals is low. Sea lice shedding from salmon farms in some regions of the world appear to pose the most likely negative impact to wild fish populations; however, preventative measures to include mandatory lice management control programs appear to mitigate the impact to wild populations. There are examples of exotic diseases introduced by farmed aquatic animals resulting in disease events in native wild animals and other farmed animals, as in the case of *G. salaris* in Norway and WSSV in shrimp in South America. Disease outbreaks occur in both wild and farmed aquatic animals, but with the exception of sea lice, there is little scientific data to link disease episodes in wild populations to farmed animals. Notable exotic disease introductions by farmed aquatic animals have been the result of inadequate health inspections or illegal imports. Most infectious diseases can be prevented/managed at farms. Vaccines play an important role in protecting farmed fish from disease and have significantly reduced the use of antibiotics in aquaculture.

6.1.2.2 Therapies to Prevent and Control Infectious Diseases

Infectious diseases in cultured marine animals can result in mortality and decreased efficiencies in production due to slowed or altered growth patterns. To prevent or control infectious disease events the primary tools used by culturists are biologics (vaccines), antimicrobials such as antibiotics, external therapies such as drugs/chemicals that are applied via the aqueous rearing environment of the animal, and good or 'best management practices' (BMPs). A list of approved drugs for use in aquaculture can be found on the FDA's website: http://www.fda.gov/cvm/drugsuseaqua.htm, and is also provided in Appendix K.

The most common biologics used for farmed fish are vaccines. Similar to vaccines used in human and terrestrial animal medicine, vaccines are injected into the host and the host subsequently develops immunity from the specific disease for which the vaccine was prepared. In finfish aquaculture, vaccines have been successfully used to prevent a variety of bacterial diseases, including vibriosis and furunculosis, and some viral diseases such as IHN and ISA. Scientific studies are in progress to develop vaccines for external parasites. All vaccines for use on fish destined for human consumption must be approved by the USDA, APHIS – the federal agency responsible for regulating animal biologics.

These approved vaccines have been determined by the USDA to be safe and effective for the aquatic host being vaccinated, and safe for the environment and the human consumer.

Antimicrobials are compounds used to treat animals that are infected with pathogens. The most common of the antimicrobials used in finfish aquaculture are antibiotics. Antibiotics are also used in human and animal medicine. Their primary function is to treat diseases caused by bacteria. They function as bacteriostats (stop the bacteria from effectively reproducing in the host), or as bactericides (kill the bacteria in the host). All antibiotics used in the United States for animals must be approved for use by the U.S. FDA, Center for Veterinary Medicine. Before an antibiotic is approved for use it must be evaluated for target animal safety, efficacy, human food safety, and environmental safety. The FDA approval process takes several years and costs millions of dollars. Currently, there are three antibiotics approved for use in finfish. Antibiotics are applied by either as an ingredient of the feed or by an injection. Regardless of route of administration, careful guidelines must be followed for dose and withdrawal times. Prescription and the administration of antibiotics are made at the direction of a licensed veterinarian.

There is a concern by some that antibiotics in uneaten fish food may pass through nets, settle to the benthos, and potentially impact resident organisms. A concern has been raised that the potential exists for these antibiotic residues to induce drug-resistant strains of human pathogens. Studies indicate that oxytetracycline may persist in sediments below pens for a period of time, but there is no indication that these residues have had long-term negative impacts on the environment or have caused human health problems. Globally, the use of vaccines to prevent bacterial diseases has in the past twenty years reduced the use of antibiotics in marine farming by 95 percent.

Other types of drugs applied to fish are compounds to kill parasites. Sometimes these compounds are applied in the feed while in others they are applied as a bath to kill external parasites or bacteria on the skin of the fish. Like antimicrobials, use of these compounds depends on approval by the FDA or the EPA (EPA is the lead federal agency if the compound is a pesticide and not a drug) and must be effective, safe for the host, safe for humans, and safe for the environment.

6.1.2.3 Measures to Protect the Health of Wild and Cultured Stocks

Prevention is the preferred method to deal with aquatic animal health issues. Three approaches need to be considered: 1) use of good management practices/BMPs by the fish culturist; 2) an ongoing fish health monitoring program by an aquatic animal health specialist; and, 3) a regulatory structure that supports aquaculture and wild stocks by preventing the introduction and dissemination of foreign or exotic diseases.

The fish farmer is the primary health giver for cultured animals. Attention must be given to providing bio-security to the culture site, practicing appropriate sanitary measures and following good management practices for fish culture. These practices include rapid removal of mortality, appropriate rearing densities, good record keeping, and working with an aquatic animal health expert in developing and implementing the health program.

The aquatic animal health expert, defined as a licensed doctor of veterinary medicine or certified by American Fisheries Society, Fish Health Section, as a “Fish Pathologist” or “Fish Health Inspector”, is responsible for regular observations and examinations of the fish, using preventative measures, such as vaccines, directing the use of approved drugs as appropriate and notifying government officials upon discovery of a serious or ‘reportable’ disease.

The third measure of prevention is policies and regulations administered by state and federal agencies. USDA/APHIS is the lead federal agency responsible for the health of all farmed animals. NOAA Fisheries Service and the USFWS are the federal agencies that share responsibility for wild and feral aquatic animals. All three agencies work closely with States and Tribes that also have their respective aquatic health policies and regulations. Historically, States have been effective in developing and implementing regulations to prevent the introduction of exotic diseases. Since 2002, when the Animal Health Act was passed by Congress, USDA/APHIS has initiated programs to address the import of diseases of concern. In cooperation and collaboration with APHIS, NOAA Fisheries Service, and the USFWS are developing a national aquatic animal health plan. This plan is scheduled to be completed this summer with implementation to follow as resources allow. By utilizing all three mechanisms to manage aquatic diseases, the experiences of introducing or spreading serious diseases, such as the Norwegian experience with *G. salaries*, should be avoided.

6.1.3 Effluents from Marine Fish Culture Facilities

6.1.3.1 Effects on Benthos from Solids and Dissolved Nutrients

The responsibilities of the EPA include regulation of the country’s coastal and offshore marine environments. For many years the Agency has continued to set parameters, both onshore and offshore, in which industries may operate. One is the marine aquaculture industry, and regulations are imposed through NPDES permits. The environments essential to fish habitats are managed by the MSFCMA, which continues to manage the fisheries and promote conservation, and the recently introduced National Offshore Aquaculture Act of 2007 (Appendix B) is designed to produce economic benefits and food production while ensuring the development of regulatory standards to protect marine ecosystems.

The relevant perceived risks of the field of marine fish culture as identified by international experts are divided into eight main categories (Nash et al. 2005). The two most important are: (i) The risks of increased organic loading on the benthos, and (ii) the nutrient enrichment of the water column. The effects of organic effluents to and from the fish farm environments have been studied now for some forty years. Consequently, the assessments of risks of fish farming and management have been summarized by Hargrave et al. (1997), Hambrey and Southall (2002), Levings et al. (2002), Brooks and Mahnken

(2003), and Pérez et al. (2003); Scottish Executive Central Research Unit (2002), the British Columbia Ministry of Water, Air, and Land Protection (MWLAP 2002); and the International Council for the Exploration of the Sea (ICES 2002-2004).

A review of these risk assessments show that the majority of effects are based on the past and current farming practices for Atlantic salmon in specific countries, and only a few other marine fish. These assessments are by many countries specifically relevant to their coastal environments; for example, aquaculture in the fjords of Norway (Maroni 2000; Kutti et al. 2007a, 2007b); among the islands of the west coast of Scotland (SEPA 2000, 2005), in the cold waters of Sweden (Ackefors 2000) and Finland (Varjopuro et al. 2000); and south in Australia and Tasmania (ANZECC 1992, Walker and Waring 1998, and Macleod and Forbes 2004). Most of the European standards of marine fish culture which have emerged are based on the Norwegian and Scottish experiences and long-established data-bases, and have been summarized for Europe by Fernandes et al. (2001), Fernandes and Read (2001), and Henderson and Davies (2001). However, it is necessary to remember that the farming areas around both Scandinavia and Europe currently are quite shallow because the net-pens are relatively close to shore. In the U.S., the EPA has developed NPDES standards concentrated aquatic animal point sources (Appendix G).

Four standards are commonly recognized as the key indicators of change and potential environmental impact in and around an aquaculture site. These are:

(i) Total volatile solids (TVS) in the sediment,
(ii) The redox potential (eH) of the sediment,
(iii) The presence of soluble hydrogen sulfide (free sulfide) in the sediment,
(iv) Dissolved inorganic nutrients, nitrogen and phosphorus, in the water column.

TVS is an alternative measure of the suspended or dissolved organic matter in any aquatic habitat which is volatile. This measure is a good but crude indicator of the biological and chemical effects in the sediments beneath and around fish farms; however, it is the preferred indicator for monitoring the benthic impact of any fish farm. Determination of the redox potential (eH) in the sediment beneath and around a farm site provides an accurate indication of its stability and quality, and the reduction and oxidation characteristics of the sediment. The increased concentration of sulfides on the sediment beneath fish farms is another consequence of the continuous deposition and degradation of organic wastes. In such anaerobic conditions, these wastes are rapidly metabolized by the reduction of sulfates to sulfides by bacteria. Finally, it is important to prevent the development of noxious conditions above the substrate for the epifauna. In addition to toxicity such conditions can lead to eutrophication, resulting in concomitant reductions in dissolved oxygen levels or production of harmful algal blooms.

There are four optional standards which are useful indicators of some changes occurring in the environment. However, these are not imperative to determine every time as they do not provide information that cannot be deduced from the four priority standards. These four secondary standards are:

Dissolved oxygen levels in the water column,
The presence of chlorophyll-a,
The acidity or alkalinity (pH) of the water column, and
Suspended solids

The purpose for the standard of dissolved oxygen levels in the marine water column is to prevent the development of anoxic conditions which would impair the physiological processes and metabolism of aquatic organisms, and to maintain the natural balance of species populations within the ecosystem. Chlorophyll-a is a plant pigment used to determine the amount of algal biomass, or standing stock of phytoplankton, present in a body of water. Excessive amounts of chlorophyll-a indicate an algal bloom that may reduce water clarity and may result in depleted oxygen levels; therefore the algal bloom conditions are defined by routine chlorophyll measurements.

Recent environmental monitoring studies conducted off Puerto Rico, New Hampshire and Hawaii indicate benthic and organic loading tends to be fairly localized around open-ocean aquaculture cages (Alston et al. 2005; Rapp 2006; UNH Marine Aquaculture Center 2006; Lee et al. 2006). Alston et al. (2005) conducted bimonthly chemical and macroinvertebrate sampling at a control site and sites 0, 20, and 40 meters away from two cages off the coast of Puerto Rico in 2002 and 2003. There were no significant differences among sampling sites in ammonia-N, nitrate-N, nitrite-N, or phosphate concentrations in the water column. Similarly, there were no significant differences detected among sampling sites in organic matter or organic nitrogen in the sediments, organic nitrogen beneath the cages, organic matter among sampling stations, and total carbon beneath the cages (Alston et al. 2005).

Rapp (2006) conducted additional environmental monitoring at the same fish cage assessed in the Alston et al. (2005) study. This study was conducted for 15 consecutive months in 2004 through 2005. Organic and benthic loading was measured at four stations along a transect extending immediately under the cage out to 100 m away from the cage. No organic loading in the benthic water was observed for the first seven months of the study. In the eighth month of the study and thereafter an increase in benthic water organic loading was observed. This increase was attributed to a change in composition and integrity of the fish feed (Rapp 2006). The study reported no increase in organic loading in the sediment for the duration of the project. Organic loading in the water column did not integrate into the sediment because of the composition of the sediment ($CaCO_3$) and high current speeds near the benthos (Rapp 2006).

Lee et al. (2006) observed differences between control and near-cage sites off Hawaii with a shift toward anaerobic conditions due to carbon influx from cages. The study noted that eutrophication effects increased away from the study site, but were localized in areas immediately surrounding the enclosure site. Lee et al. (2006) suggested that this may have been attributed to more rapid dilution and dispersal of nutrient wastes due to greater volume of water flow through the enclosure site. However, they conclude that the effects of fish feed and waste on the benthic polychaete community were evident, despite the study’s location and alongshore currents.

Since the late 1990s research has also been conducted at experimental aquaculture cages off the coast of New Hampshire (UNH Marine Aquaculture Center 2006). A series of sampling sites surrounding the cages was used to monitor water quality and benthic sediments. Since 1997, no change in the particulate organic content of bottom sediments has occurred (UNH Marine Aquaculture Center 2006). There is also no evidence of aquaculture activities affecting water quality parameters (e.g., suspended sediments, chlorophyll, and dissolved oxygen). Dissolved oxygen did decline near the bottom in fall 2006, but this decline was attributed to cooling of the water column and annual variations in dissolved oxygen in the Gulf of Maine region. Pollution intolerant benthic taxa represented a majority of taxa at sampling sites and there were no discernable trends among study sites. The study also examined species diversity and evenness, finding no significant differences in benthic taxa (pollution tolerant vs. intolerant) among study sites. However, the study did find significantly lower means for total community taxa in impact zones surrounding the cages suggesting early signs of increased organic loading. Additional studies and monitoring are now ongoing.

6.1.4 Physical Interaction with Marine Wildlife

There are a number of physical interfaces of aquaculture facilities and activities on marine wildlife. The specific sources which pose potential risks to marine wildlife include any floating or submerged structures themselves, any nets, ropes, anchor lines, and anchors for structures; garbage lost by a farm; and artificial lighting. The route of exposure of any physical interaction between marine aquaculture and migratory wildlife is simply the existence of aquaculture structures in their migratory pathways, or in their habitats such as feeding or breeding grounds. Physical interaction with marine wildlife can result in entanglement in nets in place, structures, and/or moorings etc; entanglement with lost nets and other jetsam; attraction of wildlife species disrupting the natural patterns of migrants or displacing them from an area, and predator control methods.

Based on experience from operational facilities in Hawaii, New Hampshire, and Puerto Rico, interactions with marine wildlife appear to be minimal with no negative effects. Using on-site monitoring, no effects have been seen with marine mammals in Hawaii or Puerto Rico; the only noticeable problem was shark interactions in the Bahamas because of poor management practices in removing mortalitites in a timely manner from pens.

Nash et al. (2005) included a template that outlines an approach for conducting a risk assessment for physical interactions with marine wildlife, as well as ways to reduce the potential risks to low levels. Information applicable to offshore aquaculture in the Gulf is provided in the following subsections.

6.1.4.1 Entanglement

Marine aquaculture activities in offshore environments pose a potential risk to wildlife because the facilities incorporate structures that use nets, ropes, or twine, all of which may be opportunities for their entrapment and entanglement. Of particular danger to marine mammals and turtles for entanglement are lines or ropes that are small in diameter, slack in the water, and possibly floating near the surface. Drowning after entrapment in or around a netted structure is a possible cause of loss, together with starvation following entanglement or consumption of discarded or lost debris from a farm, such as a piece of rope or plastic.

In the Gulf, offshore dolphins pose the greatest risk of physical interactions with aquaculture facilities because they are more likely to remain around facilities than more migratory species. Reports in Australia and New Zealand document bottlenose dolphin drowning as a result of net pen entanglement. Offshore facilities in New Zealand also have documented marine mammal entanglements.

All five species of sea turtles risk entanglement because of their migratory nature. Although there no published reports of sea turtles being entangled in aquaculture facilities, leatherback sea turtles are the most likely to be become entangled or impacted by debris from facilities. This is because in addition to their pelagic offshore nature, their susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on lines kept in the water. Section 5.2.2.3 provides a list of species currently considered by the MMPA and ESA for the Gulf and the potential actions to determine the impact of aquaculture on these species.

Despite the potential risks, entanglements are unlikely if anchor lines and nets are kept taut at all times.

Since 1997, the University of New Hampshire has been monitoring marine turtles and mammals at an offshore aquaculture site near the Isle of Shoals. No interactions have occurred during the course of the research project, although whales have been observed in the vicinity of the research site (UNH Marine Aquaculture Center 2006).

NOAA Fisheries Service's Office of Protected Resources conducted a workshop in 1999 to identify ways to avoid or minimize interactions between aquaculture operations and marine mammals and turtles. Potential permit requirements may include inspections of the facility via SCUBA and/or boat surveys by observers experienced in the collection of information on the presence of any listed species or marine mammals in the area. Weather permitting, daily inspection of net pens or cages may be required, regardless of whether or not stocked fish are present, so that information can be collected on the presence of marine mammals or listed species around the facility and their interactions with aquaculture gears. Reporting requirements such as monthly survey reports may also be specified. Information for each listed species and marine mammal observation may include: date, time, location of sighting on track line (either latitude or longitude or LORAN), visibility (distance), weather/cloud cover, sea state (use Beaufort scale), species and number of any observed listed species or marine mammals, approximate location of animals relative to vessel (distance and bearing), duration of sighting, (i.e., how long a particular animal or group of animals was observed), brief description of observed behaviors (feeding, diving, resting, breaching, etc.), description of interaction with net pen, a diagram of the actual track line followed, and the survey length.

6.1.4.2 Attraction of Wildlife

Wildlife may be attracted to aquaculture facilities as potential sources of food, shelter, and rest. A large cross section of marine wildlife is attracted to floating or submerged structures. Marine structures are primarily habitats where food can be found, and a place for rest and shelter. Fish aggregate in numbers to feed on smaller aquatic animals and plants that colonize around and on the structures. In other cases, wildlife may simply find them to be an obstruction in a migratory pathway or in a breeding area. Wildlife not necessarily close to a facility may also try to eat or play with garbage that has been lost from the facility.

Around structures close to the shoreline, marine mammals and birds are common visitors. The attraction is not just the chance opportunity to feed on the fish and shellfish being farmed, together with their feed, but other wildlife attracted to the area. Further offshore, the more common wildlife visitors focused on food are predatory elasmobranchs, such as sharks. The very presence of fish being cultivated may also serve as powerful attractants to marine mammals and birds that normally feed on similar or the same fish stocks in nature. Birds can potentially be entangled in nets while trying to feed on fish enclosed by the nets or cages. Above-surface lights on aquaculture facilities may also attract nocturnal birds to the facilities and thereby subject them to potential injury or death due to collision or entanglement with exposed structures. Exposed wiring and cables pose particular hazards to birds due to potential collision with and entanglement in them. Reference by applicants to the USFWS guidelines for design and placement of communication towers, available on the USFWS web site (www.fws.gov) may help in minimizing harmful interactions with birds at aquaculture facilities. Wildlife, such as whales, porpoises, and migratory marine turtles may also visit sites looking for shelter and rest. Aggregation of birds and fish around structures pose the risk of changes to animal or bird foraging and migration patterns.

Aquaculture structures are typically fitted with one or two light units. However, the lights are secured in place about 4-5 m above the bottom, in order to create an effective luminescence of 10 lx (about 1 ft candle) in the furthest corner. This light level is weak, and in temperate waters is attenuated to 1 percent within 10-20 m from the perimeter of the net-pen, and less when the net is beginning to accumulate bio-fouling organisms. Therefore the risk of such lighting directly impacting the migration of juvenile fish, or attracting forage fish and predators is very low. Moreover, net-pen complexes are in waters up to 40 m deep, and typically only larger or migratory juveniles would have the opportunity to interact with a complex, and when out-migrations are taking place.

Visual surveys conducted before and after installation of sea cages at Snapperfarm's aquaculture site in Puerto Rico indicate both species richness and abundance of wild species increased after deployment of cages (Alston et al. 2005). The cages acted as fish aggregating devices, with most fish (> 90 percent) attracted to the site belonging to the jack family (Alston et al. 2005). Additionally, a decrease in benthic macroinvertebrates was observed immediately beneath the cages when compared to control sites.

The University of New Hampshire has conducted 15 videography cruises since 2002 to track changes in benthic epifauna around several experimental aquaculture cages (UNH Marine Aquaculture Center 2006). Some differences in the total number of species were observed between spring and fall 2006. An increase in the number of northern sea stars surrounding the cages was observed and partially attributed to cleaning of biofouling from the fish cages and strong storm activity, which exposed additional food sources. Once the short-term supply of food resulting from the cleaning of the cages had dissipated, the northern sea stars dispersed.

6.1.4.3 Predator Control

As noted previously, predators may be attracted to marine aquaculture sites since they supply and abundant source of food. Most of the literature to date concerning nuisance predators has focused on pinnipeds (seals, sea lions), which do not occur in the Gulf. In the Gulf, sharks and offshore bottlenose dolphins stocks are likely to be the most common predators.

To curb predation, many marine fish farms worldwide employ control methods which exclude, harass, or remove predators. One such method, predator netting, creates a barrier which protects farmed fish from attacks by airborne or under water predators. Commercial acoustic deterrents have not proved to be effective against any of these visitors, as both animals and birds quickly get used to them, and for the most part they are no longer used or are prohibited by law.

Shark predation has led to major production loss in the Bahamas (D. Benetti, University of Miami, perssonal communication). Collaboration with other institutions and the private sector, a major effort is currently being placed on anti-predator systems, including predator nets, solid barriers, electromagnetic and magnetic fields and chemical and electrical repellants to address shark predation.

Cetaceans have not been reported to consume fish or shellfish out of farms, but have been known to get entangled in equipment, resulting in self injury, damage to gear and release of fish. Dolphin predation is more problematic because of their protected status and ability to quickly adapt.

6.1.5 Competing Uses

The development of offshore aquaculture will require the production facility to have exclusive access to the portion of the ocean where they operate. The exclusive use of an area means that the offshore aquaculture firms may compete for space in federal waters with other activities[8] (Cicin-Sain et al. 2001). Because various users are competing for the same area of the ocean, it is important to consider the interactions of various user groups during the permitting process (Rieser and Bunsick 1999).

In the Gulf, aquaculture firms may or may not compete with commercial and recreational fishers and with commercial vessels and recreational boaters for navigable waters. When considering offshore aquaculture, Knapp (2006) concluded that fewer direct conflicts with other users would be realized relative to nearshore aquaculture. Finally, as discussed in more detail in Section 7, the amount of open space occupied by offshore aquaculture facilities is likely to be exceedingly limited in relation to the total amount of available space. This would suggest that conflicts with competing uses may be relatively minor.

The following sections discuss some of these potential conflicts in the context of this EIS and the objectives of other federal, regional, and state resource use plans, policies, and controls for the area concerned.

6.1.5.1 Fishing Grounds

Conflicts between aquaculture firms and commercial or recreational fishers could arise if the aquaculture site is a desirable fishing area or if the site attracts fish. Alston et al. (2005) conducted a study as part of a demonstration project to assess the possible environmental effects involved in the culture of mutton snapper (*Lutjanus analis*) and cobia (*Rachycentron canadum*) in submerged open-ocean cages in Puerto Rico. Alston et al. (2005) stated in their research findings that “A monthly visual census was made of the composition and relative abundance of fish aggregating at the cage site before the cages were installed and after fish were stocked and cultured. A high diversity and abundance of fish were found near the cages after stocking occurred. The pelagic and reef fishes around the pen may represent an expansion of the resources available to the fishermen and therefore a possible increase in fishing potential. More research is needed to determine if the wild fish assemblage is benefiting directly or indirectly from additional nutrients from the aquaculture activity or if the cage structures naturally accumulate organisms and are simply serving as a substrate.” Alston et al. (2005) research seems to indicate that fishers could benefit from the aquaculture activity, if they are able to access fish close to the pens. On the other hand, if the sites attract fish and fishers trying to harvest those species interfere with the aquaculture facility, conflicts could be exacerbated.

Commercial harvesters using trawl gear would need to maintain sufficient separation from the nets/pens when fishing. Entanglements between trawl gear and nets/pens could result in escapement from the facility and damage to both the fishing vessel’s gear and the aquaculture facility. To minimize interactions, aquaculture sites will be clearly marked.

---

8 For example, navigation, fishing, offshore oil development, military activities, recreation, and conservation

It is important to ensure that traditional fishing grounds are considered by NOAA Fisheries Service during the siting process to ensure that conflicts are minimized. The Council's preferred alternative would not establish aquaculture zones, but would establish criteria for siting marine aquaculture facilities. Part of that siting criterion will be the consideration of historic fishing areas, in addition to the water depth and currents.

Not all interactions between the aquaculture industry and fishers are negative. The conflict resolution between recreational fishers and Texas marine aquaculture interests would have been easier if stakeholders entered the decision-making process earlier (Harvey and McKinney 2002). They concluded that if the process for determining usage of an area was viewed as fair, the participants are more willing to live with the outcome. To ensure that the process is viewed as fair all users of the resource must have a voice in the process.

Barnaby and Adams (2002) also found that commercial and recreational fishers could develop opportunities to work with offshore aquaculture businesses or start their own firm. Their knowledge of the ocean and access to vessels could prove to be of value to firms that need to transport crew, supplies, and products to and from the offshore facilities; potentially creating a symbiotic relationship.

Rubino (2008) noted that aquaculture and capture fisheries are part of a spectrum of seafood production techniques with many synergies. Boat owners (including fishermen) will be owner operators (as they already are in New England and Hawaii) or be hired by offshore operations. All of the current offshore aquaculture operations in state waters were started by U.S. fishermen or people in seafood businesses. In addition, the whole seafood supply chain, from boats to docks to processing plants to cold storage, may benefit from having a predictable and increased throughput from aquaculture. In other words, marine aquaculture may help keep working waterfronts alive.

6.1.5.2 Navigation

Because the USCG and ACOE regulate navigable waters, aquaculture firms must comply with their regulations in addition to those implemented as part of this FMP. The USCG (14 U.S.C. 83 *et seq.*) requires that aquaculture structures located in navigable waters must be marked with lights and signals. The USCG requirement is similar to this FMP's permit requirement that states "As condition of permit the applicant must agree to maintain a minimum of one locating device on each pen or enclosure and immediately notify NOAA Fisheries Service in the event the pen or any retention aquaculture enclosure is lost at sea." Pens could be marked with lights and markers as part of the locating devise required in this action. The lights and markers required should reduce unintentional conflicts with vessels navigating past the permitted aquaculture area. Persons intentionally interfering with a permitted aquaculture site could face fines or other penalties imposed by federal enforcement agencies.

The Rivers and Harbors Act (33 U.S.C. 403) requires a Section 10 permit for activities in or affecting the navigable waters of the United States, including installations and other devices permanently or temporarily attached to the seabed, erected for the purpose of exploring for, developing or producing resources from the outer continental shelf. Therefore, the aquaculture permit applicant will need to obtain a Section 10 siting permit from the ACOE. As discussed in Section 7, the permit applicant would be required to provide NOAA Fisheries Service with copies of state, ACOE and EPA permits and monitoring reports. The ACOE report will allow NOAA Fisheries Service to ensure that the permit holder has met the requirements of the Rivers and Harbors Act for siting a structure in navigable waters.

Implementing the requirements discussed above should minimize unintentional navigation conflicts. When conflicts result from intentional actions, those disputes would be settled through the enforcement/legal process.

6.1.6 Economic and Social Impacts on Domestic Fisheries

The description of the economic and social environment of Gulf of Mexico domestic fisheries is discussed in detail in Section 5.4. That discussion is included here by reference.

Several of the authors of the report entitled "Offshore Aquaculture in the United States: Economic Considerations, Implications, and Opportunities" (NOAA Aquaculture Program 2008) consider the questions raised by competition and synergies with aquaculture. The report examined trends and factors shaping aquaculture today, forces that will drive it in the future, inputs and outputs necessary to sustain its growth, economic consequences of offshore aquaculture development in the U.S. and benefits and costs of such a domestic industry to the nation.

The effect of increased U.S. aquaculture on U.S. wild caught fisheries will depend in part on whether new markets are created for increased U.S. aquaculture production, how fast and at what volumes new production comes to market, whether new U.S. aquaculture production is a substitute for existing wild catch or imports, and whether U.S. fishermen participate in offshore aquaculture production (Rubino 2008; Valderrama and Anderson 2008; Knapp 2008a; Knapp 2008b; Anderson and Shamshak 2008). In addition, Anderson (2002), Barnaby and Adams (2002), and Knapp et al. (2007) consider the relationships between fishing and farming.

Valderrama and Anderson (2008) indicated that the "largest influence of aquaculture on wild fisheries has probably occurred through international trade: aquaculture has a) influenced prices negatively through increased supply and positively through development of new markets (e.g., salmon and catfish); b) changed consumer behavior; c) accelerated globalization of the industry; d) increased concentration and vertical integration in the seafood sector; e) resulted in the introduction of new product forms; and f) significantly changed the way seafood providers conduct business." Some or all of these factors may or may not come into play in the Gulf of Mexico depending upon the growth rate, timing, scale, and type of operations that develop in the region and the relative influence of imports versus domestic production in Gulf of Mexico region fisheries markets.

At the NOAA National Marine Aquaculture Summit in June 2007, and in other venues from the Gulf of Mexico to the Pacific Northwest, some commercial fishermen have expressed concern that aquaculture will negatively affect prices for wild harvest in the U.S (Rubino 2008).

Knapp et al. (2007) and Keithly et al. (1993) examined the effect of increased global aquaculture production and imports of salmon and shrimp respectively. These studies showed that increased imports of salmon and shrimp aquaculture contributed to reduced market prices for U.S. wild caught and farmed U.S. shrimp and for U.S. salmon caught from both wild and hatchery raised and released stocks. But Knapp et al. (2007) explained that the relationships between farmed, wild, and hatchery released salmon are numerous, wide-ranging, and complex and that these issues are often oversimplified and misunderstood.

Rubino (2008) noted that competition in seafood markets will exist with or without domestic aquaculture, that the U.S. cannot meet consumer seafood demand through wild caught fishing activities alone, and that seafood imports and other forms of protein (such as chicken and beef) already provide significant competition. Anderson and Shamshak (2008) explained that even if potential offshore aquaculture species are not raised domestically, the importation of these and other aquaculture species will continue, and most likely increase, as the forecasted gap between supply and demand for seafood widens. Seafood business executives speaking at the National Marine Aquaculture Summit (NMFS 2007) said that if seafood is not available from U.S. sources, they will get it somewhere else. The challenge for U.S. domestic fisheries is to integrate aquaculture into domestic seafood production so that U.S. boat owners, fishermen, processors, and marketing companies can benefit directly (Rubino 2008).

Kirkley (2008) using an input-output model predicted that full and part time jobs created across all sectors per thousand metric tons of aquaculture production per year will number 102 for mussels, 261 for salmon, 475 for cod, and 683 for scallops (meats), increasing employment numbers reflecting higher selling prices for these products. Many of these jobs will likely be located in coastal fishing communities. Posadas (2004) analyzed the potential economic impacts of offshore aquaculture in the Gulf of Mexico.

6.1.7 Harvest of Prey Species for Feed

Fish meal and oil have long been the principal constituents of feeds for carnivorous species such as salmon and trout, and more recently, have been included in feeds for omnivorous and herbivorous fish. These two ingredients supply essential amino acids deficient in plant proteins and essential fatty acids required by the fish for normal growth. Feeds for herbivorous and omnivorous species contain relatively small amounts of fish meal (0 – 25%) and oil (0-10%) because they can utilize plant proteins and oils relatively well. Aquafeeds for salmon contain about 20-50% fish meal and 9-35% fish oil whereas those for non-salmonid marine species (e.g. turbot, halibut, bream, bass, tuna) contain 45-55% fish meal and 10-20% fish oil (Tacon and Metian 2008).

As the intensive farming of aquatics species has grown, so has the demand for marine fishery products, in the form of fish meal and oil, for use in formulated feeds. In 1988, approximately 700,000 MT of fish meal and 190,000 MT of fish oil were used in aquaculture feeds worldwide. In the succeeding 12 years, the consumption of fish meal and fish oil for aquatic feeds increased dramatically, to about 2,115,000 MT and 708,000 MT, respectively (Barlow and Pike 1999). In 2006, the aquaculture sector reportedly consumed 3,742,000 MT of fish meal (68.2% of the global fish meal production) and 835,000 MT of fish oil (88.5% of the global fish oil production), or the equivalent of 16,600,000 MT of small pelagic forage fish (Tacon and Metian 2008).

The species most used for fish meal and oil are the small planktivorous pelagic fish captured off the coast of Peru and Chile – anchovy and mackerels, and to a lesser extent herring, sandeel, and capelin caught in colder northern waters. Species from the Families Engraulidae (anchovies) and Clupeidae (includes menhaden) represent 89 percent of the fish destined for fish meal production worldwide (FAO 2005). The top species caught for production of fish meal globally include: Peruvian anchovy (6.2 million tons), blue whiting (2.38 million tons), Japanese anchovy (2.09 million tons), Atlantic herring (1.96 million tons), and chub mackerel (1.86 million tons). Gulf menhaden are 11th worldwide in total tonnage converted for purposes of fish meal. In 2003, 0.53 million tons were converted to fish meal and oils (Tacon et al. 2006). This accounted for 2.4 percent of the worldwide fish (in pounds) converted to fishmeal in 2003. Overall, the United States accounted for 5.6 percent of the worldwide fishmeal production in 2003 and 9.6 percent of the worldwide fish oil production in 2003 (Tacon et al. 2006).

Worldwide approximately 25-30 million tons of fish are reduced to fish meal and fish oil annually and has remained stable since the early 1970s (Tacon et al. 2006). According to FAO (2007), 52% of stocks of small pelagic fish targeted for reduction to fish meal and oil are at or near their maximum sustainable exploitation rates, 23% are under or moderately exploited, and 25% overexploited or depleted. In the United States, Gulf and Atlantic menhaden represent the greatest source of fish meal production, with Atlantic herrings and Californian pilchards accounted for a lesser amount of U.S. fishmeal and fish oil production. As discussed in Section 5.2.3.4, Gulf and Atlantic menhaden are not overfished and are not undergoing overfishing. Both species are managed by interstate compacts and assessments are conducted every four to five years by NOAA Fisheries Service. If demand for these species increases due to development of an aquaculture industry in the Gulf and increases in livestock feeds, then stock assessments will be used to assess the status of each of these populations. Necessary management adjustments could then be made on the basis of the assessments if fishing mortality is too high or stock biomass has dropped below threshold levels. Additional information (updated annually) about the status and management of fish stocks used to produce fish meal and oil for the UK, and summaries of reports and documents from stakeholders interested in feed fish stocks, is available from the Fishmeal Information Network (GFTA 2008).

Many of the pelagic species harvested commercially for human food or animal feeds are also important food sources for high trophic level carnivorous marine predators, including food fish species, marine mammals and birds. There is evidence that fishing activities can directly or indirectly affect species dependent on them. For example:

- In the Shetland area, a sharp decline in breeding success of Kittiwakes *Rissa tridactyla*, a seabird that generally feeds its young almost exclusively on sandeels *Ammodytes marinus*, has accompanied the establishment and intensification of the industrial sandeel fishery (Monaghan 1992).
- The bluefish *Pomatomus saltatrix*, a key predator on U.S. east coast fish species, may compete with commercial fisheries for squid, butterfish, and Atlantic menhaden (Buckel et al. 1999).
- Some overlap exists between the diet of the South American sea lion and fishery catches, but there is no definitive evidence that competition presently exists with the fishery (Alonso et al. 2000). However, sea lions appear to use food resources according to their availability, so the effects of fishing may not be apparent without detailed analysis of catch and bycatch in the region.
- Stellar sea lions *Eumetopias jubatus*, populations in the Aleutian Islands have declined by an estimated 68% since the 1970s, possibly due to changes in the availability of preferred prey species. A connection between the decline of the Stellar sea lion and its dependence on commercially exploited fish species has been suggested (Merrick et al. 1997).

The effects of fishing on benthic fauna, habitat, diversity, community structure, and trophic interactions in tropical, temperate, and marine waters have been reviewed by Jennings and Kaiser (1998).

Formulated feeds for fish in use today consist of blends of marine fish protein (fish meal and fish by-products) and oils, with the following (Higgs et al. 1995): meals and oils derived from plants (e.g. corn, soya, rape, cottonseed, and linseed); milk products (e.g. whey), by-products from non-mammalian terrestrial animals (poultry viscera and feathers); grains and grain processing by-products (whole wheat, wheat middlings, mill run); and vitamin and mineral supplements. The success of these substitutions depends largely on whether the resulting digestible amino acid and essential fatty acid content of the feed meets the dietary requirements of the fish.

Substitution of fish processing waste (trimmings) and use of by-catches which are presently not landed for economic or regulatory reasons for pelagic species diverted to the human food market are two ways reductions in total fish meal and oil availability may be avoided. The potential of these two materials to alleviate projected shortages is considerable. In 1994, annual discards at sea totaled 17.9 – 39,500,000 MT (FAO 1994), compared with 33,000,000 MT of feed grade fish harvested for fish meal production. More recent estimates (FAO 1998) of 20,000,000 MT is equivalent to 25% of the reported annual harvest by marine capture fisheries. In Alaska alone, the processing industry generates about 1,200, 000 MT of by-product waste annually, from which high quality fish meal and oil suitable for aquatic feeds may be produced (Rathbone and

Babbitt 2000). Both sources of raw material for fish meal and oil production are areas of active research worldwide.

Research funded by the European Commission (Researching Alternatives to Fish Oil in Aquaculture – RAFOA) has shown that much of the added fish oil currently used in feeds for salmon, trout, sea bream, and sea bass can be replaced by a blend of vegetable oils without compromising growth or feed conversion, the essential fatty acid requirements having been met by the lipid in the fish meal component of the diet. Substitution of marine oils rich in n-3 PUFA with plant oils containing high levels of n-6 PUFA may have detrimental effects on the immune system of cultured fish and alter the fatty acid composition of the edible product (Mourente et al. 2005). Changes in the fatty acid composition resulting from feeding vegetable oils can be readily reversed in all species tested with a fish oil finishing diet. In addition to reducing the dependence on fish oil for aquafeeds, its replacement with vegetable oils reduces the accumulation of lipophilic persistent organic toxicants, notably polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/F) and dioxin-like PCBs (DLPCB), in the fish (Berntssen et al. 2005).

Fish meal is the most expensive ingredient in feeds and numerous studied conducted over the past 25 years have focused on the use of less costly sources of dietary protein. Among plant sources, soybean meal has attracted the most attention due to its relatively high protein (and low carbohydrate) content, and favorable amino acid composition. Other protein sources, including grain products (corn and wheat gluten), oilseeds and legumes (cottonseed meal, field peas, lupin, canola), rendered materials (poultry by-products) and single-cell protein (distiller's and brewer's yeasts) have been tested and are used at varying levels in feeds for salmonids (Carter and Hauler 2000; Hardy 2000; *inter alia*.). Interest in replacing fish meal with plant sources also applies to marine teleost species, and has met with some success (Kaushik et al. 2004).

Fish meal and oil use is projected to decrease in the long run as a result of a static or decreasing market availability and higher market prices of these finite commodities and increased use of alternative protein and oil sources on a global scale (Gatlin et al. 2007). This trend is already evident (Tacon and Metian 2008). Between the years 1995 to 2005, inclusion levels of fish meal and oil in compound aquafeeds steadily declined. Fish meal levels have decreased from 28 to 20% for shrimp, 45 to 30% for salmon, 40 to 30% for trout, and 50 to 32% for marine fish. For fish oil, inclusion levels for shrimp have remained unchanged (2%), but have declined from 25 to 20% for salmon, 20 to 15% for trout, and from 15 to 8% for marine fish. Similar declines in inclusion levels for these ingredients have also occurred in compound feeds for omnivorous and carnivorous freshwater species.

In the United States and elsewhere, studies are also underway to better understand the nutritional requirements of fish and shrimp. These studies evaluate the use of alternative dietary ingredients in aquaculture feed. Potential alternatives already in use include soybeans, barley, rice, peas, canola, lupine, wheat gluten, corn gluten, algae, as well as seafood and farm animal processing co-products. Suitable alternatives with marine long chain omega 3 fatty acids are needed to help maintain the human health benefits of eating seafood. NOAA and other federal agencies play a vital role in that research and the transfer of that technology to industry. For example, the NOAA-USDA Joint Feeds Initiative highlights ongoing research advancement and identifies promising new areas for study. In addition, there is also the challenge of 'suitability' – finding ingredients that each species can digest efficiently.

The NOAA Aquaculture Program in partnership with the U.S. Department of Agriculture launched the NOAA-USDA Aquaculture Feeds Initiative in 2007 to stimulate research into alternative feeds. The results of workshops held in 2008 will provide a roadmap for federal research efforts. NOAA scientists are also working on cost-effective ways of utilizing fish processing by-products and by-catch from commercial fishing as alternative protein and oil sources. These 'co-products' may further reduce dependence on marine fish resources by feed manufacturers.

6.2 Action 1: Aquaculture Permit Requirements, Eligibility, and Transferability

The Council is considering three alternatives for permitting aquaculture facilities. The first alternative is to maintain the current practice of issuing EFPs for aquaculture facilities. The second is to require a NOAA Fisheries Service permit to operate an offshore aquaculture facility. The third alternative requires both a siting permit as well as an operational permit.

U.S. per capita seafood consumption is comprised of a combination of domestic and imported product. Between 1990 and 2005, consumption of seafood has advanced from 15.0 pounds per capita (edible meat) to 16.2 pounds (edible meat) per capita (NMFS 2007). With the population increasing during the same period from 248 million to 295 million, domestic distributors increasingly turned to imported product to satisfy domestic "wants" at an acceptable price. In 1990, for example, the U.S. supply of edible commercial fishery products totaled 12.7 billion pounds (round weight)[9]. Domestic production, equal to 7.0 billion pounds, represented approximately 55 percent of this total while imported product, equal to 5.6 billion pounds, represented the remainder. By 2005, the U.S. supply of edible commercial fishery products had advanced to 18.1 billion pounds (round weight)[10]. Domestic production, equal to 8.0 billion pounds, represented about 45 percent of this total while imported product, equal to 10.2 billion pounds, represented the remainder. Hence, while domestic production increased by approximately 1.0 billion pounds during the 15-year period ending in 2005, imported product increased by 4.6 billion pounds. Much of the increase in imported product represents aquaculture production; which is primarily comprised of shrimp and tilapia.

---

9 These figures ignore exports (1.9 billion pounds, edible weight) and supply derived from recreational activities (U.S. Dept. of Commerce, 1991).

10 These figures ignore exports (2.9 billion pounds, edible weight) and supply derived from recreational activities (U.S. Dept of Commerce, 2005).

As per capita seafood consumption continues to increase in conjunction with an increasing population, domestic wholesale, and retail suppliers are likely to increasingly turn to imported product to meet the country's demand for seafood at an acceptable price. This reflects two primary factors. First, many of the domestic capture fisheries are already fully utilized (if not overfished) and hence, any significant increase in supply from them is unlikely. Second, global aquaculture has expanded rapidly (an average compounded rate of 8.8% since 1950)[11], which has allowed the placement of additional product on the world market.

Currently, the U.S. seafood trade deficit is about $9 billion (NOAA Fisheries Service 2007), and in the absence of significant expansion of the domestic aquaculture program is expected to increase. In recognition of the potential for aquaculture to contribute to local U.S. seafood production and to jobs in coastal communities and of the growing trade deficit, the National Aquaculture Act of 1980 (since amended and reauthorized by the Farm Bills), U.S. Commission on Ocean Policy (2004), several U.S. Department of Commerce policies, and the NOAA Ten Year Plan for Marine Aquaculture call for the development domestic aquaculture One of the promising areas for future on increased production is the culture of marine species including finfish, shellfish, and algae (Nash 2004). NOAA's ten year plan indicates that increasing domestic marine aquaculture production will require the development and implementation of a viable aquaculture policy related to the rearing of marine species in coastal areas, on land in ponds and tanks, and in the EEZ. The U.S. Commission on Ocean Policy (2004) and NOAA's policies and plans indicated that aquaculture facilities should operate in an environmentally sound manner that does not pose threats to wild stocks or compromise objectives for managing wild fisheries.

6.2.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 1 creates (or does not create) a permitting system for offshore aquaculture in the Gulf EEZ. The permitting process is primarily administrative in nature and does not directly affect the physical, biological, or ecological environment. However, it could have indirect effects on the physical, biological, and ecological environments. Under **Alternative 1**, no change in the number of operational aquaculture facilities is expected; therefore, **Alternative 1** would have the least effect on this environment. **Alternative 1** does not require the development of any permitting system, but maintains the status quo of requiring an EFP for the operation of aquaculture facilities. EFPs authorize, for limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited (50 CFR 600.745).

The requirement to procure an EFP before operating an aquaculture facility has proven to be an onerous task that has stifled the offshore aquaculture industry from developing. If

11 Sustainable Marine Aquaculture Task Force report (2007)

an alternative permitting process is developed, as proposed in **Preferred Alternative 2** and **Alternative 3,** there will be an enhanced probability that the Gulf offshore aquaculture industry would develop.

Preferred Alternative 2 would create a NOAA Fisheries Service permit to operate an offshore aquaculture facility. **Preferred Alternative 2** would authorize all of the following activities: deployment and operation of an aquaculture facility; operation of a; possession, landing, transport, and sale of cultured organisms; and harvest of broodstock. Additionally, this alternative would require dealers to possess a permit in order to receive cultured organisms, landing would be prohibited at non-U.S. ports, only U.S. citizens and permanent resident aliens would be eligible for permits, and permits would be transferable.

The development of an aquaculture industry is expected to have some indirect effects on the physical, biological, and ecological environments including issues discussed in Section 6.1. However, the implementation and use of a permitting process that has a multitude of conditions and requirements designed to monitor and/or negate negative effects on the physical, biological, and ecological environments would be the most prudent avenue to pursue, which is the intent of this FMP. The operational permit proposed under **Preferred Alternative 2** would include operating requirements and restrictions, as well as recordkeeping and reporting requirements (Actions 2 and 8), tied to the continued operation of a facility under that permit. If it was found that a facility was not complying with aquaculture regulations, the permit could be revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 (Action 3). **Alternative 3** would create a permitting system with a siting permit specifying the duration, size, and location of an offshore aquaculture facility. This alternative would also create an operating permit that would authorize the same activities as described in **Preferred Alternative 2**. The two-tier permit process in **Alternative 3** presents no additional safeguards to the physical, biological, and ecological environment. Rather, it would result in additional administrative costs and partial duplication of existing siting requirements required by the ACOE. Action 6 is intended to minimize impacts of a facility on the physical, biological, and ecological environment by applying a number of criteria and conditions which dictate where a facility may operate. This siting criteria action accomplishes what would otherwise be achieved by a dual permitting process as proposed under **Alternative 3**. Further, the ACOE will require a permit for siting aquaculture facilities in the EEZ under the authority of the Rivers and Harbors Act. Therefore, potential applicants would be subjected to redundant applications and permits if **Alternative 3** was chosen.

Both **Preferred Alternative 2** and **Alternative 3** would create a standardized permit that managers could authorize or deny based on criteria specified in other actions within this FMP (Actions 2, 4, 5, 6, and 8). **Alternative 1** would have the least effect on the physical, biological, and ecological environment. The lack of development in the offshore aquaculture industry is not expected to change under **Alternative 1**; however, the intent of this FMP is to create a permitting process to foster the development of an aquaculture industry. Therefore, **Alternative 1** is the least preferred for the purposes of this Action. **Alternative 3** would create a dual permit process, which would create redundancy and unnecessary burden on potential applicants. This redundancy is both external and internal to NOAA Fisheries Service. Externally, the ACOE already has a siting permit requirement under their existing authority; internally, the conditions set forth in the siting criteria (Action 6) action will provide the necessary oversight for proper siting of facilities without the need for an additional permit. **Alternative 3**, by creating a permitting process, would have more of an effect on the physical, biological, and ecological environment than **Alternative 1**, but would accomplish the purpose and goals of this FMP.

Preferred Alternative 2 creates a single permit for regulating aquaculture in the Gulf EEZ. In order for a facility to begin and continue operation permit requirements recordkeeping requirements, and reporting requirements would have to be met (Actions 2 and 8). The conditions and requirements allow managers to efficiently examine the impacts of a facility on the physical, biological, and ecological environment in a standardized manner while still fostering the growth of an aquaculture industry in the EEZ. Additionally, **Preferred Alternative 2** does not place an undue burden on potential applicants by creating a redundant permitting process. Instead it creates one fully comprehensive permit. Though **Preferred Alternative 2** and **Alternative 3** have more of an effect on the physical, biological, and ecological environments than **Alternative 1**, they accomplish the purpose of this FMP in the best manner possible by creating a list of requirements to be met and maintained. These requirements will assist the Council and NOAA Fisheries Service in mitigating impacts associated with aquaculture to the greatest extent practicable. Therefore, **Alternative 1** has the least impact on the physical, biological, and ecological environment, but **Preferred Alternative 2** and **Alternative 3** create a permit for aquaculture, which is the intent of this FMP. These alternatives accomplish the goals and objectives of the FMP by providing managers with the necessary tools for monitoring and maintaining the integrity of the physical, biological, and ecological environment.

6.2.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. Under the status quo, any entity seeking to engage in activities associated with commercial offshore aquaculture operations that involve species managed under an FMP or activities in violation of fishery regulations in the Gulf of Mexico EEZ is currently required and would continue to be required to apply for an EFP. However, an EFP authorizes limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited. While an EFP may authorize some activities that may be associated with an aquaculture operation, an EFP does not authorize commercial offshore aquaculture. The inability to authorize commercial offshore aquaculture under an EFP is illustrated in a 2008 letter from NOAA Fisheries Service to Biomarine Technologies Inc. that states one of the reasons for rejecting the company's EFP application is that the company sought to establish a long-term, commercial-scale aquaculture operation which is not one of the purposes for which an EFP may be issued. Also, an EFP is not designed for long-term activities. Unless otherwise specified in the EFP or a superseding notice or regulation, an EFP is effective for no longer than one year, unless revoked, suspended or modified, although EFPs have been issued for offshore aquaculture for periods for 2 years and can be renewed (50 CFR 600.745(b)(4)). Thus, the short-term nature of an EFP though potentially renewable, would not be expected to satisfy the long-term requirements of a commercial aquaculture operation.

An EFP also does not authorize commercial hatchery operations in the EEZ. Any harvest of species native to the Gulf to create broodstock has occurred predominantly for scientific purposes and a letter of acknowledgement (LOA) is sufficient for such scientific activities. However, an LOA is only appropriate for scientific research activities conducted onboard a scientific research vessel (50 CFR 600.10, 600.745). As defined in section 600.10, the term scientific research does not include collection for product development or market research or testing of fishing gear. As a result, because neither an EFP nor an LOA would authorize the activities necessary for offshore hatchery operation, **Alternative 1** would not support the development of an integrated offshore aquaculture operation. However, the development of onshore or nearshore hatchery operations would not be affected because they would not fall under NOAA Fisheries Service's jurisdiction. Hence, the inability of either an EFP or LOA to authorize commercial hatchery operations may or may not impede development of offshore aquaculture operations in the Gulf.

In summary, because of the types of activities they would allow and their duration of applicability, the EFP and LOA authorizations of the **Alternative 1** (the status quo) would not be supportive of the development of commercial aquaculture or hatchery operations in the EEZ.

Because **Alternative 1** would continue current regulations and business practices, this alternative would not add any economic and social impacts above the economic and social baseline. As stated in section 5.3.5, in 2006, the U.S. exported about 3 billion pounds of seafood with a value of $4.2 billion and imported approximately 5.4 billion pounds with a value of $13.4 billion. Because the value of exports was less than the value of imports in 2006, there was a seafood trade deficit of $9.2 billion. Similarly, in 2007, the U.S. imported 5.3 billion pounds with a value of about $13.7 million and exported 2.9 billion pounds with a value of $4.2 billion, increasing the seafood trade deficit to $9.4 billion. These figures demonstrate than U.S. consumers demanded more seafood than was domestically produced. Consequently, imports were required to satisfy consumer demand.

U.S. demand for seafood is forecast to substantially increase in the next 17 years as dietary guidelines and consumer preferences change. According to NOAA Fisheries Service (www.nmfs.noaa.gov/ocs/mafac/meetings/2008_07/docs/Seafood_annexII.ppt), demand for seafood is projected to increase to approximately 14 million metric tons by 2025. U.S. production of seafood is the sum of domestic aquaculture and wild-catch fisheries production. In 2006, for example, U.S. aquaculture produced 465,061 metric tons and wild-catch fisheries 4,859,872 metric tons, live weight (USDOC 2008a). Because many U.S. wild-catch fisheries are at their maximum production capacities (NOAA Fisheries Service 2007), future increases in domestic production and reductions in the seafood trade deficit will most likely come from aquaculture.

A basic notion of neoclassical macroeconomic theory is that a trade deficit reduces national income because more dollars leave the county than enter it, and as national income falls, there is a welfare loss. **Alternative 1** would continue the seafood trade deficit and corresponding welfare loss, which can be reduced or eliminated, given the condition of fixed wild harvest capacity and limited onland and nearshore aquaculture production, (using existing methods of production), only by increasing domestic offshore aquaculture production (or in other newer production systems such as onland tanks) and reducing imports and/or increasing exports of seafood.

Preferred Alternative 2 would create an offshore aquaculture permit that would authorize a U.S. citizen or permanent resident alien to place cages, pens, platforms, and other structures in waters of the Gulf EEZ; sell products cultured in the Gulf EEZ; harvest wild broodstock and aquaculture of species native to the Gulf of Mexico; propagate and rear species; and possess and transport young fish (or shellfish) to and market-size fish or shellfish from the Gulf EEZ. While **Preferred Alternative 2** would simply establish the permit that would enable the development of offshore aquaculture in the Gulf EEZ, the development of the industry would be expected to potentially lead to a variety of direct and indirect social and economic effects. These effects are discussed in the following paragraphs.

As discussed in the previous section, the U.S. has a seafood trade deficit that is expected to increase. Aside from remedies such as tariffs to reduce exports or policies that encourage consumers to reduce spending on imported seafood, increasing domestic production can reduce and potentially eliminate the deficit, and technological change can increase production possibilities. Aquaculture — on-land, nearshore and offshore — is such a technological change. As described in Section 5.3, commercial aquaculture of fish and shellfish has been proven to expand countries' levels of seafood production significantly beyond their historical levels of wild-caught production. For example, cobia and Almaco jack are cultured in the U.S., and their culture is expanding the country's production of edible fishery products and exported products. Also, for example, tilapia is being commercially produced in recirculating tanks in places, such as Midwestern farms, that a decade ago would have been considered unthinkable.

Aquaculture has three competitive advantages over wild-caught fishing. First, it can produce volumes of fish that are not biologically or economically possible or sustainable in U.S. wild-caught fisheries. Examples are the planned production by Virginia Cobia Farms of one million pounds of cobia in 2009, with expansion in time to 5 million pounds and above (Section 5.3.4.1), and Australis Aquaculture's production of barramundi in Massachusetts (www.thebetterfish.com). Second, aquaculture is not limited by season, so it can provide consistent supply throughout the year (Rubino 2008). Third, because the aquaculture operation controls what the growing fish eat, product quality can be improved to avoid ciguatera poisoning and high levels of methyl mercury or other contaminants that may be found in wild-caught fish. For example, Kona Blue states on its website (www.kona-blue.com/ourfish.php) that its kampachi has no detectable traces of mercury or polychlorinated biphenyls (PCBs).

A representative of an existing commercial offshore aquaculture operation is Kona Blue, which produces Almaco jack, a species native to the Gulf and would be allowed for aquaculture by this alternative. According to the September 10, 2007, Draft Supplemental Environmental Impact Assessment for an Expanded Production Capacity and Extended Farm Lease for Kona Blue's Offshore Open Ocean Fish Farm Project off Unualoha Point, Kona, Hawaii, at that time the company was producing approximately 13,000 pounds per week (677,857 pounds annually), and employing 49 professional and semi-professional employees. The company has planned to expand and increase production of its Kona Kampachi by deploying 8 net pens, each 6,200 cubic meters in volume, and increasing the number of employees to 59. Each net pen would be able to produce 1,489 tonnes (about 14.9 million pounds) of fish each year and combined the company would produce 11,912 tonnes (about 26.3 million pounds) annually. For comparative purposes, from 1997 through 2007, annual U.S. commercial landings of wild-caught Almaco jack never exceeded 187,000 pounds and in the Gulf averaged only 53,000 pounds annually. In 2007, Kona Blue produced more than ten times the average annual Gulf production of Almaco jack, and its expanded operation could produce about 495 times the average annual landings of Almaco jack in the Gulf from 1997 through 2007.

Although the operation profile of Kona Blue may be unique to the conditions under which that company operates, which would include management, location, species cultured, and operating environment, among other things, the production characteristics provided above can be used to illustrate the aquaculture production potential in the Gulf that might be accommodated by **Alternative 2**. With the exception of the estimate of number of operations expected to emerge within the first 10 years of this action, the following example assumes only the implementation of this action and not any other actions in this proposed FMP that might constrain the aquaculture industry. The relevance of this will be noted where appropriate. It is currently assumed that 5 to 20 offshore aquaculture operations could emerge in the Gulf EEZ within the first 10 years of this proposed FMP. Assuming no restrictions on individual firm or total industry production (Section 6.10 for a discussion of the potential production caps that may be established under Action 9), each of these operations could be projected to employ up to 59 professional and semi-professional staff and produce up to 26.3 million pounds annually. Collectively, all operations would have 295 to 1,180 employees, pay salaries and benefits of from $17.5 million to $74 million ($3.7 million per operation; average salary and benefits estimates derived from the Kona Blue assessment), and produce from 131 million to 525 million pounds of product per year. Assuming an average price of fresh product of $4.00 per pound, one operation would generate annual revenues of approximately $105 million, and the 5 to 20 operations combined would generate product valued from $0.5 billion to $2.1 billion annually. Caveats to these totals would include, among other potential factors, potential production caps imposed by Council action, price effects of increased cultured product supply, and the effects of culturing different species with different production profiles. Nevertheless, despite these caveats, an increase in domestic production of seafood as a result of offshore aquaculture production would be expected to reduce the seafood trade deficit and increase national income and welfare.

Commercial offshore aquaculture's contribution to the increase in the volume of seafood would also be expected to create an increase in the scale and/or number of entities that buy seafood at the first point of sale. This in turn would generate additional employment in and income from the wholesale seafood, seafood processing, and retail seafood industries.

To produce about 1,500 tons per net pen, as in the Kona Blue example, it is estimated that 3,300 tons (approximately 7.25 million pounds) of feed would be required, which for 8 net pens combines to 26,400 tons (approximately 59.2 million pounds) of feed, annually. The combined 5 to 20 Gulf offshore aquaculture operations would require from 291 million to 1,164 million pounds of feed, annually. At an estimated price of $1,500 per ton ($0.68 per pound), the combined 5 to 20 operations would purchase from $198 million to $792 million of feed, annually. Hence, Gulf offshore aquaculture operations would be expected to increase demand for fish feed and other aquaculture-supporting products and services, which in turn would be expected to generate additional increases in employment and revenues and income from these industries. It should be noted that this discussion assumes the required feed, particularly that of marine origin, such as menhaden, is available and harvested from sustainably managed domestic and/or international fisheries. Thus, it is presumed that the increased demand for feed will not induce overfishing or other adverse conditions for wild stocks, with associated adverse social or economic effects. Management of these stocks, however, is outside the scope of this proposed FMP.

A common concern with the development of aquaculture is the competition of cultured product with wild product harvested by local fishermen. If offshore aquaculture operations sell their products to dealers who also buy from fishermen, offshore aquaculture may be in direct competition with fishermen. A fundamental concept of neoclassical economic theory is that an increase in the number of producers causes an increase in supply, and an increase in supply typically causes a decrease in the market price, known in Latin as *ceteris paribus*. Consequently, the price received by Gulf and other fishermen could fall, depending upon the increase in supply caused by offshore aquaculture and assuming no other changes in supply and demand conditions, that in turn would reduce fishermen's revenues from sales of those species.

Actual competition would be expected to be dependent upon the species cultured, the markets targeted by offshore aquaculture operations, and the season of production and harvest. While species differentiation exists, with some individual species or species groupings having greater name recognition than others, and different species groupings having different flavor and/or texture characteristics, (for example tuna, salmon, mackerel, and general white fish are likely easily recognized as distinct groupings) at a certain level all fish species have the capacity to be consumption substitutes, with associated market effects, for any other fish species. Similarly, meat in general is a substitute for seafood and vice versa as protein sources in our diet. Nevertheless, the competitive pressure of a particular offshore cultured product on the market price of a wild-harvested and/or presently cultured species will be influenced by the extent to which the product is a substitute for the wild-harvested and/or presently cultured species. The competitive pressure would be expected to be the greatest if both were the same species, marketed at the same time to or through the same market channels/outlets, and marketed in the same product form, and decline the more dissimilar these considerations are. Although the production example above was based on Almaco jack, the two species expected to be the most likely candidates for offshore culturing in the Gulf are red drum and cobia, both species that do not have significant commercial fisheries. The EEZ, in both the Gulf and South Atlantic, is closed to the commercial harvest of red drum, and only limited commercial harvest is allowed in state waters. Similarly, while commercial harvest of cobia in the EEZ is allowed, cobia harvests are not significant, with U.S. annual commercial landings from 1987 through 2007 ranging from a high of 429,378 pounds in 1996 to a low of 165,682 pounds in 2005 (NOAA Fisheries Service, Accumulated Landings System). In just the Gulf, annual landings ranged from a high of 263,969 pounds in 1996 to a low of 86,447 pounds in 2007, and have exhibited an overall declining trend since 1997. Therefore, offshore aquaculture operations that produce these two species would not be expected to directly compete against fishermen; however, they would be expected to directly compete with onland and nearshore aquaculture producers of these same species. To the extent that competition occurs, it can be reduced through selection of market outlet. Offshore aquaculture operations can reduce competition between themselves and fishermen by not selling to the same dealers that buy wild-caught fish, instead selling directly to restaurants and other establishments. Competition can be further reduced by selling cultured product during the off season for wild harvests, or developing and marketing different product forms.

It should also be noted that the potential for ex-vessel price to fall because of offshore aquaculture is, should there be direct competition, also dependent upon other factors. For example, if dealers' demand for fish and shellfish increases, the increase in demand could cause the ex-vessel price paid to fishermen to remain constant or increase despite the increase in supply caused by offshore aquaculture (see Knapp 2008b for discussion that marketing of aquaculture can increase consumer demand). Similarly, price competition exists from supplies other than from offshore aquaculture. On-land and/or nearshore aquaculture production could develop where it otherwise does not currently exist, or increase where it has already begun, thereby increasing supply and causing the price received by both fishermen and aquaculture operations to fall. Similarly, foreign producers of seafood have the potential to flood the U.S. market with low priced products, adversely affecting both domestic fishermen and aquaculture producers. Nonetheless, regardless of the sources of increased supply, a potential economic and social cost of the development of offshore aquaculture is declines in the ex-vessel prices of commercial species and losses of fishing and fishing-related revenues, incomes, employment and businesses. Loss of a livelihood, such as being a fisherman, is a loss of personal and social identity.

In addition to potential price effects, if any of the cultured species have domestic fisheries that are managed under an IFQ program, the values of IFQ shares, and the value of the overall IFQ program, would decline with any fall in the ex-vessel price of wild-harvested fish, as would the resale value of fishing gears and vessels that target those species. As with non-IFQ fisheries, such adverse economic impacts, should they develop, would be expected to result in an increase in fishermen going out of business, which would further reduce historical fishing community incomes and employment derived from supporting wild-caught fisheries.

In addition to the potential effects thus far discussed, another potential effect of the development of offshore aquaculture is related to market power. If offshore aquaculture operations compete directly with fishermen, their competitive advantage of higher quantity and quality and consistent supply could result in long-term contractual arrangements and/or vertical integration with dealers, dominant market shares, and anticompetitive behaviors such that fishermen are unable to sell some or all of their landings to these dealers or are offered a substantially lower price. This would reduce fishing and fishing-related revenues, income and employment and corresponding economic and social opportunities, which would adversely affect fishermen, their families, and fishing communities.

Offshore aquaculture operations would generate negative externalities; however, the magnitude of these externalities would be dependent upon additional regulatory actions, if any, that would restrict offshore aquaculture operations in order to protect both the human and biological environment. **Preferred Alternative 2** would not restrict Gulf offshore aquaculture, with the exception of limiting who could apply for and receive a permit and the activities authorized by such a permit. Hence, without additional restrictions, offshore aquaculture firms could produce genetically modified or transgenic species (if authorized by the FDA), abandon equipment, introduce disease to wild stocks, and engage in other environmentally damaging activities that are not regulated by other federal agencies. The resulting economic and social costs to fishermen, their families and communities could be beyond measure if native stocks, livelihoods, and fishing communities were permanently lost and essential habitats destroyed. Additional actions to prevent or reduce the likelihood or severity of these externalities are included in this proposed FMP and are discussed in subsequent sections. However, even if additional actions are designed to reduce the economic and social magnitude of negative externalities, negative externalities are unlikely to be totally avoided and would be created by offshore aquaculture production.

It is reasonable to expect that offshore aquaculture operations would generate negative externalities; however, the magnitude of these externalities would be dependent upon additional regulatory actions, if any, which would restrict offshore aquaculture operations in order to protect both the human and biological environment. Additional actions to prevent or reduce the likelihood or severity of these externalities are included in this proposed FMP and are discussed in subsequent sections. However, even if additional actions are designed to reduce the economic and social magnitude of negative externalities, negative externalities are unlikely to be totally avoided and would be created by offshore aquaculture production.

Preferred Alternative 2 would not restrict the duration of time when or the location where an offshore aquaculture can operate, though both considerations are addressed by subsequent actions in this proposed FMP. Without such restriction, an offshore aquaculture operation could place cages, pens and platforms anywhere it wanted in the Gulf EEZ and occupy an area or areas of the EEZ indefinitely, thereby enclosing that area and precluding all other activities. This would create the possibility that offshore aquaculture operations could site themselves in historical fishing areas, which would displace fishermen from use of some or all of those areas and cause economic losses of some or all landings, incomes and employment, which could be economically and socially upsetting to fishermen, their families and fishing communities.

There are potential benefits and other costs of legal enclosure of areas of the EEZ, depending upon one's point of view. First, it can be argued that giving offshore aquaculture operations "like-ownership" of an area of the EEZ is beneficial because it is consistent with the goal of creating an "ownership society" (www.whitehouse.gov/news/releases/200/08/20040809-9.html) and the neoclassical economic belief that common-property ownership of a natural resource is not environmentally or economically sustainable and private-property ownership is necessary for natural resource conservation (Gordon 1954, Scott 1955, Hardin 1968, Shamshak and Anderson 2008). However, ethnographical and other research in sociology, anthropology, and psychology has shown common ownership of a natural resource can be sustainable and private ownership can destroy a natural resource (Cass and Edney 1978; Acheson 1979, 1981; McCay and Acheson 1987; Ostrom 1990; Kollock 1998). Under this perspective, an offshore aquaculture permit that would enclose areas of the EEZ would have economic and social costs because it would privatize what was common wealth, transferring wealth from the public to private offshore aquaculture interests.

Another potential social cost of enabling the development of an offshore aquaculture industry in the Gulf EEZ is that it changes the cultural meanings and values of a fish. In traditional fishing, a fish becomes a commodity after it is caught, whereas in aquaculture, a fish becomes a commodity after it is hatched. Therefore, in offshore aquaculture, there would be a transformation of spawned and hatched native Gulf fish into objects consistent with monetary exchange; a Gulf fish will become a commodity throughout its life, not at its end. Such a transformation of values and meanings has additional and not minor social consequences, especially for fishing communities (Pálsson 1991).

Preferred Alternative 2 would restrict eligibility for a Gulf Aquaculture Permit to U.S. citizens or permanent resident aliens and prohibit the landing of cultured product in non-U.S. ports. This eligibility restriction is consistent with those under IFQ programs. The economic and social benefit of this restriction is that it is consistent with the economic and social values of the Americanization of the EEZ. The effect of the prohibition against foreign landing is that it precludes an entity from landing cultured product in a foreign country, then exporting it to the U.S. In other words, without this prohibition, the

U.S. could import seafood that was produced by offshore aquaculture in the Gulf. The net effect of this requirement is unknown. Landing at a foreign port could be desired by offshore aquaculture operations to take advantage of lower processing costs or, potentially, to land the product closer to its intended market. Subsequent import of this product may still be possible at an advantageous producer and U.S. consumer price; however, that would increase, not decrease, the seafood trade deficit. A required first landing at a U.S. port simply ensures that the economic activity associated with the initial landing remains in the U.S. (product could still be landed in the U.S., exported for processing, then imported for consumption at a viable consumer price). Whether the U.S. landing requirement results in a net social and economic gain to the U.S. would be dependent upon the specific circumstances of the species produced and associated consumer and labor markets, and cannot be predicted.

Under **Preferred Alternative 2**, an aquaculture permit would be transferrable. A transferable permit would generate a direct economic benefit to owners of the permit because the permit would become a marketable asset for the duration of the permit. According to neoclassical economic theory, owners of a privately owned productive asset have the incentive to preserve or increase the value of that asset. Thus, it follows that Gulf offshore aquaculture operations would act to preserve the economic value of the permit by engaging in practices that would not damage the long-term production capacity allowed by the permit. Also, it is theorized that transferable permits encourage economically efficient producers to acquire existing and inefficient operations, which would increase production of the Gulf offshore aquaculture fishery. By taking ownership of an existing permit, an efficient producer would not have to apply for a new permit and incur the time and costs to do so. Moreover, the economically efficient producer could begin operations at the newly acquired facility immediately after it purchased the permit and, hence, reduce start-up time and associated costs.

Although **Preferred Alternative 2** would allow transfer of the aquaculture permit, the site of the aquaculture operation would have to remain fixed. Requiring that the operation site remain fixed would be expected to eliminate potential problems associated with inappropriate site location or potential strategic behavior by entities with current site locations for other activities. A specific example is oil and gas platforms. If oil and gas platforms are allowed to serve as aquaculture sites, permit transferability with site change might provide an opportunity for owners of these sites to delay or totally avoid the costs of currently required dismantling after extraction activities cease. While such delay would increase the wealth to the platform owners by avoiding the platform dismantling costs, the presumed environmental and other benefits to society of platform removal would be delayed or potentially never realized.

In summary, the previous paragraphs illustrate some of the potential benefits and costs that could be associated with the development of an offshore aquaculture industry in the Gulf EEZ. Although scenarios can be hypothesized, based on specific assumptions, that alternatively demonstrate clear incremental or net benefits and costs, at the individual, local, regional, and national level, such scenarios, while potentially illustrative "what if's", would be purely speculative. USDOC (2008b) provides discussion of the potential effects of offshore aquaculture. While it is logically inarguable that the development of offshore aquaculture would result in all costs and no benefits, or the converse, the extent to which any benefits or costs develop depends on the overall structure of the system, the checks and balances established, and the flexibility of the system to recognize and respond to adverse developments. In essence, the goal of this proposed FMP is to create an operating environment that best enables the realization of the benefits while minimizing the costs. **Preferred Alternative 2** would allow the development of an offshore aquaculture industry in the EEZ, with associated potential costs and benefits, by establishing a necessary permitting system. The permitting system would not in itself, however, satisfy all the structural, procedural, or administrative management needs of the aquaculture system and, thus, would not significantly control (other than from the perspective of a conclusion that no industry could develop without a central permitting system) the actual occurrence or development of any specific benefit or cost. The occurrence of these effects would depend on the full suite of actions implemented under the proposed FMP, as well as the implementation of the plan over time in reaction to developments internal and external to the fishery. Nevertheless, again, to reiterate, **Preferred Alternative 2** would simply enable the development of an offshore aquaculture industry in the Gulf EEZ by establishing a necessary permitting system. In addition to the consideration of the potential costs and benefits of an offshore aquaculture industry discussed thus far, the establishment of a permitting system imposes certain operational costs which are the subject of the following paragraphs in this section.

Under **Preferred Alternative 2**, two types of permits would be required, an aquaculture permit and a dealer permit. Although permit application costs exist for other current Gulf federal permits, an application cost and estimated time of preparation for the aquaculture permit application is unknown at this time (see **Action 2** for discussion of the alternative application requirements). A permit cost is determined by the time required for review and processing of the application. Due to the potential amount of information required for the permit application (**Action 2**), and the associated review time, the permit cost could be in the thousands of dollars. An actual cost has not yet been determined. However, even if the cost were thirty, forty, or fifty times the cost of other Gulf permits, the permit cost would be expected to be minor relative to the overall expenditures required to prepare a business plan and establish a viable aquaculture business.

At present, an annual dealer permit (OMB No. 0648-0205) is required to receive the following species harvested in the Gulf EEZ: reef fish, sharks and swordfish. All applications must include a payment of a non-refundable application fee of $50.00 for the first fishery and $12.50 for each additional fishery requested on the application. It is estimated that the time required to complete the average application for an annual dealer permit is 20 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and reviewing the collection of information (page 4 of Federal Permit Application for an Annual Dealer Permit). Presently, certain fisheries have mandatory reporting requirements. Under **Preferred Alternative 2**, anyone who purchases cultured organisms from the Gulf EEZ would be required to have a Gulf aquaculture dealer permit. The annual cost of this requirement would be $12.50, if the buyer already has an annual dealer permit, and $50, if not.

Alternative 3 would divide the single aquaculture permit of **Preferred Alternative 2** into two separate permits, a Gulf aquaculture siting permit and a Gulf aquaculture operating permit. The siting permit would authorize use of a particular area of the Gulf EEZ for purposes of aquaculture; however, it would not authorize deployment or operation of a facility. An operating permit would authorize the same activities that the single permit of **Preferred Alternative 2** would, with the exception that an operating permit would not authorize deployment or operations in any area of the EEZ for purposes of aquaculture. In effect, in order to functionally develop and operate a Gulf offshore aquaculture operation, both permits would be required by the same entity or partnering entities.

The economic and social costs of **Alternative 3** would be expected to be the same as those of **Preferred Alternative 2**, except, if the permits are separate and transferable, this alternative would: 1) increase the combinations of compatible sites and operations that do not require a new permit, and 2) increase the time and due diligence costs of purchasing compatible permits. Also, the separability of the permits under **Alternative 3** may create compatibility issues between approved operation plans and permitted sites. It is possible that aspects of a specific operation plan are only appropriate or best appropriate if the operation is to occur at a certain (or similar) site. Conducting the operation at a different or dissimilar site may result in unanticipated problems, with associated adverse social and economic costs. While the likelihood of this occurring may be small if the same entity successfully makes application for both permits (it is presumed they have factored the commonality of the plan and site into their applications), separation of the permits could result in one entity with one or more site permits (they may not have applied or applied and were unsuccessful in getting an operating permit) and another entity with one or more operation permits (with reverse behavior/success in getting a site permit). These entities could subsequently engage in a transaction that results in an operation ill-suited (from a fisheries management perspective) to the site. As a result, the separation of the operation permitting process from the site permitting process may result in unexpected consequences, with associated adverse social and economic consequences. A comparison of the Action 1 alternatives is provided in Table 6.2.2.1

Table 6.2.2.1 Comparison of Action 1 Alternatives

Action 1	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Rising seafood trade deficit	
	Higher prices of seafood	
Preferred Alternative 2	Negative externalities of unrestricted offshore aquaculture could have negative economic and social impacts on fishermen, their families, communities, and businesses. These externalities are expected to be reduced by controls established by other proposed actions.	Enables unconstrained increases in domestic production unless limited by additional action
	Fishermen displaced from areas of EEZ	Reduces seafood trade deficit.

	indefinitely and possibly from traditional fishing grounds if offshore aquaculture is unrestricted causing losses to some or all landings, revenues, employments from fishing and supporting industries. Those losses could be economically and socially devastating to fishing communities. These effects are expected to be reduced or avoided by controls established by other proposed actions.	Potentially reduces consumer prices of seafood.
	Offshore aquaculture in direct competition with fishermen could cause ex-vessel prices to fall, losses of fishing and fishing-related revenues, incomes, employment and businesses	Increases national income and welfare
	Offshore aquaculture's long-term contractual arrangements or vertical integration with dealers, dominant market shares, and/or anticompetitive behaviors could create market conditions such that fishermen are unable to sell some or all of their landings to these dealers or are offered a substantially lower price	Increases consistency of domestic supply and improves quality of seafood
	Changes cultural meanings and values caused by transformation of spawned and hatched fish into objects consistent with market exchange that have additional social consequences for fishing communities	Increases employment in and incomes from aquaculture, aquaculture-supporting, wholesale seafood, seafood processing, and retail seafood industries
	Transfers common wealth to corporate aquaculture interests	Increases wealth by creating a transferable permit authorizing operation of aquaculture in an area of the Gulf EEZ
	Creates aquaculture operators permit with currently unspecified cost and additional dealer permit, $12.50 to $50 and 20 minutes annually per buyer of cultured products	Creates monetary incentive for sustainable operations by creating transferable permit
	May reduce benefits derived from dismantling of decommissioned oil and gas platforms	Encourages less efficient producers to leave industry
Alternative 3	Same as Alternative Two Plus:	Same as Alternative Two Plus:
	May increase transactions costs of those attempting to enter the industry by buying existing permits, particularly if one seller's site permit may not be compatible with same or other seller's operating permit.	Reduces time and costs for platform owners to apply for a permit by reducing it to a Site Permit.
		Increases the combinations of site and types of operations that would not require a new permit

6.2.3 Direct and Indirect Effects on the Administrative Environment

The creation of a permitting system will have a direct effect on the administrative environment, though the extent of that effect is difficult to determine due to the uncertainty in the number of applicants expected to apply for a permit. It is estimated that 5-20 operations could begin operation and achieve the 64 mp OY level specified in Action 9. Despite not knowing how many operations may eventually operate in the Gulf, a permit is almost completely administrative in nature and therefore is expected to have a direct effect on the administrative environment.

The status quo as applied under **Alternative 1** currently has a negative effect on the administrative environment. The full requirements and process for application and issuance of an EFP can be found in 50 CFR 600.745 and are summarized here. The RA must review all information pertinent to the EFP and, where necessary, request further information if clarification is needed. NOAA Fisheries Service must then publish the EFP in the *Federal Register* and solicit public comment on the proposal for 15-45 days. Finally, after the public comment period, the Council reviews the EFP, comments, and then NOAA Fisheries Service approves or disapproves the EFP. In addition to NOAA Fisheries Service and the Council's administrative environment being negatively affected, other regulatory agencies, depending on the nature of the EFP and their regulatory authority, may also have to comment or request additional information. This negatively affects these agencies' administrative environments.

The intent of creating a permitting process through this FMP, whether one permit (**Preferred Alternative 2**) or two (**Alternative 3**), is to eliminate some of the burden placed on the administrative environment of NOAA Fisheries Service and various agencies'. A standardized permit(s), as created by **Preferred Alternative 2** and **Alternative 3**, would afford agencies a more streamlined review of the aquaculture facility's operations and impacts without sacrificing the integrity of their review. NOAA Fisheries Service would incur increased administrative costs associated with review, issuance, and renewal of permits, review of operations, enforcement, and publication of written notices and comment periods. **Preferred Alternative 2** also allows transferability of an aquaculture permit, which may create some addition burden on the administrative environment depending on how many modifications to the permit are needed. **Alternative 3** also has the option for transferability of a siting and operating permit, potentially doubling the burden of the administrative environment.

The permit will be designed to incorporate some of the requirements of other agencies (Action 2), thereby eliminating the need for some additional information requests. Memoranda of Understanding (MOU) or General Permits could be issued by these agencies which provide authority to NOAA Fisheries Service in issuing aquaculture permits, provided conditions are met as specified in the MOU or General Permit. Such an MOU has been created for the culture of live rock. Considering the potential burden on the administrative environment that could be expected from the EFP process, both **Preferred Alternative 2** and **Alternative 3** are more beneficial than **Alternative 1**.

Further, **Preferred Alternative 2** is more beneficial than **Alternative 3** to the administrative environment because it involves only one permit, thereby reducing the burden placed on the administrative environment even more.

For the same reasons as described above, **Preferred Alternative 2** and **Alternative 3** would have more beneficial indirect effects on the administrative environment than **Alternative 1**. By reducing the burden on the administrative environment in the application process and review, administrative resources could be allocated in areas of higher concern for both NOAA Fisheries Service and other agencies.

6.3 Action 2: Application Requirements, Operational Requirements, and Restrictions

This action includes three alternatives for establishing application and operational requirements and restrictions. **Alternative 1** would not specify any conditions when issuing a permit to an aquaculture facility. **Alternative 2** would require a facility to meet the conditions set forth in an EFP. **Preferred Alternative 3** would require each aquaculture operation to adhere to a number of application and operational requirements and restrictions for both the initial issuance of a permit and the continued operation of the facility under the permit. These requirements are designed to provide as much information as possible to NOAA Fisheries Service for permit issuance, review, and renewal.

The requirements and restrictions (as listed in Section 4.2) in **Preferred Alternative 3** are designed to: 1) obtain basic information about an aquaculture operation, 2) prevent or limit to the extent practicable impacts on wild Gulf stocks, 3) monitor the health of animals and habitat in and surrounding an aquaculture facility, 4) improve law enforcement capabilities, and 5) provide NOAA Fisheries Service with other details of facility operation.

6.3.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Requiring conditions to be met prior to issuing a permit and monitoring the compliance with those conditions is an administrative function and has no direct effect on the physical, biological, or ecological environment. However, the majority of these permit conditions are designed to limit the impact on wild populations and the environment and will therefore have an indirect effect on the physical, biological, and ecological environments.

Alternative 1 would allow aquaculture facilities to be issued permits without having to meet any application and operational requirements or other restrictions. This could negatively affect the physical, biological, and ecological environments by not providing NOAA Fisheries Service with the necessary information for permit issuance and monitoring. For example, basic information about an aquaculture facility would not be provided before permit issuance, nor would a permittee have to obtain an assurance bond, certify that they are not using genetically modified or transgenic species, identify an aquatic animal health expert, or abide by various monitoring requirements. Additionally, law enforcement capabilities would be greatly reduced because permitted aquaculture operations would not have to abide by numerous restrictions intended to aid law enforcement. By not specifying specific requirements and restrictions, permitted aquaculture facilities would only be subject to regulations specified by the EPA, ACOE, and other federal agencies, and any other regulations approved in this FMP. **Alternative 1** is the least conservative of any of the alternatives considered in Action 2 and therefore would have the greatest potential negative impact on the physical and biological environments.

Alternative 2 would require an aquaculture facility applying for a permit to meet the conditions specified in an EFP (Appendix A). EFP regulations require an applicant to submit the following information: Date of the application, relevant contact information, species expected to be harvested under the EFP, amount(s) of such harvest necessary to conduct the exempted fishing, arrangements for disposition of all regulated species harvested under the EFP, anticipated impacts on marine mammals or endangered species, and a statement of the purposes and goals of the exempted fishery for which an EFP is needed, including justification for issuance of the EFP. Additionally, the EFP applicant must provide documentation for each vessel to be covered by the EFP, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used. The RA or SRD, as appropriate, may request additional information for determining issuance of an EFP. These conditions may vary from permit to permit because the RA can set terms and conditions for the permit and there is a general lack of specificity provided in the EFP regulations. In addition to the requirements listed above, Section 5.3.4.3 summarizes conditions and requirements proposed by the RA for a previous EFP application. This EFP application was later denied by NOAA Fisheries Service after review by the Council. However, these requirements and conditions serve as a baseline for comparison with requirements and restrictions proposed in **Preferred Alternative 3**. Overall, the proposed EFP requirements are similar to the requirements proposed in **Preferred Alternative 3** and within other actions of this FMP, although less comprehensive. **Preferred Alternative 3** provides several additional requirements that are not included in the EFP conditions. Therefore, **Alternative 2** would afford more protection to the physical and biological environments than **Alternative 1**, but less than **Preferred Alternative 3** because issuance of a permit would be based partly on information specified at the discretion of the RA or SRD.

Preferred Alternative 3 would specify numerous application and operational requirements for permit issuance and aquaculture facility operation. Key application requirements would include contact information, descriptions of allowable aquaculture systems and equipment, site coordinates, documentation of an assurance bond, an emergency disaster plan, identification of an aquatic animal health expert, certification that broodstock used for juveniles were harvested from U.S. waters of the Gulf and certification that no genetically modified or transgenic species will be used for culture. Key operational requirements include: a use it or lose it provision, documentation that broodstock are marked or tagged, certification that cultured animals are pathogen free prior to stocking, and various monitoring requirements. Requirements also include the use of drugs, biologics, and pesticides in compliance with regulations of other federal agencies, maintenance of one locating device on each allowable aquaculture system, gear stowage when transporting cultured organisms to and from a facility, and limiting landing between 6 a.m. and 6 p.m. to aid law enforcement.

Preferred Alternatives 3(a)(1) requires potential permittees to complete an application form for an aquaculture permit. Any application considered for approval by NOAA Fisheries Service would have a written notice and public comment period before issuance. The details of how written notice and public comment would be conducted are described in Section 4.1.

Preferred Alternative 3(a)(2) contains several additional requirements that would be included on the application form. Many of these requirements are administrative in nature (**Preferred Alternatives 3(a)(2)(i-ii), 3(a)(2)(v), 3(a)(2)(vi), 3(a)(2)(x), 3(a)(2)(xv), 3(a)(2)(xvi),** and **3(a)(2)(xvii)**) and none of these requirements would have direct effects on the biological and physical environments. However, some of the requirements may have indirect effects on these environments. Specifying application requirements will allow managers to assess the impacts of a proposed facility by obtaining necessary information about the operation prior to permitting. Key requirements for reviewing and assessing environmental impacts prior to permitting would include:

1. Description of the exact location and dimensions of a proposed aquaculture facility (**Preferred Alternative 3(a)(2)(iii)**);
2. A list of species to be cultured; estimated start up production level by species; and the estimated maximum total annual poundage of each species to be harvested from the aquaculture facility (**Preferred Alternative 3(a)(2)(iv)**);
3. A description of the allowable aquaculture systems to be used (**Preferred Alternative 3(a)(2)(vii)**);
4. A description of the equipment and methods necessary for feeding, transporting, maintaining, and removing cultured species (**Preferred Alternative 3(a)(2)(viii)**);
5. Documentation that the applicant has posted an assurance bond for removal of all components of an aquaculture facility (**Preferred Alternative 3(a)(2)(x)**);
6. Certification that all broodstock used to produce fingerlings were harvested from U.S. waters of the Gulf (**Preferred Alternative 3(a)(2)(xi)**);
7. Certification that no genetically modified or transgenic species are used or possessed at the aquaculture facility (**Preferred Alternative 3(a)(2)(xii)**);
8. Certification by the applicant that a contractual arrangement with an identified aquatic animal health expert has been obtained (**Preferred Alternative 3(a)(2)(xiii)**); and,
9. An emergency disaster plan (**Preferred Alternative 3(a)(2)(xiv)**).

All of these requirements would be used by NOAA Fisheries Service when determining whether or not to issue an aquaculture permit. Additional requirements pertaining to operation of a facility, allowable aquaculture systems, siting, and recordkeeping and reporting are contained in **Preferred Alternative 3(b)** and in other actions throughout this document.

Preferred Alternatives 3(a)(2)(iii) will assist NOAA Fisheries Service in determining whether or not a proposed site will negatively affect marine resources. Additional requirements in Action 6 will also be used for siting marine aquaculture facilities. These requirements will ensure facilities are sited in areas that prevent or minimize to the extent practicable negative impacts to EFH and other marine resources.

Preferred Alternatives 3(a)(2)(iv), 3(a)(2)(xi), and **3(a)(2)(xii)** will provide NOAA Fisheries Service with necessary information to determine if allowable species are being used for culture, where those species were harvested as broodstock, and whether or not those species are transgenic or have been genetically modified. Information on production levels will also be used to determine if the proposed operation complies with the preferred production cap (20 percent of OY) in Action 9. This will ensure that no operation acquires an excessive share of the fishery. These alternatives will also ensure that genetic characteristics of cultured species are consistent with wild species in the event escapement occurs.

Preferred Alternatives 3(a)(2)(vii) and **3(a)(2)(viii)** would provide NOAA Fisheries Service with information on allowable aquaculture systems and equipment during case-by-case review. Additional requirements are specified in Action 5. All of these requirements would be used to determine if proposed aquaculture systems would be sufficient to withstand major storm events in the Gulf. These requirements would help NOAA Fisheries Service assess the potential risk for escapement or damage to marine resources if the proposed aquaculture systems were to be used.

Preferred Alternative 3(a)(2)(x) would require documentation certifying an applicant has posted an assurance bond sufficient to cover the costs of removal of all components of the aquaculture facility. The assurance bond would also cover the costs of removing organisms with OIE-reportable pathogens, genetically modified organisms, and transgenic species if a permittee does not remove these organisms upon order by NOAA Fisheries Service (Action 2, Alternative 3(a)(2)(xiii) and Action 8, Alternative 2(d)). All oil, gas, and mineral extraction firms are required under MMS regulations to remove platforms and connecting pipe lines and return the ocean bottom to its original configuration (http://www.gomr.mms.gov/homepg/regulate/ regs/ntls/ntl00-16.html). Additionally, the National Offshore Aquaculture Act of 2007 (Appendix B) proposes requiring an assurance bond for removal of the aquaculture structures as a criterion of the permit. Requiring an assurance bond would eliminate the potential for navigation hazards in the event an operation terminates their business. It would also protect the biological and physical environment by preventing long-term damage to habitat and entanglement of wildlife in derelict gear.

Preferred Alternative 3(a)(2)(xiii) would require applicants to certify that they have entered into a contractual agreement with a certified aquatic animal health expert. The aquatic animal health expert would be a licensed doctor of veterinary medicine or certified by the American Fisheries Society as a fish pathologist or fish health inspector. This individual would be responsible for inspecting animals prior to stocking and determining if pathogens exist. This requirement is intended to reduce the potential for the spread of pathogens to wild stocks. Additional information on pathogens in cultured species can be found in Section 6.1.2

Preferred Alternative 3(a)(2)(xiv) would require an emergency disaster plan prior to permit issuance. The intent of this plan is to develop procedures for preparing allowable aquaculture systems and equipments, as well as cultured organisms, in the event of a disaster. Requiring an emergency disaster plan will help businesses prepare their operations in the event of a disaster, thereby reducing risks and potential impacts to the physical and biological environments.

In addition to the 17 application requirements mentioned above, Action 2 also specifies 15 operational requirements. Operational requirements include:

1. A use it or lose it provision to prevent speculative entry (**Preferred Alternative 3(b)(1)**);
2. Marking of broodstock at hatcheries (**Preferred Alternative 3(b)(2)**);
3. Inspection of cultured animals prior to stocking in allowable aquaculture systems (**Preferred Alternative 3(b)(3)**);
4. Maintenance of a electronic locating device on each cage or net pen (**Preferred Alternative 3(b)(4)**);
5. Compliance with EPA feed monitoring and management practices (**Preferred Alternative 3(b)(5)**);
6. Compliance with EPA and ACOE monitoring and reporting requirements (**Preferred Alternative 3(b)(6)**);
7. Inspection of allowable aquaculture systems for entanglements or interactions with marine mammals, protected species, and migratory birds (**Preferred Alternative 3(b)(7)**);
8. Use of drugs, pesticides, and biologics in compliance with other federal agency regulations (**Preferred Alternative 3(b)(8)**);
9. Maintenance of fish with heads and fins intact (**Preferred Alternative 3(b)(9)**);
10. Prohibition on possession of wild fish at or within the boundaries of an aquaculture facilities restricted access zone, with the exception of fish used for hatcheries at a facility (**Preferred Alternative 3(b)(10)**);
11. Prohibition on possession of wild fish or invertebrates onboard facility vessels, vehicles, or aircraft, except when harvesting broodstock (**Preferred Alternative 3(b)(11)**);
12. Allowing NOAA Fisheries Service access to permitted aquaculture sites, facilities, and equipment to conduct inspections (**Preferred Alternative 3(b)(12)**);

13. Juvenile organisms for grow-out at an aquaculture facility may only be obtained from a hatchery located in the U.S. (**Preferred Alternative 3(b)(13)**);
14. Cultured species must be landed between 6 a.m. and 6 p.m. (**Preferred Alternative 3(b)(14)**); and,
15. Any vessel transporting cultured organisms to or from an aquaculture facility must stow fishing gear ((**Preferred Alternative 3(b)(15)**).

These requirements will allow NOAA Fisheries Service to prevent, or minimize to the extent practicable, negative impacts on the physical or biological environments that may result from an aquaculture facility.

Preferred Alternatives 3(b)(1) is administrative in nature (use it or lose it provision) and would have no direct or indirect effects on the physical or biological environments. Similarly, **Preferred Alternative 3(b)(2)** pertains to marking of captive broodstock. This requirement would also have no direct or indirect effect on the physical or biological environments, but could be used by NOAA Fisheries Service to determine genetic lineage in the event that genetic modification is suspected.

Preferred Alternatives 3(b)(3) and **3(b)(4)** would directly or indirectly benefit the physical and biological environments by requiring inspection of animals prior to stocking and marking of net pens and cages with locating devices. Stocking of pathogen-free organisms will be in the best interest of both the operation, as well as NOAA Fisheries Service. By requiring an aquatic animal health expert to certify cultured species as pathogen-free, the risk of transmitting pathogens to cages and subsequently wild stock would be reduced. Additionally, requiring locating devices on cages and net pens will reduce long-term damage to EFH and marine resources that could result from derelict gear.

Preferred Alternatives 3(b)(5), **3(b)(6)**, and **3(b)(8)** all refer to existing monitoring requirements or regulations imposed by other federal agencies. Regardless of whether or not the Council includes these alternatives in this FMP, these regulations would be in effect. It should also be noted that monitoring and reporting requirements imposed by other federal agencies may exist (e.g., USCG and MMS) and the proposed alternatives do not preclude aquaculture permittees from having to abide by other federal agency regulations.

Water quality standards and monitoring requirements are required by the EPA and specified in National Pollutant Discharge Elimination System permits issued by the EPA. These requirements are intended to monitor water quality, including benthic and organic loading, for comparison with established EPA water quality standards. NOAA Fisheries Service would also require permittees to comply with EPA regulations at 40 CFR 451.21 that include feed monitoring and management practices. The FDA, EPA, and USDA regulate drugs, pesticides, and biologics. Permittees would be required to comply with the existing regulations of these agencies. Lastly, the ACOE would issue siting permits for aquaculture operations. Within previously proposed siting permits are numerous requirements for assessing benthic habitat and other marine resources prior to and after permitting.

Preferred Alternative 3(b)(7) would require permittees to regularly inspect allowable aquaculture systems for entanglements and interactions with marine mammals, protected species, and migratory birds. This requirement will assist NOAA Fisheries Service in determining whether allowable aquaculture gear is negatively affecting these species. If entanglements or interactions occur, permittees would have to report this information to NOAA Fisheries Service as specified in Section 4.8.

Lastly, **Preferred Alternatives 3(b)(9)** through **3(b)(15)** are all intended to enhance enforceability of regulations pertaining to aquaculture operations and could indirectly benefit the physical and biological environments. Requiring fish to be maintained with heads and fins intact and prohibiting possession of wild fish at aquaculture facilities and onboard vessels (with limited exceptions) will reduce the likelihood that wild species will be caught and sold as cultured products. Inspections by NOAA Fisheries Service will also ensure that regulatory requirements are being met. Requiring juvenile organisms to be obtained from U.S. hatcheries and specifying a time frame for landing will aid law enforcement by providing access to hatcheries within the U.S. and allowing them more opportunity to meet vessels at the point of landing. The stowage requirement will help prevent wild organisms from being harvested and sold as “cultured” species.

Overall, **Preferred Alternative 3** provides the most comprehensive list of requirements that aquaculture permittees and applicants would have to meet. This alternative would therefore provide the greatest protection and benefits to the biological and physical environments of any of the alternatives in Action 2. **Alternative 2** would also provide numerous application and operating requirements, but those requirements would be less comprehensive and subject to change from one permit to the next because of discretion given to the RA or SRD. **Alternative 1** would not specify any application or operational requirements and would provide the least benefit to the physical and biological environments.

6.3.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not specify application requirements, operational requirements or restrictions for aquaculture in the Gulf EEZ.

Without additional restrictions, offshore aquaculture firms could produce negative externalities, such as genetically modified or transgenic species (if authorized by the FDA), abandoning equipment, introducing disease to wild stocks, and engaging in other environmentally damaging activities that are not regulated by other federal agencies. The resulting economic and social costs to fishermen, their families, and communities could be beyond measure if native stocks, livelihoods, and fishing communities were permanently lost and essential habitats destroyed.

This alternative would allow an offshore aquaculture operation to place cages, pens and platforms anywhere it wanted in the Gulf EEZ and occupy an area or areas of the EEZ indefinitely, thereby enclosing it. That would leave the possibility that offshore aquaculture operations could site themselves in historical fishing areas, which would displace fishermen from use of some or all of those areas and cause economic losses of some to all landings and fishing and fishing-related incomes and employment. Those losses of historical fishing grounds would be economically and socially upsetting to fishermen, their families, and fishing communities.

Alternative 1 would be economically beneficial to offshore aquaculture operations as they would not be required to incur costs to reduce the negative externalities of unrestricted aquaculture operations or placements.

Alternative 2 would impose the same restrictions as those required by the application and issuance requirements of an EFP. As stated in 50 CFR 600.745(b)(2), the application for an EFP must include payment of any required fee as specified by paragraph (b)(1) of §600.745 and a written application that includes, but is not limited to, the following information:

i. The date of the application.
ii. The applicant's name, mailing address, and telephone number;
iii. A statement of the purposes and goals of the exempted fishery for which the EFP is needed, including justification for issuance of the EFP.
iv. For each vessel to be covered by the EFP, as soon as the information is available and before operations begin under the EFP:
    A. A copy of the USCG documentation, state license, or registration of each vessel, or the information contained on the appropriate document.
    B. The current name, address, and telephone number of the owner and master, if not included on the document provided for the vessel.
v. The species (target and incidental) expected to be harvested under the EFP, the amount(s) of such harvest necessary to conduct the exempted fishing, the arrangements for disposal of all regulated species harvested under the EFP, and any anticipated impacts on marine mammals or endangered species.
vi. For each vessel covered by the EFP, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used.
vii. The signature of the applicant.
viii. The Regional Administrator or Director, as appropriate, may request from the applicant additional information necessary to make a determination required under this section.

The RA or SRD may attach terms and conditions to an EFP consistent with the purpose of the exempted fishing, including, but not limited to (50 CFR 600.745(b)(3)(v)):

A. The maximum amount of each regulated species that can be harvested and landed during the term of the EFP, including trip limitations, where appropriate.

B. The number, size(s), name(s), and identification number(s) of the vessel(s) authorized to conduct fishing activities under the EFP.
C. The time(s) and place(s) where exempted fishing may be conducted.
D. The type, size, and amount of gear that may be used by each vessel operated under the EFP.
E. The condition that observers, a vessel monitoring system, or other electronic equipment be carried on board vessels operated under an EFP, and any necessary conditions, such as predeployment notification requirements.
F. Reasonable data reporting requirements.
G. Other conditions as may be necessary to assure compliance with the purposes of the EFP, consistent with the objectives of the FMP and other applicable law.

When NMFS announced receipt of an EFP application from Florida Offshore Aquaculture, Inc. for purposes of offshore aquaculture on July 30, 2003 (68 FR 44745), it stated that it intended to add the following terms and conditions to any issuance of the EFP to ensure that there would be no significant impacts on the environment or on its enforcement efforts regarding existing prohibitions on the taking of the cultured species. The proposed terms and conditions were:

1) Applicant must notify NMFS of any changes to the list of hatcheries to be used.
2) All fingerlings must be certified by the hatchery to be disease-free prior to placement in the cages.
3) Only chemotherapeutants approved by the FDA or prescribed by a qualified veterinarian may be used.
4) Use of toxic chemicals as defined in 50 CFR 622.2 to control fouling of nets is prohibited.
5) Immediate notification must be provided to NMFS if any of the following events occur:
    a. Damage to cages or malfunction of supporting structures;
    b. Large-scale escapement, i.e., loss of more than 20 percent of a cage population;
    c. Major disease outbreak resulting in mortalities exceeding 10 percent; or
    d. Entanglements of marine mammals or endangered or threatened sea turtles.
    e.
6) Quarterly reports are required beginning 90 days after anchoring cages in site on:
    a. Any disease occurrence;
    b. Any use of chemotherapeutants approved by FDA or prescribed by a qualified veterinarian;
    c. Outcome of any events requiring immediate notification (see 5 above);
    d. Changes in faunal composition of the area around the experimental site;
    e. Substrate and water quality monitoring;
    f. Harvests of maricultured fish species;
7) The following samples/records must be maintained a minimum of at least one year after the termination of the EFP and made available for inspection:

a. Sources of feed including batch codes;
b. Sources of each group of fish stocked including:
    1. total number of fish by species;
    2. estimated size of fish;
    3. date of each introduction/stocking;
    4. name, address and phone number of each supplier;
    5. disease status of supplier's facility including, name, address and phone number of analytical facilities assessing disease status;
    6. samples of frozen samples of each group of fish including fish harvested from cages, and during any unusual morbidity or mortality events as per USDA standards; and
    7. phase-one fry will be satellite DNA documented by geneticists at designated hatchery.

8) Fish must be maintained intact through offloading ashore. Fish will be placed in live haul containers located on the harvest vessels, brought to shore, and loaded on live haul trucks for sale to traditional live markets. Any fish over the capacity of the live market will be processed and sold. Once harvested, the mariculture fish must be reported in accordance with State and Federal reporting requirements. Sale is allowed only to dealers licensed by the State to sell maricultured fishery products landed in the State.
9) Not less than 24 hours prior to harvest, provide the following information to the NMFS Law Enforcement Office, Southeast Region, St. Petersburg, FL: date, port, and facility at which the maricultured product will be landed and name(s) and phone number(s) of licensed dealer(s) receiving the fish.
10) NMFS retains the authority to make periodic inspections of mariculture operations and records. If the applicant becomes an aquaculturist certified by the State, the applicant must notify NMFS Law Enforcement of the annual unique serial number required on all mariculture records, including sales, and the records must be made available on inspection by authorized officers and maintained for the duration of the EFP for one year.
11) NMFS has the authority to revoke or suspend the EFP if: the application is found to contain false, incomplete, or inaccurate information; the applicant fails to comply with its terms and conditions; significant new information becomes available indicating that one of the conditions for denial of the EFP applies.
12) Issuance of the EFP does not eliminate the need for the applicant to obtain any other Federal, State, or Local authorizations required by law.

The above stated terms and conditions for issuance of a particular EFP could represent the net effect of what **Alternative 2's** requirements would be; however, they may not. **Alternative 2** would not explicitly establish restrictions to address potentially upsetting negative externalities, such as prohibiting use of genetically modified or transgenic species, monitoring immediate and surrounding habitat, and restricting offshore aquaculture operations from taking areas within historical fishing grounds. Consequently, **Alternative 2** may have the same or slightly reduced economic and social costs as **Alternative 1**. With no specified preclusions, under **Alternative 2**, aquaculture operators would not necessarily have to incur economic costs to reduce the magnitude of negative externalities they produce.

Preferred Alternative 3 would establish specific application requirements and operational requirements and restrictions. Overall, these requirements and restrictions are expected to reduce the magnitude of negative externalities that would be produced by an unrestricted offshore aquaculture industry. For example, the application requirements would prohibit the use and processing of genetically modified or transgenic organisms and requires posting of an assurance bond sufficient to cover the costs of removal of all components of the aquaculture facility. Also, for example, the operational requirements and restrictions would mandate inspection of animals and certification that they are free of reportable pathogens prior to stocking in an offshore aquaculture container system, establish feed monitoring practices, and reduce the set of drugs, pesticides and biologics that can be used.

Preferred Alternative 3 is the most transparent of the three alternatives because it specifies what the application requirements and operational requirements and restrictions would be. This alternative would also give NMFS more of the information that is required to adequately estimate the impacts that a proposed offshore operation would be expected to have on the human and biological environment. Although **Preferred Alternative 3** would likely be the most burdensome alternative on a prospective and operating offshore aquaculture business, these requirements are expected to be the most effective among the alternatives considered in reducing the incidence and severity of the potential negative impacts of an offshore aquaculture industry on the biological environment, wild-harvest fisheries, and associated communities. A comparison of the Action 2 alternatives is provided in Table 6.3.2.1.

Table 6.3.2.1 Comparison of Action 2 Alternatives

Action 2	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Negative externalities of unrestricted offshore aquaculture could have significant negative economic and social impacts on fishermen, their families, and communities	Reduced costs may accrue to offshore aquaculture operations that are not required to incur the costs of reducing negative externalities
	Fishermen displaced from areas of EEZ indefinitely and possibly from traditional fishing grounds if offshore aquaculture is unrestricted causing losses to some or all landings, revenues, and employment from fishing and supporting industries. Those losses could be economically and socially significant to fishermen, their families and fishing communities	
Alternative 2	Same as or slightly reduced economic and social costs of Alternative 1	Similar to Alternative 1, though some requirements to reduce negative externalities may be imposed

Preferred Alternative 3	Imposes costs on offshore aquaculture operations to comply with application requirements and meet more stringent operational requirements and restrictions	Expected to reduce the magnitude of or eliminate or mitigate negative externalities created by offshore aquaculture and their associated economic and social impacts on fishermen, their families, and communities
	Fishermen may be displaced from traditional fishing grounds and customary harvests, with associated impacts on landings, revenues, and employment from fishing and supporting industries. Those losses could be economically and socially significant to fishing communities, subject to the mitigation potential of this alternative and other actions in the FMP	

6.3.3 Direct and Indirect Effects on the Administrative Environment

As stated in Section 6.3.1, application and operational requirements are primarily administrative in nature and would therefore have a direct effect on the administrative environment.

Alternative 1, the no action alternative, would allow the issuance of open ocean aquaculture permits to applicants without requiring any application or operational requirements or restrictions. This alternative would have no direct effect on the administrative environment, since it does not require potential permittees to submit information for issuance of an application. This alternative would also not impose requirements for operating a facility. Indirect effects associated with **Alternative 1** would be significant and could include the inability to monitor environmental impacts, issuance of permits without necessary information for review, and a general lack of regulations for protecting wild species. **Alternative 1** would therefore have the greatest indirect effects on the administrative environment and provide the least benefits to the physical and biological environments.

Alternative 2 would require any facility applying for an aquaculture permit to follow the EFP guidelines at 50 CFR 600.745 (b). Issuance of an EFP is a cumbersome, lengthy process, which negatively affects the administrative environment. Reviewing an application for an EFP, requesting additional information, and soliciting other agency and public comment can take six months or longer before an EFP is issued. This not only negatively affects the administrative environment of NOAA Fisheries Service, but also the Council and other federal and state agencies. As mentioned in Section 6.3.1, the RA has discretion to impose additional requirements for compliance with the EFP. Examples of such discretionary requirements are provided in Section 5.3.4.3. These requirements would represent a significant administrative burden on NOAA Fisheries Service staff to ensure permittees are complying with the restrictions.

Preferred Alternative 3 would create numerous application and operational requirements and restrictions to be met by an aquaculture facility prior to or after permit issuance. These requirements are described in detail in Section 4.2. The requirements are designed to minimize impacts on the physical, biological, and ecological environments of the Gulf by requiring information necessary to issue an aquaculture permit and monitor the impacts of an aquaculture operation.

All application and operational requirements set forth by **Preferred Alternative 3** require involvement of the administrative environment. The administrative environment would be responsible for reviewing permit applications and determining compliance with regulations. Increased requirements would be placed on law enforcement to ensure operations are abiding by regulations. In general, the requirements set forth in **Preferred Alternative 3** can be divided into three categories affecting the administrative environment:

1) ensuring biological integrity of wild stocks;
2) limiting environmental impacts; and,
3) aiding law enforcement.

Specific conditions for ensuring the biological integrity of wild stocks include the identification of source broodstock, descriptions of proposed aquaculture systems and sites, an assurance bond, and pathogen inspection. Environmental impacts will be monitored through existing federal regulations for water quality, feed management, use of drugs and chemicals, facility inspections, and surveys. Law enforcement requirements include permits being carried by vehicles (boats, trucks, planes, etc.) used in aquaculture operations, copies of valid aquaculture permits, maintaining fish with heads and fins intact, prohibiting possession of wild fishes (with limited exceptions) at aquaculture facilities and onboard vehicles used for aquaculture, submission of fin clips, and marking and tagging of broodstock.

Regardless of the preferred alternative chosen, NOAA Fisheries Service expects to have a Regional Aquaculture Program Coordinator who is directly responsible for monitoring and evaluating aquaculture operations. This will result in direct administrative costs to the agency. Additional costs will be incurred by NOAA Law Enforcement, since currently no aquaculture operations exist in the Gulf and are in need of enforcement.

In summary, although **Alternative 1** does not directly affect the administrative environment, the long-term consequences of not having application and operational requirements may be more burdensome than the other two alternatives. **Alternative 2** has proven to be onerous and burdensome on the administrative environment both directly and indirectly. **Preferred Alternative 3** while directly affecting the administrative environment provides the best solution for short-term and long-term burden placed on the administrative environment. The use of a specialized Program

Coordinator will allow the development of an offshore aquaculture industry that is carefully monitored and held to standards set forth in this FMP.

6.4 Action 3: Duration of the Permit

Action 2 includes two alternatives. **Alternative 1**, no action, would continue to allow an EFP to be effective for one year. **Preferred Alternative 2** would require an aquaculture permit to have an effective period of 5, 10, or 20 years, or indefinitely.

6.4.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

The alternatives under consideration differ only in the length of the aquaculture permit effective period. Depending on the alternatives chosen for other actions in this FMP, records kept by the aquaculture facility owners may be reviewed by regulators well before a permit is up for renewal. However, renewal of the permit could entail a more thorough analysis of owner compliance with permit requirements and whether the environmental effects of the facility are acceptable. If a facility is causing unacceptable physical, biological, or ecological effects (as defined and described elsewhere in this document), longer permit durations could lead to greater detrimental physical, biological, and ecological consequences than shorter ones because these unacceptable effects would persist over a longer time before remediation. Therefore, if a facility had negative effects, **Alternative 1** would have the least negative physical, biological, and ecological consequences since it has the shortest permit duration, while **Alternative 2(d)** would potentially have the most negative consequences because it allows the longest permit duration (indefinite). The remaining alternatives, in decreasing order of permit duration and potential for negative environmental effects, are **Alternative 2(c)**, **Preferred Alternative 2(b)**, and **Alternative 2(a)**.

However, with the recordkeeping and reporting requirements established in Action 8 and the conditions attached to the permit (Action 2), it is not expected that a facility will be able to operate for any extended period of time while engaging in detrimental activities to the physical, biological, and ecological environment. NOAA Fisheries Service is expected to have Regional Aquaculture Coordinators and other staff, who will conduct on-site inspections on at least an annual basis, if not more frequent, to monitor compliance with the conditions and requirements specified in other actions of this FMP. Additionally, permittees will have to satisfy reporting requirements of other federal agencies. If an operation is determined to not be complying with aquaculture regulations, the operation’s permit could be revoked, suspended, or modified in accordance with subpart D of 15 CFR part 904. Therefore, the permit duration most likely have no effect at all on the physical, biological, and ecological environment, whether directly or indirectly.

6.4.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative might suggest that a Gulf offshore aquaculture permit would be of indefinite duration. However, as written, the duration of an aquaculture permit under the status quo would be of the same duration as an EFP, which is one year unless otherwise specified and no more than short-term if renewed. The financial commitments of an aquaculture operation are expected to be sufficiently large enough that it is unlikely that an operation would be willing to commit their resources to a project permitted for one year or the short-term. As a result, **Alternative 1** would not be expected to be conducive to the development of an offshore aquaculture industry in the Gulf EEZ.

Although **Alternative 1** would not be expected to be conducive to the development of an aquaculture industry, should any permit actually be issued, the effects of such permitting and siting would be as described for the previous actions. Specifically, fishermen may be displaced from areas of EEZ and possibly from traditional fishing grounds causing losses to some or all landings, revenues, employment from fishing and supporting industries. Those losses could be economically and socially devastating to fishing communities depending on the magnitude and duration of the losses.

Preferred Alternative 2 considers alternative permit durations from 5 years to indefinitely. The potential impacts of the development of an aquaculture industry have been previously discussed and the following discussion focuses only on nuances to these impacts that would be expected to result from the duration of the aquaculture permit. Under each of the alternatives, the permit would remain valid for the specified period of time unless revoked, suspended or modified.

Alternatives 2(a) and **2(c)** would make the aquaculture permits effective for 5 years and 20 years, respectively. Neither alternative would allow the permit to be renewed. If not renewable, a permit of short duration may have little to no market value. For example, the 5-year permit under **Alternative 2(a)** may be of insufficient duration to get facilities at the site in position and ready for the introduction of its first batch of fingerlings, so the permit may expire before the operation could produce a marketable product. Even a 20-year non-renewable permit may be of insufficient duration to cover the investment and operation costs with a reasonable rate of return sufficient to make the investment worthwhile, particularly if the business has to cease operation and re-start somewhere else. Hence, the market value of a 20-year non-renewable permit may be zero. Whether the duration of a permit is of sufficient length or not to generate revenues greater than the fixed and variable costs, the value of a non-renewable permit would fall precipitously towards the end of its useful life and there is little incentive to preserve the value of a soon-to-be invalid transferable permit. It is unclear whether the permit holders could simply apply for a new but essentially identical permit, with associated costs, or whether the application period could overlap the existing permit period such that, should the new permit be approved, no interruption of business would occur. Nevertheless, such uncertainty and the overall potential limitations of the permit duration and non-renewal condition could effectively reduce the number of operations that are expected to enter the fishery within the next 10 years, thereby reducing both the potential costs and potential benefits of an offshore aquaculture industry. The cessation of aquaculture operations when their permits expire would open the aquaculture sites to alternative uses. This would include access to normal fishing activities, and the associated social and economic benefits, that might have existed prior to the use of the site as an aquaculture site.

Preferred Alternative 2(b) would make the aquaculture permit effective for 10 years with renewal opportunity in 5-year increments. Renewal requirements have not been specified. Hence, renewal could be automatic and Preferred Alternative 2b could essentially duplicate **Alternative 2(d)** which would allow the permit to be effective indefinitely, except **Preferred Alternative 2(b)** would require the periodic time and costs associated with permit renewal. Conversely, there may be renewal requirements that effectively limit the ultimate life of a permit. Because this alternative offers renewal that Alternative 2(c) does not, it offers the possibility of a permit life greater than 20 years, which would be more attractive to those offshore aquaculture interests seeking longer or permanent operations.

Alternative 2(d) would allow the offshore aquaculture permit to be effective indefinitely. Consequently, an offshore aquaculture operation would never require renewal of a permit to continue operations. A permit of this duration would give the permit holder exclusive use of a particular site for an indefinite amount of time, which would prevent others from benefiting from use of that site for an indefinite amount of time. While this alternative would be expected to be the most attractive and economically beneficial to aquaculture businesses, the converse would be true for existing and alternative future users of the sites. A comparison of the Action 3 alternatives is provided in Table 6.4.2.1.

Table 6.4.2.1 Comparison of Action 3 Alternatives

Action 3	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Potential indefinite displacement of fishermen from traditional and increasing fishing areas with associated negative economic and social effects. Those losses could be economically and socially significant to fishermen, their families and fishing communities. Potential uncertainty of permit duration may preclude development of an offshore aquaculture industry with corresponding losses of potential benefits from that industry.	Potentially less negative externalities to wild-harvest fisheries and associated industries and communities if fewer aquacultures operations result.
Alternative 2(a)	Reduces number of offshore aquaculture operations, and less cultured production, less reduction of seafood trade deficit, and less employment and income that derive from aquaculture and aquaculture-supporting industries.	Similar to Alternative 1.
Preferred Alternative 2(b)	Displacement and associated costs same as Alternative 1.	Expected to be conducive to the development of an offshore aquaculture industry, with associated social and economic benefits, including benefits to support industries.
Alternative 2(c)	Same as Alternative 2a or smaller reduction in operations, production, exports, employment and income	Similar, though reduced, to Alternative 1.
Alternative 2(d)	Displacement and associated costs same as Alternative 1.	Same as Preferred Alternative 2(b) but without the renewal caveat.

6.4.3 Direct and Indirect Effects on the Administrative Environment

Permit renewal is administrative in nature and would affect this environment directly. However, the intensity of that effect varies with frequency of review and renewal. The administrative burden of reviewing applications for permit renewal decreases as the length of time between renewals increases. The administrative environment would be least affected with an indefinite period (**Alternative 2(d)**), and most affected by the continued use of EFPs. Given the lack of recent applications through the EFP process, it may be better to state **Alternative 2(b)** would impose the greatest burden to the administrative environment. The remaining alternatives, in decreasing order of permit duration and increasing potential for negative administrative effects are **Alternative 2(c)**, **Preferred Alternative 2(b)**, and **Alternative 2(a)**.

As stated previously, the development of an aquaculture industry is going to directly affect the administrative environment. Most of this burden comes from the inspection of facilities and checking for compliance with requirements and conditions of the permit, not from the renewal of permits which may be an unnecessary burden given the level of engagement from the administrative environment. At the same time, renewals should be fairly straight forward and easily accomplished due to the wealth of information that will already exist on a facility because of the reporting requirements, recordkeeping requirements, and inspections. Therefore, renewal periods may not directly affect the administrative environment much more than it will already be affected by carrying out the necessary responsibilities from the creation of a permit process. Therefore, any of the suboptions under **Preferred Alternative 2** would have less impact on the administrative environment than **Alternative 1**, because of the other actions that are part of creating a permit process (i.e., the information for determining to renew or not renew a permit will already exist from recordkeeping, reporting, and inspections).

6.5 Action 4: Species Allowed for Aquaculture and Included in the Aquaculture Fishery Management Unit

Action 4 has four alternatives. **Alternative 1**, no action, would not specify what species could be used for aquaculture. **Alternative 2** would allow the culture of red drum and all species in the Council's reef fish and coastal migratory pelagics FMPs. Harvest of red drum is currently prohibited in the Gulf EEZ. Shrimp, spiny lobster, stone crab, and corals could not be used for aquaculture under **Alternative 2**. Commercial harvest of corals is currently prohibited in federal waters. **Alternative 3** would allow the aquaculture of all marine species managed by the Council, except shrimp, corals, and goliath and Nassau grouper. Harvest of goliath and Nassau grouper is currently prohibited in the Gulf. **Preferred Alternative 4** would allow the aquaculture of all marine species in the Gulf managed by the Council, except shrimp and corals, and includes a request to the HMS division of NOAA Fisheries Service to allow the culture of species managed under their authority (tunas, billfish, sharks, and swordfish). No non-native or genetically modified species would be allowed under this alternative. **Alternatives 2-4** would each include allowable aquaculture species in the Aquaculture FMU.

Endangered and threatened species under the ESA in the Southeast Region cannot be used for commercial aquaculture. Section 9 of the ESA makes it unlawful for any person to take any endangered species of fish or wildlife. Under Section 4 of the ESA, the take prohibition may be extended to species listed as threatened if deemed necessary and advisable for the conservation of the species. NOAA Fisheries Service has issued regulations extending the prohibition of take, with limited exceptions, for all threatened species listed in the Southeast Region. None of the take exceptions allow for the commercial aquaculture of any Southeast Region endangered or threatened species. Species of Concern (SOC) are not listed under or protected by the ESA. No specific protections would be afforded SOC with regard to commercial aquaculture.

6.5.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Determining what species are permissible for aquaculture activities could have both direct and indirect effects on the physical, biological, and ecological environment. The first factor to consider in determining allowable species is impacts to wild stocks. These impacts are discussed in Section 6.1.1, and briefly revisited here. **Alternative 1** is the only alternative that allows non-native species and/or genetically modified species (if such use were permitted by FDA) to be used in aquaculture operations. Under **Alternative 1**, NOAA Fisheries Service, in consultation with the USFWS could determine if culture of a particular species was acceptable, including non-native species. The Lacey Act Amendments of 1981 (16 U.S.C. §§ 3371-3378) provide the USFWS with authority to regulate the import, transport, and possession of non-native species. Regulations at 50 CFR 16.13 state that no live fish, mollusks, crustaceans, or any progeny or eggs of these organisms may be released into the wild except by a State wildlife agency having jurisdiction over the area of release or by persons having prior written permission from such agency. However, such approval of non-native species is unlikely because the USFWS and NOAA co-chair the federal Aquatic Nuisance Species Task Force, whose task is to prevent and control aquatic nuisance species, and implement the NANPCA of 1990. Further, The Council's Ad Hoc Aquaculture AP has also indicated opposition to the use of any non-native species for aquaculture.

There is some evidence of the detrimental effects of non-native species on ecosystems. If non-native species were allowed to be cultured in the Gulf EEZ and some escaped, it could have negative impacts on the biological, physical, and ecological environments (Section 6.1). Potential negative effects caused by the introduction of non-native species include: competition with wild stocks, changes to community structure and food web dynamics, and modification of genetic structure if mating occurred with wild stock. In the most extreme cases in which non-native species become established, fundamental changes in ecosystem function may result in habitat degradation, transmission of pathogens, and loss of other species. Allowing only species native to the Gulf and managed by the Council will ensure that any species being cultured are under an FMP and managed according to the National Standards.

The difference between **Alternatives 2**, **3**, and **4** is only in the number of species allowed for aquaculture, not the origin of the species. Shrimp and coral are excluded from all alternatives, except **Alternative 1**. Shrimp are currently raised in onshore ponds and it is expected that offshore aquaculture of this species will not be technically feasible or cost effective. Corals are currently prohibited from harvest and there is not expected to be high demand for culturing corals for commercial purposes. The effects on the biological, physical, and ecological environments are expected to be similar for **Alternatives 2-4**. Thus, the impact to the wild stocks would not be expected to come from the introduction of non-native species. Instead, the impact to the wild stock populations would come from two other sources. The first would be from competition from con-specifics that escape aquaculture facilities and interact with their wild counterparts. This potential impact is discussed in Section 6.1.1. The second potential impact would come from the collection of broodstock for use in hatchery operations. Any harvest of broodstock would be regulated under the authority of the MSFCMA, and therefore harvest would be constrained to the current regulations developed under the FMP for a particular species. Therefore, the harvest of broodstock is expected to have minimal impacts on the wild populations, as only a relatively few number of individuals is required for hatchery purposes at any given time. Selecting **Alternative 2**, **3**, or **4** would therefore have less effect on the physical, biological, and ecological environment than **Alternative 1** when examining the impact on wild stocks.

Another factor to consider in determining species allowed for aquaculture is the potential to create loopholes or opportunities for poaching to occur. The alternatives under consideration do not specify how many specimens would be taken. Instead, they differ in the number of species that could be cultured. **Alternative 1** would allow the greatest number of species to be cultured and so would potentially cause the greatest opportunity for poaching to occur. The remaining alternatives, in decreasing number of species allowed for culture and associated risk, are **Alternatives 2**, **3**, and **4**. **Alternative 3** would provide the best protection and subsequent recovery of goliath and Nassau grouper by preventing a means of illegal sale of wild-caught species. However, it should be noted that many operational requirements and reporting requirements in Actions 2 and 8 are intended to assist law enforcement and prevent illegal harvest and sale. Legal sale of cultured goliath and Nassau grouper, which could occur under **Alternatives 1**, **2**, and **4**, could make it easier to sell illegally harvested wild fish by fraudulently marking them as "cultured." Similarly, **Alternative 2** would best prevent harvest of wild corals by preventing a potential means of illegal sale of these species. Sale of illegally harvested red drum as "cultured" would be possible under all alternatives. However, the potential for illegal sale is greatly decreased by the permit requirements developed under Action 2. The requirements developed for improving law enforcement capabilities were a direct result of the concerns of creating opportunities for illegal sales of fish in the marketplace under the pretext of those sales being cultured fish. By providing law enforcement the necessary tools for determining the origin of cultured species (submission of fin clips), agents can discern if in fact individual fish are products of aquaculture facilities.

Production of native species through aquaculture could result in a net biological benefit to the species and their ecosystems by creating a new source of seafood which could reduce the amount of fishing pressure on wild Gulf stocks. **Alternative 1** would allow culture of non-native species, if approved by the USFWS and NOAA Fisheries Service. Production of these non-native species would not as readily reduce demand for wild-caught native species as would production of native species. The more native species allowed for culture by a particular alternative, the more chances for relief from fishing pressure for those species. **Alternatives 2, 3, and 4** only allow culture of species native to the Gulf, potentially creating positive effects for the wild population by reducing fishing pressure. It must be noted; however, that differences in public demand for cultured versus wild fish could influence the extent of any reduction in fishing pressure on native stocks.

6.5.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would allow an aquaculture applicant to request to culture any species, whether it was native to the Gulf of Mexico or not (See **Preferred Alternative 2** of **Action 1** which restricts harvesting of wild broodstock and aquaculture of species to those native to the Gulf). Under this alternative, all Gulf fishermen and on-land aquaculture producers could be damaged by direct competition with Gulf offshore fish farms. **Alternative 1** might have the greatest adverse economic and social impacts on fishermen, their families and communities that are caused by direct competition.

If the restriction on native species specified in **Preferred Alternative 2** of **Action 1** were not accepted, then the status quo alternative could allow the culture of any species, native or non-native to the Gulf, thereby creating the greatest social and economic threat to fishermen, their families, and associated industries and communities. While the flexibility to potentially culture any species may create the best business opportunity for the aquaculture sector, it would have the greatest adverse economic and social impacts of the alternatives.

Alternative 2 would restrict the set of allowable species to finfish that are native to the Gulf and in the reef fish, red drum and coastal migratory pelagics FMPs and include these species in the Aquaculture FMU.

Alternative 2 would be expected to reduce the number of Gulf fishermen, fishing families and communities that could be economically and socially harmed by Gulf offshore aquaculture operations that directly compete with fishermen. For example, Gulf shrimpers could not be in direct competition with offshore aquaculture shrimp producers, which would further increase a U.S. supply already flooded by foreign imports, because such offshore production of shrimp could not exist. However, by restricting the set of native species that can be cultured, **Alternative 2** could reduce the potential economic benefits to offshore aquaculture operations and associated businesses.

Alternative 3 would set the number of allowable native species between the number allowed by the **Alternative 1** and **Alternative 2**. Consequently, **Alternative 3** would, similar to **Alternative 2**, reduce the potential harm to Gulf fishermen, fishing families, and communities that could be economically and socially harmed by the development of a Gulf offshore aquaculture industry, but not as much as **Alternative 2** because more species could potentially be cultured. Similarly, by not reducing the set of allowable species as much as **Alternative 2**, **Alternative 3** would not be expected to reduce the potential economic benefits to offshore aquaculture operations and associated businesses as great **Alternative 2**.

Preferred Alternative 4 would set the number of allowable species between the number allowed by **Alternative 1** and **Alternative 3**, meaning it would allow the second greatest number of native species that could potentially be cultured. Consequently, the economic and social impacts of **Preferred Alternative 4** would be expected to less than those of **Alternative 3** and greater than those of **Alternative 1**. In effect, the potential social and economic harm to the wild-harvest industry under **Preferred Alternative 4** would be expected to be greater than under **Alternative 3**, but less than under **Alternative 1**, while the potential reduction in economic benefits to the aquaculture industry under **Preferred Alternative 4** would be expected to be less than under **Alternative 3**, but greater than under **Alternative 1**. A comparison of the Action 4 alternatives is provided in Table 6.5.2.1.

Table 6.5.2.1 Comparison of Action 4 Alternatives

Action 4	Economic & Social Costs	Economic & Social Benefits
Alternative 1	Greatest adverse economic and social impacts on fishermen, their families and communities from direct competition with offshore aquaculture producers. Potentially significant adverse economic and social impacts on fishermen, their families, and communities due to possible culture of non-native species.	Greatest potential economic benefits to aquaculture sector that derive from the largest set of allowable species.
Alternative 2	Largest reduction in potential economic benefits to offshore aquaculture operations and associated industries due to fewest allowable species.	Largest reduction in potential social and economic harm to Gulf fishermen, their families, and communities due to fewest allowable species.
Alternative 3	Smaller reduction in potential economic benefits to offshore aquaculture operations and associated industries due to smaller restriction in allowable species.	Smaller reduction in potential social and economic harm to Gulf fishermen, their families and communities due to smaller restriction in allowable species.
Preferred Alternative 4	Smallest reduction in potential economic benefits to offshore aquaculture operations and associated industries due to smallest restriction in allowable species.	Smallest reduction in potential social and economic harm to Gulf fishermen, their families and communities due to smallest restriction in allowable species

6.5.3 Direct and Indirect Effects on the Administrative Environment

As described above, **Alternative 1** would allow culture of non-native species and carries the highest risk of problems due to escapement of cultured fish and their detrimental effects on native stocks and the ecosystem. All other alternatives do not allow culture of non-native species, therefore the negative impacts of accidental escapes on the wild stocks and ecosystem would be much less, and the potential agency action in response to such escapes.

Culture of goliath grouper, Nassau grouper, red drum, and/or corals could result in illegal harvest of wild animals, increasing the administrative burden on law enforcement. Choice of **Alternative 1, 2,** or **4**, which would allow culture of goliath and Nassau grouper, could result in increased administrative costs due to enforcement of regulations and prosecution of violators. **Alternative 3** would prohibit culture of these species of grouper, and ideally would not cause these expenses. **Alternative 2** prohibits culture of corals, so it would not cause administrative costs from addressing illegal sale of corals. Measures which would allow culture of corals could increase enforcement costs and therefore negatively affect the administrative environment.

Alternatives 2, **3**, and **4** allow the aquaculture of various ranges of marine species in the Gulf that are currently managed by the Council and therefore have essential fish habitat identifications and descriptions in GMFMC (2004). Because the range of species in **Alternative 1** is not restricted to species currently managed by the Council (or NOAA Fisheries Service) the essential fish habitat provisions of the MSFMCA would need to be addressed in this FMP for any additional species added to the Aquaculture FMU.

6.6 Action 5: Allowable Marine Aquaculture Systems

The MSFCMA and 50 CFR 600.747 require the Secretary to prepare a list of all fisheries and the gears used in those fisheries. The use of any gear or participation in a fishery is prohibited if it is not included on the allowable list of gears and fisheries in 50 CFR 600.725. An individual fisherman can notify the appropriate Council of the intent to use a gear not already on the list. Unless regulatory action is taken by the Council within 90 days to prohibit the use of such gear, the fisherman may use the gear in the fishery. Upon approval of this FMP, the aquaculture fishery and any allowable gear types would need to be added to this list by the Secretary.

Alternative 1 would not specify the types of marine aquaculture systems (e.g., cages, net pens) allowed in the Gulf. Because **Alternative 1** would not specify any allowable gears, aquaculture either could not occur or the Secretary would have to specify all gears as allowable. **Alternative 2** would allow only cages and net pens for offshore aquaculture. Only allowing cages and net pens could limit culture of other species in the future that are grown using other gear types (e.g., mussel longlines). **Preferred Alternative 3** would not authorize (or prohibit) specific allowable aquaculture systems. Instead, NOAA Fisheries Service would evaluate the marine aquaculture system proposed in each permit application on a case-by-case basis. Permit applicants would be required to submit information sufficient for the RA to determine the structural integrity of proposed allowable aquaculture systems. The RA would also consult with NOAA's offices and programs to determine if proposed aquaculture systems pose a significant risk to EFH, protected resources, marine mammals, public health, and safety.

6.6.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Though determining what is considered an allowable marine aquaculture system is administrative in nature, it can have effects on the physical, biological, and ecological environments. An acceptable aquaculture system must be:

1). Robust enough to withstand open Gulf conditions, including hurricanes without breaking apart;
2). Effective in preventing escapement, and
3). Effective at dispersing wastes by allowing sufficient current flow.

If a system does not meet these standards it may negatively affect the physical and biological environments. **Alternative 1** does not specify aquaculture systems, nor does it provide guidance for evaluating systems proposed by aquaculture operations. This lack of guidance may allow systems to be used, which do not meet the three key factors in determining an effective system listed above. This could lead to negative impacts on the physical, biological, and ecological environment. Negative impacts could include: systems with low structural integrity that are vulnerable to storm events, damage or destruction of critical habitat due to lost or damaged gear, reduced water quality associated with poor dispersal of wastes, and increased risks of escapement by cultured organism.

Alternative 2 would only allow net pens or cages to be used (Appendix F). As long as the applicant planned to use a cage or net pen it would be approved for aquaculture, unless the cage or net pen poses a risk to protected resources and EFH, as regulated under the ESA and MSFCMA. **Alternative 2** provides no requirements for evaluating the robustness and structural integrity of a cage. There would also be no requirements to evaluate a cage or net pen's ability to prevent escapement, prevent environmental damage, or prevent impacts to marine resources, such as marine mammals and protected resources. **Alternative 2** would also prevent the use of any system developed using technology not yet invented that does not meet the definition of a net pen or cage. Such new systems could be far superior to net pens or cages requiring the Council to amend their FMP if they elected to allow such systems. **Alternative 2** also would prevent other existing aquaculture systems from being used (e.g., longlines), especially if the Council includes more species in its FMU. **Alternative 2** is expected to provide slightly greater benefits to the physical and biological environments than **Alternative 1** because it would specify at least two allowable gear types. However, **Alternative 2** will provide fewer benefits to the physical and biological environments than **Preferred Alternative 3** because it does not provide criteria for evaluating the structural integrity of the system.

Preferred Alternative 3 would base approval not on the type of system proposed, but on a case-by-case evaluation by NOAA Fisheries Service of the soundness of the proposed design. This is expected to be the best alternative with the least effects on the physical, biological, and ecological environment. As new technologies are developed and unique niches exploited in the aquaculture industry, a case-by-case review will allow NOAA

Fisheries Service to examine the appropriateness of a system to its application while examining the impacts to the physical, biological, and ecological environments. Applicants would be required to submit documentation sufficient for NOAA Fisheries Service to evaluate the structural integrity of a proposed system. Documentation could include computer and physical oceanographic models. Additionally, NOAA Fisheries Service would assess the risks a proposed system poses to EFH, marine mammals, protected species, wild fish stocks, public health, and safety. Assessment and review would be based on consultations with NOAA offices and programs, such as the NOAA Aquaculture Program and the SERO Habitat Conservation and Protected Resources Divisions. If a proposed system is determined to cause or potentially cause significant risks to marine resources and the human environment, then the proposed aquaculture system would be denied. Any denial would be provided to the applicant in writing. Because of the multiple levels of review, as well as additional documentation that would need to be obtained from the applicant, **Preferred Alternative 3** is expected to provide the greatest benefits to the physical and biological environments.

6.6.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not specify and explicitly restrict the types of systems used in Gulf offshore aquaculture. NOAA Fisheries Service would still have the authority to approve or disapprove specific systems based on an unspecified evaluation criteria and determination of appropriateness. Consequently, **Alternative 1** could be viewed as almost functionally equivalent to **Preferred Alternative 3**, which also would not specify types of allowable systems, but more explicitly identifies the process and criteria that would be used to determine whether a specific system should be approved or not. However, in practice, the absence of these details under **Alternative 1** increases the possibility that the review criteria would not be as stringent as under **Preferred Alternative 3** and that an inappropriate system may be allowed, increasing the likelihood that negative externalities created by systems, with associated adverse social and economic effects, would occur. Examples of these externalities are the damages caused by systems that are inadequate to withstand adverse weather and risks to protected species, habitat, and public health. Absent specific process and criteria requirements, aquaculture operations may be able to reduce their costs by avoiding more detailed and careful consideration of systems capable of reducing these externalities.

Alternative 2 would restrict the types of systems used to cages and net pens. This is the most restrictive of the alternatives and may offer the greatest benefit in terms of reducing the negative externalities of inadequate or inappropriate systems and economic and social costs associated with these externalities. From the aquaculture industry perspective, however, a restriction on the types of systems that can be used could reduce the potential economic viability and returns from the operation because it may disallow the use of a system that best meets the operation's production goals. Adequate reduction of the likelihood of the incidence and/or magnitude of negative externalities may be possible using a system other than cages or net pens.

As previously noted, **Preferred Alternative 3** would not specify allowable systems, but would specify the process and criteria that would be employed for system approval. **Preferred Alternative 3** would not be as restrictive as **Alternative 2,** but would be more specific than **Alternative 1**. Consequently, **Preferred Alternative 3** has the potential flexibility to allow the use of a system that best or better meets the operation's production goals, while addressing the need to reduce potential negative externalities and associated economic and social costs associated with those externalities. Because the evaluation process is more clearly stated in **Preferred Alternative 3** than under **Alternative 1**, the likelihood of using inappropriate systems would be reduced under **Preferred Alternative 3**. However, the cost to the prospective aquaculture operator to satisfy the evaluation process may be greater under **Preferred Alternative 3** than under **Alternative 1**. A comparison of the Action 5 alternatives is provided in Table 6.6.2.1.

Table 6.6.2.1 Comparison of Action 5 Alternatives

Action 5	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Increased possibility of incurring the costs associated with negative externalities resulting from the use of environmentally inappropriate systems	Greatest potential benefit to offshore aquaculture operations that derives from largest set of allowable systems
Alternative 2	Largest reduction in economic benefits to offshore aquaculture operations associated with reduction of allowable systems	Reduction in the costs associated with negative externalities resulting from the use of inappropriate systems
Preferred Alternative 3	Smallest reduction in economic benefits to offshore aquaculture operations associated with reduction of allowable systems	Reduction in the costs associated with negative externalities resulting from the use of inappropriate systems. Greatest potential to approve a system that reduces negative externalities and meets economic goals of the operation

6.6.3 Direct and Indirect Effects on the Administrative Environment

Alternatives 1 and **2** would not require any additional NOAA Fisheries Service review of the proposed aquaculture system before it was deployed, but would require review under the ESA and provisions of the MSFCMA related to EFH. These alternatives would have the least effects on the administrative environment. **Preferred Alternative 3** would require direct review of each system proposed and would therefore directly affect the administrative environment more than the other alternatives. Because both **Alternatives 1** and **2** would not require additional administrative review other than what is already required, they may lead to indirect effects on the administrative environment. Indirect effects could result if proposed systems are authorized that cannot handle the rigors of the offshore environment. If systems are of poor structural integrity, system failures could be expected, leading to escapement of cultured organisms and potential damage to EFH and other marine resources. This could lead to huge increases in demand on the administrative environment as mitigating efforts must be developed and implemented. **Preferred Alternative 3** is not expected to encounter these types of problems as any uncertainty in the use of systems would be addressed in the initial review of a proposed system. However, **Preferred Alternative 3** would result in the greatest costs to the administrative environment because of the time-consuming nature of case-by-case review. Overall, **Preferred Alternative 3** is expected to have the greatest impact on the administrative environment, but the least impacts on the physical, biological, and social environments.

6.7 Action 6: Marine Aquaculture Siting Requirements and Conditions

Action 6 includes three alternatives. **Alternative 1**, no action, would not designate areas in the Gulf EEZ where aquaculture would be allowed. **Alternative 2** would establish marine aquaculture zones. Marine aquaculture would be limited to these zones. **Preferred Alternative 3** would establish criteria and include specific prohibitions to be used when siting a proposed aquaculture facility. These criteria and the baseline assessment provided by the permit applicant would be used by NOAA Fisheries Service to evaluate each proposed location identified in a permit application on a case-by-case basis.

Regardless of the alternative selected in this FMP, the ACOE still has the authority to issue siting permits under its current authority. **Alternative 1** acknowledges this authority and defers to ACOE. However, the Council and NOAA Fisheries Service may have other criteria that would not be considered by the ACOE and therefore selecting an alternative that incorporates these criteria seems more prudent. **Alternative 2** would create aquaculture zones, where facilities may operate. The problem with **Alternative 2** would be in continuously updating these reference maps for acceptable locations of siting facilities. With the number of agencies that have authority in the EEZ, this is a monumental task to accomplish Gulf-wide given the probability that only select areas will be used for aquaculture within the Gulf EEZ.

Preferred Alternative 3 would establish specific criteria for siting, but would not establish predefined zones. It is estimated that approximately 28,719 nm^2 would be suitable for offshore aquaculture in the Gulf (Figure 4.6.1). This area would represent approximately 13.7 percent of the entire Gulf EEZ. Aquaculture would be prohibited in marine protected areas and marine reserves, HAPCs, SMZs, permitted artificial reef areas, and coral reef areas (**Alternative 3(a)**). Operations would also be required to be sited at least 1.6 nm from each other (**Alternative 3(b)**) and the permitted site would need to be twice as large as the area encompassed by allowable aquaculture systems to allow fallowing and rotation of cages, net pens, and other allowable systems (**Alternative 3(c)**). Additionally, permit applicants would be required to submit to NOAA Fisheries Service with their application packet a baseline assessment which will include, but not be limited to, procedures and methods for: 1) conducting diver and video surveys, 2) measuring hydrographic conditions, 3) collecting and analyzing benthic sediments and infauna, and 4) measuring water quality characteristics of the proposed aquaculture site (**Alternative 3(d)**). This baseline assessment and environmental monitoring would allow NOAA Fisheries Service to evaluate the benthic habitat at the proposed site to ensure siting would not affect any EFH, artificial reefs, or ecologically important habitat. NOAA Fisheries Service would also be provided authority to conduct case-by-case reviews of specific sites (**Alternative 3(e)**). The case-by-case approach of **Preferred Alternative 3** would provide for a more comprehensive review process for specific sites that is not provided by **Alternative 2**.

6.7.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

If **Alternative 1** were chosen, NOAA Fisheries Service would evaluate each proposed site by commenting on the ACOE's Section 10 permit application. This permit is required before constructing an offshore aquaculture facility. The ACOE must consider "…a broad range of potential environmental and other impacts…" before issuing a Section 10 permit, including "…water quality, pollution, economic factors, safety, accurate charting of any structures, aesthetics, navigational integrity, and the effects of the structure on recreation, fish, and other wildlife (33 CFR 320.4)." However, the ACOE's evaluation of the effects of the structure may not address factors NOAA Fisheries Service considers critical. If NOAA Fisheries Service had concerns about the permit application, these concerns would not necessarily be addressed by the ACOE or the applicant before the Section 10 permit was issued.

Alternatives 2 and **Preferred Alternative 3** would be better than **Alternative 1** by allowing NOAA Fisheries Service to evaluate the suitability of a proposed site and its potential impacts to the physical, biological, and ecological environment. However, **Alternative 2** would not allow NOAA Fisheries Service to evaluate the characteristics of a potential site on a localized scale. Rather, **Alternative 2** would establish 13 predefined aquaculture zones. A benefit to this approach would potentially include the reduced time for approving a facility's location. However, a negative effect would include establishing broad zones that may not include sufficient detail to prevent or minimize localized, small-scale impacts associated with a particular site. If this alternative is selected by the Council as the preferred, then additional authority would likely need to be provided to NOAA Fisheries Service to evaluate specific sites within each of the predefined zones.

Preferred Alternative 3 would prohibit aquaculture operations from being sited in certain areas and would allow NOAA Fisheries Service to review proposed aquaculture sites on a case-by-case basis. Criteria considered by NOAA Fisheries Service during case-by-case review would include, but would not be limited to, depth of the site, current speeds, substrate type, the frequency of harmful algal blooms or hypoxia at the proposed site, marine mammal migratory pathways, and the location of the site relative to commercial and recreational fishing grounds and important fishery habitats (e.g., seagrasses). These criteria will allow some flexibility in the siting review process without compromising environmental safeguards for the protection of EFH and other marine resources. Explicitly prohibiting aquaculture in sensitive areas, such as coral reefs and HAPCs, will afford protection to those habitats and prevent, or minimize to the extent practicable, any impacts from occurring (e.g., nutrient loading) that are associated with aquaculture operation. The Council considering prohibiting offshore marine aquaculture in NOS marine sanctuaries, but ultimately moved this action to considered but rejected (Appendix D), so that each marine sanctuary can evaluate whether marine offshore aquaculture is compatible with their management plan. The requirement to provide a baseline assessment and environmental monitoring at the proposed site will allow NOAA Fisheries Service to determine if critical and sensitive habitat at the site exist and are being impacted by aquaculture operation. If critical or sensitive habitat does exist, alternative sites would have to be considered to avoid detrimental environmental impacts. NOAA Fisheries Service would coordinate the development of baseline assessment/monitoring guidance and procedures with the EPA, ACOE, and other federal agencies with regulatory authority over marine aquaculture. Requiring facilities be sited at least 1.6 nm from one another will limit transmission of pathogens between facilities. There is no widely accepted standard for how far apart facilities should be sited, but estimates range from 300 m to 8 km (Levings et al. 1995). Lastly, requiring an aquaculture site to be twice as large as the area encompassed by allowable aquaculture systems gives the opportunity to rotate them. This will diminish the build-up of wastes and organic matter below cages, net pens, and other allowable systems, thereby benefiting the physical environment.

Overall, **Preferred Alternative 3** would include the most thorough review of a proposed site, and therefore would provide the greatest net benefits to the physical and biological environments. **Alternative 2** would provide benefits to the physical and biological environment on a broad scale by prohibiting aquaculture in areas not considered suitable for aquaculture, but this alternative may not adequately address small scale siting considerations within broader aquaculture zones. Additionally, as mentioned above, suitable areas for aquaculture would change over time as new regulations are established and old regulations are abolished by federal agencies. **Alternative 1** would not provide NOAA Fisheries Service with authority to regulate siting of aquaculture facilities. NOAA Fisheries Service would continue to comment on ACOE siting permits to ensure proper siting of facilities. This alternative would relegate NOAA Fisheries Service role to only commenting on permits under the authority of other federal agencies, potentially providing the least protection to the physical and biological environments.

Preferred Alternative 3 would more effectively identify unacceptable sites by evaluating each on a case-by-case basis using specified criteria and a baseline assessment of benthic habitat at the proposed site. Therefore, it is less likely to result in negative impacts to the physical, biological, and ecological environment.

The alternatives in order from least likely to have negative effects on the physical, biological, and ecological environments to most likely are **Preferred Alternative 3**, **Alternative 2**, and **Alternative 1**.

6.7.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not designate areas where aquaculture would be allowed. Consequently, without such restriction, an offshore aquaculture could place cages, pens and platforms anywhere it wanted in the Gulf EEZ, subject to ACOE siting permits. As a result, **Alternative 1** would have the greatest possibility among the alternatives considered that offshore aquaculture operations could site themselves in historical and increasing fishing areas, and displace fishermen from the use of some or all of these areas, which could cause the economic loss of some or all traditional landings, incomes and employment, which could be economically and socially upsetting to fishermen, their families and communities. From the aquaculture industry perspective, **Alternative 1** would give the largest flexibility in siting their offshore operations and, among the alternatives, offer the largest economic benefits, such as selecting a site for its proximity to shoreside support facilities and markets, or may otherwise allow lower siting costs which would include the possibility of using an existing platform.

Alternative 2 would restrict the areas where aquaculture could occur by establishing marine aquaculture zones, but not to the same extent of **Preferred Alternative 3**. By restricting the areas where aquaculture operations could be located, this alternative would be expected to reduce the likelihood of site placement in traditional fishing areas, thereby reducing the potential economic and social impacts on fishermen, their families, and communities caused by the loss of fishing areas to offshore aquaculture. Restricting site placement may also reduce the magnitude of negative externalities that are created by site location, although zones could create density issues that could exacerbate environmental externalities. Under Alternative 2, aquaculture businesses may have to incur higher set-up costs, operational costs, and productivity effects as a result of the siting restrictions, particularly if the zones create density problems for those businesses.

Preferred Alternative 3 would restrict the areas where offshore aquaculture can occur, the distance between sites, and the total area of each site. While **Preferred Alternative 3** would restrict site placement, sites would not be limited to marine aquaculture zones. Hence, aquaculture applicants would have more choices in terms of locating their offshore operations. Site placement restriction would be expected to reduce the magnitude of the negative externalities that may be created by unrestricted site location. **Preferred Alternative 3** would reduce and may eliminate offshore aquaculture operations from being sited within historical and increasing fishing areas, thus reducing the costs to fishermen, their families and communities associated with reduced harvests and/or higher operating expenses to fishermen. The restriction on the distance between aquaculture sites would be expected to reduce the density of offshore aquaculture. While this restriction would increase the costs of transiting from one affiliated facility to another, reducing the density of sites reduces the potential for cumulative externality effects, such as combined effluent flows, larger exclusion areas that would need to be transited around. The site size requirement would be expected to reduce the environmental problems, and associated social and economic costs, of production concentration by allowing systems to be rotated within the area of the site. As with any restrictions on site locations, aquaculture businesses may face higher set-up and operating expenses relative to **Alternative 1**, but there should be greater flexibility under **Preferred Alternative 3** than under **Alternative 2**. A comparison of the Action 6 alternatives is provided in Table 6.7.2.1.

Table 6.7.2.1 Comparison of Action 6 Alternatives

Action 6	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Does not reduce negative externalities and associated economic and social costs created by unrestricted site location	Largest economic benefit to offshore aquaculture operations due to largest set of allowable sites.
Alternative 2	Potentially highest reduction in economic benefit to offshore aquaculture operations due to potentially smallest set of allowable sites May have largest negative externalities associated with operation density.	Reduces negative externalities and associated economic and social costs by restricting siting location
		May reduce or eliminate offshore aquaculture operations from being sited in historical and increasing fishing areas
Preferred Alternative 3	Smaller reduction in economic benefit to offshore aquaculture operations due to smaller set of allowable sites. Smaller negative externalities and associated costs from operation density	Reduces negative externalities and associated economic and social costs by restricting siting locations
		Reduces and may eliminate offshore aquaculture operations from being sited in historical and increasing fishing areas

6.7.3 Direct and Indirect Effects on the Administrative Environment

Alternative 1 would require the least direct effects on the administrative environment, because NOAA Fisheries Service would only be commenting on the application for an ACOE permit and not evaluating a proposed site through its own permitting process. If the ACOE allowed a system NOAA Fisheries Service found had unacceptable biological, ecological, or physical effects, negotiation with the ACOE and the applicant to resolve NOAA Fisheries Service's concerns could be time consuming for staff. Indirect effects on the administrative environment could result if the ACOE sites a facility in an area that poses negative environmental impacts to marine resources and EFH.

Alternative 2 would have greater effects on the administrative environment than **Alternative 1**, but less effects than **Preferred Alternative 3**. Under this alternative, NOAA Fisheries Service would only need to determine if a proposed facility was located in the allowable aquaculture zones (Figure 4.6.1 and Table 4.6.1), and whether the site was consistent with other federal laws (e.g., ESA, MSFCMA requirements for EFH) From the perspective of the administrative environment, **Alternative 2** would be advantageous relative to **Preferred Alternative 3** because it would allow for faster permit review. However, additional administrative effects may result from siting aquaculture facilities using broad pre-permitted zones, rather than siting facilities using case-by-case review. There is potential for EFH and other important marine resources to be within a large pre-permitted zone. If no site specific information is obtained by NOAA Fisheries Service, then aquaculture facilities cited within these zones have the potential to impact EFH and other marine resources. Therefore, additional information would be necessary for NOAA Fisheries Service to adequately review a proposed site, placing a greater burden on the administrative environment during the review process or after the review process if negative impacts occur. Administrative costs for **Alternative 2** have largely been absorbed up-front through development of this FMP and the proposed zones.

Preferred Alternative 3 is expected to result in the greatest burden on the administrative environment when compared to the other alternatives in Action 6. NOAA Fisheries Service would need to ensure that facilities are not sited in prohibited areas, sites are of appropriate size, and are spaced at least 3 km from other facilities. NOAA Fisheries Service would also have to review benthic surveys of the site to ensure critical habitat or EFH does not exist or would not be impacted by the siting of an aquaculture facility. Lastly, NOAA Fisheries Service would have to conduct case-by-case reviews of a site to determine if facilities would be sited at appropriate depths with sufficient currents where HAB and hypoxia do not occur or occur infrequently. NOAA Fisheries Service Sustainable Fisheries Division would also have to consult with the Protected Resource and Habitat Divisions, as well as other NOAA offices to ensure sites do not pose significant risks to critical habitat, marine mammals and protected resources, or other marine resources. **Preferred Alternative 3** is expected to take considerable staff time to ensure applicants provide necessary data and information to approve their proposed aquaculture site.

In summary, **Preferred Alternative 3** would result in the greatest administrative effects (i.e., costs and time spent reviewing sites), but would also have the greatest benefits to the biological and physical environment. **Alternative 2** would streamline the permitting process and reduce the burden on the administrative environment, but may negatively affect the biological and physical environments if a facility is not properly sited within a pre-permitted zone. **Alternative 1** would have no direct effects on the administrative environment, but indirect effects would result if the ACOE sites a facility in areas that NOAA Fisheries Service would recommend against.

6.8 Action 7: Restricted Access Zones for Marine Aquaculture Facilities

The Council has authority to create zones that exclude fishing or fishing vessels. Examples are zones where fishing with certain gear is prohibited and no-take zones where fishing and possession of fish is prohibited. Restricting access around aquaculture facilities would afford some protection to an operation's equipment and the product being cultured. On the other hand, limiting usage near these sites could be seen as a user conflict by denying public access to these areas. The most prudent way to overcome this issue is for an aquaculture facility to request a site permit large enough to afford protection from potential user conflict problems (e.g., a vessel accidentally cutting a mooring line while passing the facility), while at the same time maximizing other user groups' access to the open ocean.

6.8.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Establishing restricted access zones around aquaculture facilities is primarily administrative and does not directly affect the physical, biological, or ecological environment, but does indirectly affect these environments. Restricted access zones would reduce gear and user conflict, and therefore have the potential to indirectly affect the physical, biological, or ecological environment.

Alternative 1 would not restrict access around a marine aquaculture facility. Fishing vessels could fish close to allowable aquaculture systems and vessels could transit in or through permitted aquaculture sites. These activities could result in damage to allowable aquaculture systems, including escapement of cultured fish. To minimize the risks of allowable systems being damaged, **Preferred Alternative 2** and **Alternative 3** propose establishing restricted access zones for marine aquaculture facilities.

The zone for **Preferred Alternative 2** would correspond to the coordinates on the ACOE siting permit, which should be an area at least twice as large as the total area encompassed by the allowable aquaculture systems (e.g., cages and net pens) as required in the siting criteria of Action 6. The ACOE permit will determine the appropriateness of the siting permit based on "the extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited" (33 CFR 320.4(a)(2)(iii). This area would need to be marked with buoys or other gears to make boaters and fishermen aware of the restricted access zone. However, the USCG is responsible for the regulation and enforcement of various activities in the navigable waters of the U.S. and would be responsible for making the determination for the appropriate marking requirements. The USCG requires structures be marked with lights and signals to ensure compliance with private aids to navigation (33 C.F.R. 66.01). Title 33 C.F.R. 64 also requires the marking of structures, sunken vessels, and other obstructions for the protection of maritime navigation. Types of structures and their marking requirements can be found at 33 CFR 67.

Alternative 3 is similar to **Preferred Alternative 2** in that it would restrict access around allowable aquaculture systems. Fishermen and vessels would be prohibited within 100, 500, or 1,640 feet of allowable aquaculture systems. This latter distance corresponds to the specified distance for MMS safety zones established for some oil and gas platforms in the Gulf.

Restricting access around a facility may directly protect species known to aggregate around structure. Aquaculture facilities have been shown as aggregation sites for many wild species. For example, Alston et al. (2005) found species abundance and richness significantly increased around an aquaculture cage off the coast of Puerto Rico after it was deployed. Additionally, the lack of anchoring or any other interactions that may occur with the physical environment will benefit the benthos of these restricted sites. Also, preventing access around a facility will reduce the likelihood of damage to a facility, particularly cages and net pens, thereby reducing any potential impacts associated with fish escapement. Overall, **Preferred Alternative 2** or **Alternative 3** would benefit the physical, biological, and ecological environments more than **Alternative 1**.

6.8.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not restrict access near marine aquaculture facilities. A potential cost of unrestricted access near an aquaculture facility is that operation of a fishing vessel close to an aquaculture facility could result in accidental damage to the facility, vessel and/or personnel caused by use of fishing gear or other equipment or a vessel strike. The possibility for such accidental damage may increase as aquaculture sites could become fish aggregation areas for wild fish that are attracted to the structures, feed, waste products, or prey. Thus, while the incidence of accidental damage and associated costs may increase, the quality of the fishing experience for recreational fishers at the sites could result in increased social and economic benefits for that sector.

Preferred Alternative 2 would create a restricted access area around each aquaculture facility, based on the ACOE siting permit, and require a facility to mark its borders. No fishing could occur within the zone/area. This alternative would reduce the risk of damages, and associated costs, caused by use of fishing gear or other equipment or a vessel strike. The prohibition on fishing in the restricted access zone would apply to fishermen, both commercial and recreational, as well as the aquaculture facility owner, employees, and contracted personnel. Thus, while the costs associated with accidental gear, vessel, or system damage would be reduced, the prohibition on all fishing would be expected to reduce the potential social and economic benefits of fishing in these areas. As noted for **Alternative 1**, this could represent foregone increased benefits from fishing in areas surrounding a facility if the systems become fish attractants. Any reduction in economic or social benefits to commercial or recreational fishermen would be expected to have spill-over consequences to their families, communities, and associated fishing businesses. The restricted access zones may provide additional benefits in further assisting in reducing density-related externalities. Site operators would be required to incur the cost of marking their restricted access zones and maintaining these markings.

Alternative 3 considers buffer zones for fishing vessels of at least 100 feet (**Alternative 3a**), 500 feet (**Alternative 3b**) or 1,640 feet (**Alternative 3c**) away from a marine aquaculture system. Other than the specific distances, the primary difference between

Alternative 3 and **Preferred Alternative 2** is that **Alternative 3** would establish uniform restricted zones whereas the zones under **Preferred Alternative 2** would be based on siting coordinates. Thus, **Alternative 3** may reduce the risks and associated damages and costs to vessels, fishing gear, or aquaculture systems somewhat better than **Preferred Alternative 3** if the fixed distances make it easier to know when fishing gear, other equipment or vessel is approaching a facility's borders. Risk reduction would be expected to increase as the minimum distance increases. However, the absence of mandatory zone marking may reduce some of this protection, especially if detection of a facility is severely impaired by existing weather conditions. Also, while a larger zone would be expected to result in less unintended damages, the larger the zone, the greater the potential loss of fishing access, with associated reductions in harvests and associated social and economic benefits. A comparison of the Action 7 alternatives is provided in Table 6.8.2.1.

Table 6.8.2.1 Comparison of Action 7 Alternatives

Action 7	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Largest risk of damages caused by fishing vessels operating or transiting near offshore aquaculture facilities	Largest potential benefits from improved fishing near aquaculture sites if sites serve as fish attractants.
Preferred Alternative 2	Reduces areas where fishing vessels can operate and transit, which may reduce landings, revenues, employment and adversely affect fishing communities. Reduces or eliminates potential benefits from improved fishing near aquaculture sites	Potentially largest reduction in damages caused by fishing vessels operating or transiting near offshore aquaculture facilities
	Requires facility owners to incur costs to mark zone borders	
Alternative 3	Reduces areas where fishing vessels can operate and transit, which would have economic and social costs if landings are reduced. Reduces or eliminates potential benefits from improved fishing near aquaculture sites.	Reduces risk of damages caused by fishing vessels operating or transiting near offshore aquaculture facilities

6.8.3 Direct and Indirect Effects on the Administrative Environment

As stated earlier, creating restricted access zones is primarily administrative in nature. **Alternative 1** would not have a direct effect on the administrative environment as it does not create any restricted access zone around aquaculture facilities. Selecting **Preferred Alternative 2** would rely on the coordinates of the aquaculture facility as established through the siting permit issued by the ACOE to delineate the restricted access zone. The direct effect on the administrative environment of **Preferred Alternative 2** would involve verifying the correct size of the siting permit (at least twice as large as the total area encompassed by the allowable aquaculture systems (e.g., cages and net pens) as required in the siting criteria of Action 6) and the enforcement of the restricted access zone. Administrative effects for **Alternative 3** would be similar to those of **Preferred**

Alternative 2 and there would be an increased burden on NOAA Fisheries Service to enforce the restricted access zones. The enforcement of these zones could result in significant costs given that marine enforcement is difficult and expensive.

The creation of a restricted access zone may allocate resources, particularly those of law enforcement, away from their primary focus, and could therefore, directly affect the administrative environment. For these reasons **Preferred Alternative 2** and **Alternative 3** would have more of an effect on the administrative environment than **Alternative 1**. **Preferred Alternative 2** would likely have the greatest effect on the administrative environment, since no size standard would be established for restricted access zones. Without a size standard, it will be difficult for fishermen and the general public to know where fishing and vessel transit is prohibited around an offshore aquaculture facility.

6.9 Action 8: Recordkeeping and Reporting

Recordkeeping and reporting requirements are meant to allow both aquaculture facilities and NOAA Fisheries Service to examine the operation and thereby the impacts to the physical, biological, and ecological environments. These reports will act as the checks and balances system in the time periods between permit issuance and renewal. By requiring annual reports, managers can assess all aspects of a facility and its operation. These recordkeeping and reporting requirements are intended to mitigate impacts associated with marine aquaculture and alert managers to potential problems. If potential problems arise, these requirements will allow NOAA Fisheries Service to work with a facility to resolve potential problems and environmental impacts, or revoke the facilities permit if problems and impacts persist.

6.9.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Recordkeeping and reporting are administrative in nature and would have no direct effect on the physical, biological, or ecological environment. However, information contained in recordkeeping and reporting may indirectly affect the physical, biological, and ecological environment as these requirements are designed to monitor the effects a facility has on the physical, biological, and ecological environment. By establishing reporting requirements, the impacts of an aquaculture facility on the physical, biological, and ecological environment can be examined. Where appropriate, additional conditions of an aquaculture's operation could be implemented to mitigate these impacts and therefore, reduce the effects on these environments.

As previously discussed in this Section the environmental impacts and concerns associated with marine aquaculture are largely associated with: 1) Modification of wild stock genetic diversity; 2) transmission of infectious disease to wild stocks; 3) modification of benthic habitat from discharged effluents, such as solids, and dissolved nutrients; 4) escaped fish competing with wild fish; and 5) entanglement of wildlife with aquaculture structures. Recordkeeping and reporting requirements are designed to monitor these concerns and where appropriate, implement plans to mitigate any deleterious effects.

Alternative 1 would provide the RA authority to specify EFP recordkeeping and reporting requirements, but only if Action 1, Alternative 1 (Exempted Fishing Permit) is selected as the preferred alternative. Because Action 1, **Alternative 2** was selected by the Council as the preferred (NOAA Fisheries Service permit to operate a facility), only **Alternative 2** can be selected. The greatest impacts to the biological and physical environments would have occurred if the Council did not select a preferred alternative for Action 8. By not selecting a preferred alternative, aquaculture operations would not have to meet recordkeeping and reporting requirements. There would be no checks and balances system to monitor environmental impacts. This could negatively affect the physical and biological environments by degrading habitat, spreading disease, and allowing fish escapement.

Instead, **Preferred Alternative 2** will require aquaculture facilities to meet the 17 recordkeeping and reporting requirements. These reporting requirements include,

1. notifying NOAA Fisheries Service of escapement, entanglements, and disease outbreaks;
2. notifying NOAA Fisheries Service of changes in hatcheries;
3. maintaining purchase invoices for feed;
4. submitting sale records;
5. notifying NOAA Fisheries Service prior to fingerling transport, and harvest and landing of cultured organisms;
6. maintaining a bill of lading through the first point of sale;
7. maintaining daily records of organisms introduced or removed from allowable aquaculture systems;
8. providing current contact and vessel information;
9. providing on a continuing basis currently valid state and federal aquaculture permits;
10. submitting a request for broodstock 30 days prior to each time a permittee or their designee want to harvest broodstock;
11. authorizing use of paper-based reporting during catastrophic conditions; and,
12. other appropriate recordkeeping and reporting requirements.

Overall, **Preferred Alternative 2** would provide NOAA Fisheries Service with sufficient information to monitor and assess the impacts of an aquaculture facility when determining compliance with permit conditions. Many of the alternatives in **Preferred Alternative 2** would not directly benefit the physical or biological environments, but may indirectly benefit these environments by providing NOAA Fisheries Service with information to both enforce regulations and evaluate impacts associated with aquaculture operation.

6.9.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not specify recordkeeping and reporting requirements, and, hence, can be interpreted to mean there would be no such requirements. Without recordkeeping and reporting requirements, there would be no added reduction in the incidence and magnitude of negative externalities that could be caused by an unrestricted offshore aquaculture industry. However, the NOAA Fisheries Service RA has the authority to specify recordkeeping and reporting requirements in an EFP. Hence, it is possible that under **Alternative 1,** there would be recordkeeping and reporting requirements and possibly the same as under **Preferred Alternative 2**. If such were the case, the expected social and economic effects of each alternative would be identical. However, the absence of systematic requirements under **Alternative 1** increases the possibility that important information would not be collected or not become available in a sufficient manner to ensure adverse events do not occur or are minimized to the extent practical. As a result, under **Alternative 1**, the potential incidence and magnitude of negative externalities created by no reporting and recordkeeping or under-reporting and recordkeeping is highest. Thus, the potential for adverse social and economic effects would be higher for **Alternative 1** than **Preferred Alternative 2**.

Preferred Alternative 2 would establish 17 recordkeeping and reporting requirements that are important to reducing the incidence and severity of events that could adversely affect the human and biological environments. Consequently, **Preferred Alternative 2** would be expected to reduce the adverse social and economic effects of these events. Although these recordkeeping and reporting requirements generally constitute responsible business practices, their requirement could impose an additional expense on the aquaculture operation. A comparison of the Action 8 alternatives is provided in Table 6.9.2.1.

Table 6.9.2.1 Comparison of Action 8 Alternatives

Action 8	**Economic & Social Costs**	**Economic & Social Benefits**
Alternative 1 (Status Quo)	Increased possibility of costs associated with environmental damages caused by accidental and unforeseen events, such as releases of cultured organisms or entanglements	
Preferred Alternative 2	Offshore aquaculture operators incur reporting and recordkeeping costs	Reduces environmental damages caused by accidental or unforeseen events by mitigating actions

6.9.3 Direct and Indirect Effects on the Administrative Environment

Record keeping and reporting is an administrative function and would directly effect this environment. Both the aquaculture facility and NOAA Fisheries Service would be directly affected by requirements to maintain, submit, prepare, and review reports and records. However, the use of records and reports is designed to monitor impacts associated with aquaculture operations, which may reduce long-term burdens on the administrative environment. Detecting problems with an operation and taking action to halt those negative practices before they become hazardous to the environment or have irreversible impacts will have less of an impact to the administrative environment than waiting for the permit renewal stage to discover these problems. Although recordkeeping and reporting is burdensome and directly affects the administrative environment, **Preferred Alternative 2** is more beneficial than **Alternative 1** because of the trade-off between long-term and short-term impacts and burden.

6.10 Action 9: Biological Reference Points and Status Determination Criteria

The MSFCMA was written in part to establish the legal framework for managing wild fisheries resources of the United States, and not explicitly written for managing at sea fish farming or aquaculture operations. Many of the principles and concepts that guide wild stock management under the MSFCMA are either of little utility or are not generally applicable to the management of aquaculture operations. Despite this lack of conceptual similarity, offshore aquaculture falls within the realm of activities subject to regulatory control under the MSFCMA and therefore must be accommodated within the existing legal framework. Many MSFCMA legal requirements do not fit well or are difficult to satisfy with respect to aquaculture, thereby making them seem less useful or even unnecessary. This is particularly true for yield targets and stock status parameters around which management of wild fisheries is based. Regardless, there are legal requirements, and until additional legal authority specifically suited for management of open ocean aquaculture is established, all such requirements must be satisfied.

Action 9 considers two alternatives. **Alternative 1**, no action, would not specify biological reference points or status determination criteria for aquaculture in the Gulf. The Council would be required to establish these criteria and reference points in a subsequent amendment as required by the MSFCMA. **Preferred Alternative 2** would establish biological reference points and status determination criteria for aquaculture in the Gulf. This alternative would specify MSY and OY for the entire aquaculture fishery. It would also set a cap on planned production for any individual, corporation, or other entity equal to 5-20 percent of OY. **Preferred Alternative 2** would also require NOAA Fisheries Service to publish a control rule if planned aquaculture production exceeds OY. If the OY proxy is exceeded, the Council would initiate review of the OY proxy and aquaculture program. The control date would provide future participants notice that entry into the aquaculture fishery may be limited or restricted after the control date. In addition to satisfying the legal mandates of the MSFCMA, **Preferred Alternative 2** would also limit production of cultured species in the Gulf until more is known about the impacts of offshore aquaculture.

6.10.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Setting status determination criteria and biological reference points for aquaculture will not directly affect the physical, biological, or ecological environments, but may have indirect effects on those environments. **Alternative 1** would not establish status criteria or reference points, allowing aquaculture production to go unregulated. Theoretically, there will be some maximum capacity of the Gulf to produce cultured fish that does not adversely affect wild stocks or the marine environment (e.g., water quality and habitat). By allowing aquaculture production to go unregulated and not specifying status criteria for assessing stock status, production could exceed some critical threshold and negatively impact wild populations. Negative impacts to the physical and biological environments could occur if the cumulative impact of production significantly reduces water quality, degrades habitat, or increases the transmission of disease and pathogens to wild stocks. To avoid these negative impacts, **Preferred Alternative 2** proposes establishing biological reference points and status determination criteria for aquaculture in the Gulf.

Preferred Alternative 2 includes two options for establishing a proxy for MSY. The first option would set MSY equivalent to the total annual production capacity of all aquaculture operations in the Gulf EEZ, while the second option would set MSY equal to 16, 32, 36, 64, or 190 mp ww. Setting MSY equivalent to the annual production capacity of all aquaculture operations in the Gulf EEZ is essentially the same as **Alternative 1,** in that production of cultured species would go unregulated. The number, size, and capacity of facilities, as well as the carrying capacity of the Gulf for aquaculture would be the only factors that limit production. In comparison, the Council's preferred option would set MSY equal to 64 mp ww. This allows the Council to take a more precautionary approach until more is known about the impacts of aquaculture in the Gulf. As with other fisheries, the MSYproxy may be modified based on new information as this component of the fishery proceeds. Procedures for modifying both MSY and OY are proposed in Section 4.10 (Framework Procedures). If negative impacts are determined to occur from aquaculture then MSY could be adjusted downward to reduce environmental impacts. Similarly, if environmental impacts are not determined to be occurring, or have been minimized to the extent practicable, then MSY could be adjusted upward to allow more production. The ultimate level MSY is set at will depend on the carrying capacity of the Gulf and whether or not environmental impacts are determined to be affecting Gulf marine resources and habitat.

The proxies for MSY are based on either the productivity of wild stocks (Suboptions 2(c) or 2(e)) or expected production capacity of an estimated 5-20 operations starting business in the Gulf over the next ten years (Suboptions 2(a), 2(b), and 2(d)). Methods for calculating MSY proxies for suboptions 2(a), 2(b), and 2(d) are summarized in Section 4.9, and are incorporated here by reference. Suboption 2(c) represents wild stock landings of all Council managed species proposed for culture in this FMP (i.e., reef fish, coastal migratory pelagics, stone crabs, spiny lobster, and red drum), while Suboption 2(e) represents the average landings of all marine species in the Gulf, except menhaden and shrimp, during 2000-2006. Using domestic commercial landings from the Gulf provides a useful proxy for estimating OY. It also can be used to assess the relative risks and potential impacts to wild stocks. Until more is known about the aquaculture fishery in the Gulf, including potential environmental impacts and economic sustainability, these OY estimates are intended to serve as proxies for production capacity. The higher that OY is set, the greater the risk of impacts to the physical and biological environments. By establishing a precautionary OY level, the Council can assess the impacts of aquaculture as the industry grows to determine if the specified OY level is adequately protecting wild stocks and habitat. If impacts are not observed, or are considered to be minimized to the extent practicable and are not resulting in significant negative impacts, than the Council could consider increasing OY/MSY in the future. OY proxies, in order from greatest to least potential risks to the physical and biological environments, are: Suboption 2(f) – 190 mp, Suboption 2(e) – 64 mp, Suboption 2(d) – 36 mp, Suboption 2(c) – 32 mp, and Suboption 2(b) – 16 mp. The Council's preferred suboption for OY is 64 mp.

In addition to establishing a definition for MSY, **Preferred Alternative 2** would also establish a definition for OY. NOAA Fisheries Service guidance states that OY should be based on MSY, or on MSY as it may be reduced by social, economic, and ecological factors (50 CFR 600.310). Unlike wild stock management, there is no need to leave cultured animals in offshore aquaculture grow-out systems to support future generations. There is also no social, economic, or ecological factors supporting a reduction from MSY; therefore, OY and MSY can be set equal to one another. The Council has proposed setting OY anywhere from a minimum of 16 mp ww to a maximum of 190 mp ww. The Council's preferred option for OY is to set it equal to MSY, i.e. 64 mp ww. The Council has also proposed a cap on production equivalent to 20 percent of the maximum OY. This production cap will prevent any one entity from obtaining an excessive share of the fishery, as required by the MSFCMA.

Preferred Alternative 2 also includes a process for reviewing the OY proxy and aquaculture program if planned production exceeds OY. This process and the one described in Section 4.10 would have no direct impacts on the physical or biological environments. Indirect effects would result only if changes are made to the OY proxy. Such changes would occur either through framework actions, as specified in Action 10, or through a full plan amendment. Any change (increase or decrease) to OY should be based on the extent and magnitude of any adverse environmental and economic impacts that may result from the existing aquaculture management regime. Benefits to the physical and biological environments would occur if OY is reduced (i.e., less risks to environmental impacts, such as habitat degradation and water quality), while increased environmental risks may result if OY is increased. The Council will need to proceed cautiously to ensure negative, detrimental impacts do not occur as an indirect result of the specified OY harvest level.

During review of the program and OY proxy, NOAA Fisheries Service would publish a control date in the *Federal Register* after which entry into the aquaculture industry may be limited. Any permits issued after the control date may be subject to revocation. No individual, corporation, or other entity will be issued a permit authorizing the production of more than 20 percent of OY (Council preferred). The Council also considered capping planned production for a single operation at 5 or 10 percent of OY. This provision is necessary to ensure entities do not obtain an excessive share of the allowable yield (National Standard 4: 50 CFR 600.325(a)(3)). The level selected by the Council for capping production must ensure against possible anti-competitive effects resulting from a small number of entities accounting for fmost or all of the offshore aquaculture production.

Preferred Alternative 2 also identifies thresholds for determining overfishing and overfished status. These thresholds are not directly applicable to the cultured fish themselves, given that all fish stocked for culture are intended for harvest. However, it is conceivable that some level of aquaculture in the Gulf EEZ could result in adverse impacts to wild stocks, which could result in overfishing and depletion of such stocks. Therefore, **Preferred Alternative 2** proposes to assess impacts of aquaculture operations using overfishing and overfished thresholds for wild stocks approved by the Council. These thresholds will be used by NOAA Fisheries Service to determine if offshore aquaculture in the Gulf EEZ is adversely affecting wild populations, causing them to become overfished or undergoing overfishing. If NOAA Fisheries Service identifies adverse impacts to wild stocks resulting in populations falling below the established thresholds or becoming subject to excessive fishing mortality, as a consequence of aquaculture operations (reduced biomass levels resulting in increased F), the appropriate overfished or overfishing determination will be triggered. Adverse environmental impacts to the aquaculture operations will be based on data collected via the ongoing monitoring (including monitoring by other federal agencies) of permitted operations. If there is a reasonable basis to tie aquaculture operations to adverse environmental impacts, which are in turn resulting in reduced abundance (depletion) of wild stocks, appropriate action will be taken by NOAA Fisheries Service (e.g., aquaculture operation production may be reduced, cultured fish transmitting disease may be removed, facility siting may be reevaluated to avoid habitat degradation).

6.10.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. This alternative would not establish biological reference points or status determination criteria specific to aquaculture in the Gulf EEZ. Biological reference points and status determination criteria are required components of an FMP. As a result, **Alternative 1** would not support the approval and implementation of this proposed FMP. While such would eliminate any potential social and economic costs associated with this proposed FMP, any potential benefits would similarly not be realized. Subsequent approval of the FMP would require additional work and expenditures to support the plan development process.

Aside from the issue that these specification are required in order for an FMP to be approved, these criteria are necessary to place bounds on a fishery for proper management. In the absence of these specifications, assuming the proposed FMP could be implemented and the aquaculture industry allowed to develop, offshore aquaculture operations could produce an unlimited amount of product, subject only to financing, production, and market constraints. The economic benefit of this unconstrained production could be a large quantity of cultured seafood produced in the Gulf EEZ with corresponding economic benefits to the producers and general public. However, such unconstrained production could have upsetting economic and social consequences for fishermen targeting wild species. It is unknown whether fishers would be in direct competition with the offshore aquaculture producers, (e.g., selling the same species) or just generally in competition with market prices of cultured seafood products. Moreover, increasing numbers of aquaculture facilities decreases the total area where fishermen can operate in the EEZ, which can have additional and substantial economic and social impacts to fishermen, their families and communities. Section 6.2.3., provides an example of the potential aquaculture production under specific operating assumptions, calculating a production estimate of 131 million to 525 million pounds of product per year within the first 10 years. **Alternative 1**, if the industry were allowed to develop without production restrictions, it could result in an uncontrolled level of production.

Preferred Alternative 2 would establish biological reference points and status determination criteria for aquaculture in the Gulf. MSY and OY proxies under this alternative would range from the total yield produced by all operations in a given year to 190 million pounds. **Preferred Alternative 2** would also establish a cap on the production by an individual company, which would range from 5 percent to 20 percent. Finally, **Preferred Alternative 2** would require NOAA Fisheries Service to publish a control date if aquaculture production exceeds the OY, after which entry into the fishery may be limited or restricted. The preferred specifications in **Preferred Alternative 2** are an MSY and OY of 64 million pounds (sub-options **2(e)** and **2(h)**, respectively), and an individual production cap of 20 percent (sub-option **2(g)**).

Alternative 2a for both the specification of MSY and OY would essentially allow aquaculture operators to establish both benchmarks based on actual production. For example, if there were 20 aquaculture operations and they produced 525 million pounds of product (whole weight) in a given year of the FMP, then both MSY and OY would be 525 million pounds. The other alternatives would establish specific levels of MSY and OY, three of which, 16 million pounds, 32 million pounds, and 36 million pounds respectively, would be less than the preferred values of 64 million pounds (MSY and OY), while the last alternative would establish values approximately three times the preferred values, or 190 million pounds. While both the MSY and OY represent target capacities, the OY level itself is the reference point that would place the operational restriction on the industry. In general, OY values less than the preferred value would be expected to result in lower social and economic benefits to the aquaculture operations and associated industries than the preferred value. There might also be lower social and economic costs to the fishermen, associated industries, and communities relative to the OY that would be established by **Preferred Alternative 2(h)**. The opposite results would be expected to occur under the 190-million pound values of **Alternative 2(i)** (higher benefits to producers and associated industries and higher potential costs to fishermen and associated industries and communities).

The 20-percent individual, corporation, or other entity production cap of the preferred alternative offers the greatest social and economic benefit to aquaculture facility owners and those who benefit from their production because it would allow aquaculture producers to increase their scale of production, produce larger quantities, and potentially experience greater economies of scale than the other two alternatives. Lower cap values would produce lower benefits of this nature. For a given OY, the higher the production cap, the lower the minimum number of potential participants, the lower the competition, hence the greater the potential for economic and social harm from anti-competitive behavior.

As stated earlier in this document, Virginia Cobia Farms, an inland aquaculture company, produced its first crop of cobia in May of 2007, estimated at about 100,000 pounds, which is a level of production equivalent to 56 percent of the total commercial landings of wild caught cobia in 2007. The company plans to produce one million pounds in 2009, which represents a level of production greater than 5 times that of the 2007 wild catch. The company's long-range plans are to expand to 100 million pounds. This is to illustrate that offshore aquaculture operators would not be the only competitors with fishermen. If Virginia Cobia Farms expands production as planned, it would potentially produce more seafood than all Gulf offshore aquaculture operations combined 64 million pounds. Nonetheless, offshore aquaculture operations could compete directly with Gulf fishermen as described in Section 6.2.3 and because of their competitive advantages could cause ex-vessel seafood prices to fall. The preferred alternative for Action 9 reduces the potential economic and social costs that could result from offshore aquaculture competing directly with fishermen by creating the OY proxy of 64 million pounds, and no individual, corporation, or other entity being permitting to produce more than 20 percent of OY. A comparison of the Action 9 alternatives is provided in Table 6.10.2.1.

Table 6.10.2.1 Comparison of Action 9 Alternatives

Action 9	**Economic & Social Costs**	**Economic & Social Benefits**
Alternative 1 (Status Quo)	Does not reduce potential damages caused by offshore aquaculture in direct competition with fishermen: decreased ex-vessel prices, losses of fishing and fishing-related revenues, incomes, employment, and businesses. May not allow approval and implementation of FMP.	Maximum volume of cultured production technologically and economically allowed if FMP can be approved without biological reference points or status determination criteria.
Alternative 2 (MSY=unrestricted)	May not reduce the potential damages caused by offshore aquaculture in direct competition with fishermen: decreased ex-vessel prices, losses of fishing and fishing-related revenues, incomes, employment and businesses	Would allow the production of as much cultured product as could be technologically and economically produced

Alternatives 2 (MSY=16 mp)	Largest reduction in volume of cultured seafood that could be produced and associated economic benefits from production	Largest reduction in potential damages caused by offshore aquaculture in direct competition with fishermen: decreased ex-vessel prices, losses of fishing and fishing-related revenues, incomes, employment, and businesses
Alternative 2 (MSY=32 or 36 mp)	Smaller reduction in volume of cultured seafood and associated economic benefits from production	Smaller reduction in potential damages caused by offshore aquaculture in direct competition with fishermen
Preferred Alternative 2 (MSY=OY=64 mp; 20% cap)	Reduction in volume of cultured seafood and associated benefits, less than 2c and 2d, more than 2f	Reduction in potential damages caused by offshore aquaculture in direct competition with fishermen, but not as much as 2c or 2d, but more than 2f:
Alternative 2 ((MSY=OY=64 mp; cap = 5% or 10%	May impede economies or scale or scope experienced by aquaculture producers relative to Preferred Alternative 2	More economic and social benefits derived from increased competition.
Alternative 2 (MSY=190 mp)	Smallest reduction in volume of cultured seafood and associated economic benefits from production	Smallest reduction in potential damages caused by offshore aquaculture in direct competition with fishermen:

6.10.3 Direct and Indirect Effects on the Administrative Environment

Both **Alternative 1** and **Preferred Alternative 2** would directly impact the administrative environment. **Alternative 1** would not specify biological reference points or status criteria as required by the MSFCMA, thereby making NOAA Fisheries Service susceptible to legal challenges. The Council would have to develop a subsequent amendment to this FMP in order to satisfy this MSFMCA requirement, which could result in significant costs and considerable staff time. Additionally, the inability to restrict production and lack of status criteria to assess impacts of aquaculture on wild stocks will indirectly affect the administrative environment if negative impacts occur in the future.

Preferred Alternative 2 would satisfy MSFCMA requirements for establishing biological reference points and status criteria, thereby diminishing the potential for legal challenges. Effects on the administrative environment from this action would include publication of a control date in the *Federal Register* and review of the OY proxy and aquaculture program. Control dates are occasionally published by NOAA Fisheries Service, and would not represent a substantial burden relative to the status quo. Review of the OY proxy and aquaculture program could be costly, but this review is a necessary part of any managed fishery. Status determinations for wild fisheries would be made through periodic stock assessments that are reviewed by peer-reviewed panels and the SSC. Assessments are regularly conducted for most recreationally and commercially important species; therefore, monitoring the status of wild stocks based on proposed status criteria would not be an additional burden on the administrative environment. Effects on the administrative environment are expected to occur based on the procedures for modifying MSY and OY specified in Action 10, and not directly from Action 9.

6.11 Action 10: Framework Procedures

The intent of this action is to establish a framework procedure for implementing changes to various aquaculture regulatory measures in a more timely fashion. The proposed framework procedures would continue to allow several opportunities for public comment and input before any proposed changes to regulatory measures are approved by the Council and NOAA Fisheries Service. Additionally, the framework procedures propose an annual process for reviewing the aquaculture program.

6.11.1 Direct and Indirect Effects on the Physical, Biological, and Ecological Environment

Action 10 would have no direct effects on the physical or biological environments. Indirect effects may result from this action as a result of recommendations and regulations proposed by the Council and their Aquaculture Advisory Panel (**Alternatives 2** and **3**). Indirect effects would include adjustments to OY/MSY based on biological considerations and the timeliness of regulatory measures that could be implemented to address adverse impacts related to aquaculture.

Alternative 1 would not specify framework procedures for aquaculture. This alternative would affect how quickly management measures and biological benchmarks could be changed or implemented, thereby resulting in indirect effects. Negative indirect effects could occur if modifications to regulations are not be implemented in a timely fashion to prevent further environmental impacts, if occurring. Because the Council would have to implement or modify aquaculture regulations through a plan amendment, considerable time could pass before regulations are put in place that benefit both the biological and physical environment and the overall aquaculture program.

Alternatives 2 and **3** propose framework procedures for modifying biological benchmarks (MSY/OY) and some aquaculture regulatory measures (**Preferred Alternative 3 only**). Both **Alternatives 2** and **3** would rely on an Aquaculture AP that would meet bi-annually to provide recommendations to the Council. The authority of the AP would be much more limited under **Alternative 2**; they could only recommend changes to MSY and OY. Under **Preferred Alternative 3**, the AP would have broader authority, which would include recommending changes to: MSY and OY, application and operating requirements, recordkeeping and reporting requirements, siting requirements, and allowable aquaculture system requirements. The main responsibilities of the Panel would include: 1) Reviewing annual planned aquaculture production levels relative to MSY and OY; 2) evaluating the condition and status of wild stocks and other marine resources and whether their status has been adversely affected by offshore aquaculture; and 3) assessing economic and social considerations of aquaculture in the Gulf EEZ. This AP would indirectly benefit the physical and biological environments by providing oversight of the aquaculture program. The AP would provide recommendations to the Council, and ultimately NOAA Fisheries Service, that are intended to improve the program and further minimize environmental impacts from occurring.

Under **Alternative 2**, if the Council supported the AP's recommendations for MSY and OY, it could then submit the recommendations to the RA for further consideration. The RA would have the authority to approve or deny the proposed changes to MSY and OY. If the RA approved the changes, then they would be published in the *Federal Register*. This would benefit the physical and biological environments if negative environmental impacts (e.g., disease transmission to wild stocks, benthic and organic loading, habitat degradation) are determined to be occurring because MSY/OY is set to high. Social and economic benefits could also result from this alternative if the AP recommends increasing MSY/OY because there is no evidence of environmental impacts, or impacts have been minimized to the extent practicable. **Alternative 2** would provide the fastest process for making changes to MSY/OY, but the AP and Council's authority would be much more limited when compared to **Preferred Alternative 3** framework procedures.

Preferred Alternative 3 is similar to **Alternative 2**, except the Council would need to develop a regulatory amendment for proposed regulatory changes recommended by the AP. **Preferred Alternative 3** would provide for numerous modifications or additions to aquaculture regulations, unlike **Alternative 2**. This would allow the Council and NOAA Fisheries Service to address key aspects of the aquaculture program in a timely fashion if negative environmental impacts are determined to occur. This would also allow the Council to make changes more quickly to improve the program and the information needed to monitor and evaluate it. Any regulatory amendment developed by the Council would then be submitted to the RA for further consideration.

The framework procedures described in **Alternative 2** and **3** are both intended to allow timelier implementation of regulatory measures necessary to prevent or mitigate impacts to the physical, biological, social, economic, and administrative environments. In addition to allowing faster implementation of regulations, both **Alternatives 2** and **3** would provide oversight and review of the aquaculture program through the use of an Aquaculture AP composed of scientists, sociologists, and aquaculture experts. This would indirectly benefit the physical and biological environments by providing regular review and modifications to the aquaculture program.

6.11.2 Direct and Indirect Effects on the Economic and Social Environment

Alternative 1 is the status quo alternative. **Alternative 1** would not establish framework procedures for modifying aquaculture regulations or biological reference points. Each time the Council amended their regulations, a full plan amendment would have to be developed, which would take considerably more time than development of a regulatory amendment or *Federal Register* notice. This alternative would therefore result in the greatest economic costs to the Council and NOAA Fisheries Service of any of the alternatives considered in this action. Additionally, not being able to implement regulations in a timely manner may have negative physical, biological, social, and economic consequences. Lack of an annual review process would also result in negative economic and social effects, especially for persons concerned about the potential negative environmental impacts that may result from offshore aquaculture. Of the alternatives considered in this action, **Alternative 1** is expected to result in the greatest economic and social costs and least economic and social benefits.

Alternative 2 would establish an organizational framework for the Council and NOAA Fisheries Service to effectively manage the aquaculture fishery; however, it provides only limited authority for the Council and NOAA Fisheries Service to make regulatory changes. The Council, upon recommendation by its Aquaculture AP could recommend to NOAA Fisheries Service changes to MSY/OY. Changes in the offshore aquaculture industry, such as technological change, that should necessitate other regulatory changes, such as reporting and/or operational requirements, would not be possible under this alternative. Hence, it would not establish a mechanism for NOAA Fisheries Service to respond to developing industrial practices while potentially decreasing negative externalities and increasing support of offshore aquaculture. Costs incurred by NOAA Fisheries Service under **Alternative 2** would include participating in AP meetings, review of AP and Council recommendations, and preparation of a *Federal Register* notice.

Preferred Alternative 3 would also establish an organizational framework for the Council and NOAA Fisheries Service to effectively manage the aquaculture fishery. **Preferred Alternative 3** would also include an Aquaculture Advisory Panel. The panel could recommend to the Council changes to MSY or OY, permit application requirements, operational requirements and restrictions, and monitoring requirements. **Preferred Alternative 3** would provide the Council with broader authority to make regulatory changes than **Alternative 2. Preferred Alternative 3** would establish a more flexible regulatory process that could adapt to ongoing changes in the offshore aquaculture industry, which could both support the developing industry and reduce negative externalities and associated economic and social costs caused by the industry. **Preferred Alternative 3** is expected to result in greater economic costs to the Council and NOAA Fisheries Service than **Alternative 2,** but less economic costs than **Alternative 1.** Costs incurred by NOAA Fisheries Service under **Alternative 2** would include participating in AP meetings, review of AP and Council recommendations, and preparation of a *Federal Register* notice. **Preferred Alternative 3** would include the same costs as **Alternative 2,** plus there would be additional economic costs for preparing a regulatory amendment. Overall, **Preferred Alternative 3** is expected to provide the best balance between timely review of the aquaculture program, timely implementation of regulatory measures, and public opportunities for proposed regulatory changes. A comparison of the Action 10 alternatives is provided in Table 6.11.2.1.

Table 6.11.2.1 Comparison of Action 10 Alternatives

Action 9	Economic & Social Costs	Economic & Social Benefits
Alternative 1 (Status Quo)	Does not reduce risks and associated economic and social damages caused by absence of an established organizational framework for the Council and NMFS in order to effectively manage fishery and derive the economic and social benefits from a managed fishery.	
Alternative 2	Added costs to Council and NOAA Fisheries Service associated with framework process.	Reduces risks and associated economic and social damages caused by absence of an established organizational framework for the Council and NMFS in order to effectively manage fishery and derive the economic and social benefits from a managed fishery.
Preferred Alternative 3	Highest added costs associated with framework and regulatory amendment process.	Potentially larger reduction in risks and associated damages than Alternative 2

6.11.3 Direct and Indirect Effects on the Administrative Environment

All three alternatives in Action 10 would either directly or indirectly affect the administrative environment. **Alternative 1** would not establish framework procedures in this FMP. Any changes to regulations or MSY/OY would have to be made through a subsequent plan amendment. Development of a plan amendment will potentially take longer than developing and implementing regulations through framework procedures. This could result in additional indirect effects to the administrative environment if negative impacts to the physical, biological, or socioeconomic environments occur during development of a plan amendment.

Alternatives 2 and **3** propose framework procedures for aquaculture. Both alternatives would use an Aquaculture AP. This board would meet bi-annually and result in direct costs to the Council associated with travel and holding a meeting. The charge of the AP would be much more limited under **Alternative 2**; they could only recommend changes to MSY and OY. Under **Alternative 3**, the Panel would have broader authority, which would include recommending changes to: MSY and OY, application and operating requirements, recordkeeping and reporting requirements, siting requirements, and allowable aquaculture system requirements. Any recommendations made by the AP would be provided to the Council for further consideration. **Alternative 2** would require the Council to submit their recommendation for MSY/OY to NOAA Fisheries Service, including the rationale and supporting documentation for the decision. Preparation of a report and a letter to NOAA Fisheries Service would increase the burden on the administrative environment, but to a much lesser extent than preparing a full plan amendment. If NOAA Fisheries Service approved the MSY/OY values recommended by the Council, then a *Federal Register* notice would be published. This would have an effect on the administrative environment, but once again to a lesser extent than developing a plan amendment. NOAA Fisheries Service frequently publishes *Federal Register* notices and this requirement is a regular part of operating procedures. **Preferred Alternative 3** would have similar effects on the administrative environment as **Alternative 2**. One major difference is that **Preferred Alternative 3** would require the Council to develop a regulatory amendment for changes recommended by their AP. Development of a regulatory amendment would be more time consuming than simply submitting a recommendation to NOAA Fisheries Service (as proposed in **Alternative 2**), but less time consuming than preparation of a full plan amendment. In either case, both alternatives would allow timelier implementation of regulatory measures.

6.12 Comparison of Alternatives to Magnuson-Stevens Fishery Conservation and Management Act National Standards

NOAA General Counsel has concluded that aquaculture in the EEZ constitutes "fishing" under the MSFCMA. Fishing includes activities and operations related to the taking, catching, or harvesting of fish. Any FMP prepared by the Council, or by the Secretary, must include provision specified in Sec 303(a) of the MSFCMA. Additionally, numerous discretionary provisions may be prescribed, including measures, requirements, or conditions and restrictions determined to be necessary and appropriate for the conservation and management of a fishery (Sec. 303(b)(14) of the MSFCMA). Any FMP or regulations prepared to implement an FMP or amendment, must be consistent with the ten MSFCMA national standards for fishery conservation and management. These national standards are:

1. Conservation and management measures shall prevent overfishing while achieving on a continuing basis, the optimum yield from each fishery for the United States fishing industry.
2. Conservation and management measures shall be based upon the best scientific information available.
3. To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.
4. Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.
5. Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

6. Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.
7. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.
8. Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of paragraph (2), in order to (A) provide for the sustained participation of such communities, and (B) to the extent possible, minimize adverse economic impacts on such communities.
9. Conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.
10. Conservation and management measures shall, to the extent possible, promote the safety of human life.

The development of an aquaculture program requires balancing the potential benefits of aquaculture to the nation's economy and food supply while maintaining the quality and health of the marine environment and its resources. The effects of the actions and preferred alternatives in this FMP as they relate to the MSFCMA and the National Standards are discussed below.

National Standard 1

This National Standard requires conservation and management measures to prevent overfishing while achieving, on a continuing basis, the OY from the fishery (16 U.S.C. § 1851(a)(1)). Though separate issues, the prevention of overfishing and the achievement of OY are related. In effect, the most important limitations on the specification of OY are that management measures designed to achieve it must also prevent overfishing. "Overfishing" is defined in the MSFCMA as a level or rate of fishing mortality that jeopardizes the capacity of a fishery to produce MSY on a continuing basis (16 U.S.C § 1802(3)(29)).

The primary goal of federal fishery management, as described in National Standard 1 of the MSFMCA, is to conserve and manage U.S. fisheries to "...prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry". OY is defined as the amount of fish that provides the greatest net benefits to the Nation, particularly with respect to food production and recreational opportunities and taking into account the protection of marine ecosystems. While economic and social factors are to be considered in defining the OY of each fishery, OY may not exceed MSY, or the maximum amount of fish that can be removed without impairing the fishery's ability to replace removals through natural growth or replenishment. OY must prevent overfishing and, in the case of an overfished fishery, must provide for rebuilding stock biomass to a level consistent with that which would produce MSY.

Action 9 specifies the MSY and OY for the aquaculture fishery. The Council's preferred alternative would set MSY and OY equal to one another, since there are currently no social, economic, or ecological factors supporting a reduction from MSY. The values for MSY and OY would serve as proxies until more is known about the environmental impacts of aquaculture and the production capacity of the Gulf. The Council's Preferred Alternative for OY is 64 million pounds. It is estimated that 5 to 20 operations could harvest OY over the short-term.

Aquaculture operations will harvest all cultured fish and invertebrates produced, excluding losses due to natural mortality. Because the harvest and yield of cultured animals is separate from that of wild stocks, it would not be possible to overharvest the animals. Therefore, thresholds for determining overfishing and overfished status are not directly applicable to the cultured fish themselves. However, it is conceivable that some level of aquaculture in the Gulf could result in adverse impacts to wild stocks, which could result in overfishing and depletion of such stocks. Therefore, overfishing and overfished thresholds for wild stocks will be used by NOAA Fisheries Service to determine if offshore aquaculture in the Gulf EEZ is adversely affecting wild populations.

Offshore aquaculture may also help reduce fishing mortality on Council and HMS managed stocks by providing an alternate source of food in place of overfished wild stocks and stocks undergoing overfishing. Additionally, increased supply from domestic aquaculture could relieve some fishing pressure on wild stocks.

National Standard 2
National Standard 2 requires conservation and management measures to be based on the best scientific information available (16 U.S.C § 1851(a)(2)). The analytical work and data sources queried in developing this FMP were extensive. This analytical work relied on the most current economic, social, and biological information available at the time of the analysis. Data and analysis sources are provided in Section 10. Prior to approval of this FMP, the SEFSC will make a determination if this FMP is based on the best scientific information available. The preferred alternatives summarized in Sections 4.2 and 4.8 would enhance data collection, therefore assisting the Council and NOAA Fisheries Service in identifying and utilizing the best scientific information available when developing subsequent NEPA analyses and amendments.

National Standard 3
This standard requires an individual stock of fish to be managed, to the extent practicable, as a single unit throughout its range, and interrelated stocks of fish to be managed as a unit or in close coordination (16 U.S.C § 1851(a)(3)). Action 4, Preferred Alternative 4 would only allow species native to the Gulf. Additionally, Action 2 would prohibit the use of genetically modified or transgenic species and require all broodstock to be harvested from U.S. waters of the Gulf. Broodstock would also have to be collected from the same population or sub-population where the aquaculture facility is located. This FMP considers the entire range of each stock proposed for aquaculture under the

management jurisdiction of the Council and NOAA Fisheries Service. Aquaculture species would be managed throughout the Gulf and would not affect the existing range wild stocks are managed by in other FMPs.

National Standard 4

Under National Standard 4, conservation and management measures shall not discriminate between residents of different states (16 U.S.C § 1851(a)(4)). Discrimination is defined as differentiating among people or corporations based on their state of residency. Fishery management plans must not rely on or incorporate a discriminatory state statute (50 CFR § 600.325(b)). Allocation is defined as direct and deliberate distribution of the opportunity to participate in a fishery among identifiable, discrete user groups or individuals (50 CFR § 600.325(c)(1)). To be consistent with the "fairness and equity" criterion, an allocation should be rationally connected with the achievement of OY or with the furtherance of a legitimate FMP objective (50 CFR § 600.325(c)(3)(i)(A)). Otherwise, inherent advantage of one group to the detriment of another would be without cause. In addition, an allocation of fishing privileges may impose hardships on one group if they are outweighed by the total benefits received by another group (50 CFR § 600.325(c)(3)(i)(B)).

Persons who are granted permits for an aquaculture facility will be those who demonstrate they can comply with the permit requirements stated in this FMP and subsequent regulations. This FMP does not consider actions or alternatives that would discriminate between residents of different states. However, this FMP would assign fishing privileges by authorizing a maximum amount of cultured organisms (Action 9) that an aquaculture operation could produce annually. By establishing an annual cap on production, a person or entity would be prevented from acquiring an excessive share of the fishery, thus preventing inordinate control by buyers and sellers that would not otherwise exist. Also, establishing a maximum annual production level associated with OY (Action 9) promotes conservation and management consistent with the objectives of this FMP by allowing the Council to set a lower, more precautionary production level until more is known about the potential impacts of offshore marine aquaculture. Criteria used to assess where an aquaculture facility is sited will be considered on a case-by-case basis and do not discriminate among permittees or aquaculture operations based on their proposed location of operation. Selection of aquaculture sites will not discriminate against fishermen and other competing resource users. Sites will be selected by NOAA Fisheries Service that are intended to avoid traditionally important fishing grounds, thereby minimizing or preventing user conflicts (Action 6).

National Standard 5

This standard requires conservation and management measures to promote efficiency in the use of fishery resources, where practicable, except that no such measure will have economic allocation as its sole purpose (16 U.S.C § 1851(a)(5)). The National Standard Guidelines recognize that, theoretically, an efficient fishery would harvest the OY with the minimum use of economic inputs such as labor, capital, interest, and fuel (50 CFR § 600.300(b)(2)). Hence, an efficient management regime conserves all resources, not just fish stocks.

It is anticipated that the culture processes will be carried out efficiently, especially the feeding process. Aquaculture operations will require large investments of capital and financial resources. Each operation will function as a private business with profits depending on productivity and marketability of cultured products minus costs. If an operation does not function efficiently, then it will not be profitable. Additionally, actions and alternatives considered in this FMP are intended to prevent or mitigate to the extent practicable environmental impacts on wild fisheries. These measures are considered necessary for preventing or mitigating impacts to marine resources when operating aquaculture facilities and will allow managers to efficiently assess an operation's compliance with regulatory requirements.

National Standard 6

National Standard 6 requires management measures allow for variations among, and contingencies in, fisheries, fishery resources, and catches (16 U.S.C § 1851(a)(6)). Variations, uncertainties, and unforeseen circumstances can be experienced in the form of biological or environmental changes, or social, technological, and economic changes. Flexibility of a management regime is necessary to respond to such contingencies (50 CFR § 600.335(b) and (c)).

Several actions and preferred alternatives in this FMP provide for flexibility in the management regime. These include actions 5 and 6, which allow for NOAA Fisheries Service to evaluate siting criteria and allowable marine aquaculture systems on a case-by-case basis. By allowing case-by-case review, technological changes and new biological and environmental information on the impacts of marine aquaculture can be accounted for and addressed. Additionally, the numerous reporting and recordkeeping requirements required in Actions 2 and 8 allow for unforeseen circumstances to be accounted for and addressed. These unforeseen circumstances include, but are not limited to: storm damage, escapement, disease outbreaks, and entanglements of wildlife.

National Standard 7

This National Standard requires management measures to minimize costs and avoid unnecessary duplication (16 U.S.C § 1851(a)(7)). Management measures should not impose unnecessary burdens on the economy, individuals, organizations, or governments (50 CFR § 600.340(c)).

The Regulatory Impact Review (RIR) indicates the aquaculture programs would initially increase annual administrative and enforcement costs. Actions 2 and 8 require extensive application, operational, recordkeeping and reporting requirements to be met. Costs associated with meeting these requirements will be incurred by both aquaculture operations and NOAA Fisheries Service. Additionally, costs to enforcement will increase since the regulations proposed in this FMP constitute new regulations to monitor and enforce. These additional costs are believed to be necessary, and have been minimized to the extent practicable, to ensure environmental impacts are prevented or mitigated.

When possible and to the extent practicable, the Council and NOAA Fisheries Service have attempted to avoid duplication of paperwork requirements. Aquaculture or regulations affecting aquaculture fall under the jurisdiction of multiple federal agencies, each with distinct jurisdictions. This FMP acknowledges the role of each of these agencies in the permitting and monitoring process and does not attempt to impose overlapping requirements on aquaculture permit applicants. The authority of each federal agency is discussed briefly in Sections 5.5 and 9.0. With the exception of Actions 2 and 6, no other actions in this FMP would duplicate requirements of other federal agencies. Action 2 will require permittees to comply with EPA, USDA, and FDA regulations for administering drugs, biologics, and pesticides. Action 2 also requires permittees to comply with ACOE and EPA monitoring and reporting requirements and EPA feed management practices. None of these regulations duplicate the regulations of these other federal agencies. Rather, Action 2 merely highlights that these regulations will be an important component of the Council and NOAA Fisheries Service's aquaculture program.

Action 6 provides NOAA Fisheries Service with authority to review proposed sites for aquaculture. The ACOE has authority to issue a siting permit for structures in navigable waterways, including aquaculture facilities. This FMP would not require a siting permit for aquaculture, but would include criteria used by NOAA Fisheries Service for assessing the adequacy of an aquaculture site. These criteria may differ from criteria used by the ACOE to assess a site, but there still remains potential for duplication and multiple reviews of an aquaculture site. This potential duplication is considered a necessary result of the diverse considerations at issue and the fact that the different agencies will be relying on different areas of expertise in examining various potential impacts to siting decisions.

Lastly, both Actions 2 and 8 refer to permits required by other agencies, such as the EPA and ACOE. The information required for these actions is intended to assist NOAA Fisheries Service in determining compliance with and issuance of aquaculture permits and is not believed to be duplicative since similar standards and permits will not be required by NOAA Fisheries Service.

National Standard 8

This National Standard provides that conservation and management measures shall, consistent with the conservation requirements of the MSFCMA (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities (16 U.S.C § 1851(a)(8)).

Gulf fishing communities potentially affected by this action are listed in the EFH EIS (GMFMC 2004 and GMFMC 2005) and in Section 5.4. Impacts to fishing communities are also discussed in Sections 4, 6, 7, and 8 of this FMP. It is unknown at this time whether aquaculture will directly compete with landings from domestic fisheries. If aquaculture does compete with domestically landed wild fisheries, then there is potential for impacts on fishing communities to occur (loss of jobs, loss of revenue due to decreased prices). However, because foreign imports represent a significant amount of the current U.S. seafood, it is not expected that domestically cultured species will significantly impact fishing communities over the short term. Over the long-term economic benefits may accrue to those communities providing support to aquaculture ventures, which may have some negative ramifications on fishing communities relying on wild stocks.

National Standard 9

The MSFCMA requires fishery management plans establish a standardized reporting methodology to assess the amount and type of bycatch occurring in the fishery (16 U.S.C. §1853(a)(11)). National Standard 9 requires conservation and management measures, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch (16 U.S.C. §1851(a)(9)).

Actions 2, 5, and 8 are the only actions considered in this FMP that are expected to affect bycatch. Action 2 requires permittees to inspect allowable aquaculture systems for entanglements and interactions with marine mammals and protected resources.
If entanglements or interactions are observed to occur, than permittees would be required to report this information to NOAA Fisheries Service as specified in Action 8. This will allow NOAA Fisheries Service to assess if aquaculture operations and gears are negatively impacting protected resources and marine mammals. If interactions or entanglements occur, NOAA Fisheries Service Protected Resources Division would be consulted.

Action 5 specifies allowable marine aquaculture systems. The type of system used for aquaculture may incidentally create bycatch of fish, sea turtles, and other protected resources. Bycatch could occur if a species becomes trapped or entangled in an aquaculture system, such as a cage. To minimize bycatch to the extent practicable, NOAA Fisheries Service will review and approve aquaculture systems on a case-by-case basis. Those systems that pose a significant entanglement risk to endangered and threatened species, and other marine species would not be permitted.

Lastly, in Action 8, permittees are required to submit a request to NOAA Fisheries Service prior to collecting broodstock. The request would specify the number and size of broodstock proposed for capture and the gears used for capture. NOAA Fisheries Service could limit the number of broodstock harvested. It is expected that only a small number of fish (sufficient to satisfy genetic diversity requirements) will be captured each year by aquaculture permittees or hatchery designees. Although bycatch may occur during the capture of broodstock, the amount of bycatch is expected to be small and negligible relative to overall bycatch occurring in each fishery.

National Standard 10

This national standard provides that, conservation measures shall, to the extent practicable, promote the safety of human life at sea (16 U.S.C § 1851(a)(10)).

All offshore aquaculture facilities must comply with the private aids to navigation (33 C.F.R. 66) and the vessel safety requirements of the U.S. Coast Guard. The ACOE permitting process will apply to the offshore facilities constructed by permit applicants. That includes review of the construction characteristics of the facility. Additionally, Action 2 requires aquaculture operations to describe emergency disaster plans, which should assist operations in improving safety-at-sea during natural catastrophes.

6.13 Required Magnuson-Act Provisions for Fishery Management Plans

Section 303(a) of the MSFCMA outlines 15 required provisions that must be included in a Council FMP. Section 303(b) of the MSFCMA outlines an additional 14 discretionary provisions, which may be included but are not required in FMPs. This section summarizes each of the required MSFCMA provisions for FMPs and describes where they have been addressed in this FMP.

(a) REQUIRED PROVISIONS.—Any fishery management plan which is prepared by any Council, or by the Secretary, with respect to any fishery, shall—

(1) contain the conservation and management measures, applicable to foreign fishing and fishing by vessels of the United States, which are—

(A) necessary and appropriate for the conservation and management of the fishery to prevent overfishing and rebuild overfished stocks, and to protect, restore, and promote the long-term health and stability of the fishery;

(B) described in this subsection or subsection (b), or both; and

(C) consistent with the national standards, the other provisions of this Act, regulations implementing recommendations by international organizations in which the United States participates (including but not limited to closed areas, quotas, and size limits), and any other applicable law;

<u>Discussion</u>: All ten actions contained within this FMP are necessary and appropriate for the conservation and management of wild and cultured fisheries. Actions in this FMP are intended to prevent, or minimize to the extent practicable, adverse impacts to wild stocks, essential fish habitat, fishing communities, and public safety. The actions are consistent with the national standards, other provisions of the MSFCMA, and other applicable laws, as described in Sections 6.12 and 9.0 of this FMP.

(2) contain a description of the fishery, including, but not limited to, the number of vessels involved, the type and quantity of fishing gear used, the species of fish involved and their location, the cost likely to be incurred in management, actual and potential revenues from the fishery, any recreational interest in the fishery, and the nature and extent of foreign fishing and Indian treaty fishing rights, if any;

<u>Discussion</u>: A description of the aquaculture fishery is included in Section 5.3. Because an aquaculture fishery does not currently exist in the Gulf, the description is speculative with regard to the types and quantities of fishing gear used, the species involved, and the locations of operations. Section 5.3 provides numerous examples of aquaculture firms in

the U.S. that are currently operational. Costs to management and potential revenues are described in Sections 6.10, 7, and 8. There are no recreational interests in the fishery, although user conflicts may arise between commercial operations and recreational anglers over siting. Lastly, the FMP requires permit holders to be U.S. citizens or permanent resident aliens. Operations would be required to land all cultured products at a permitted dealer within the U.S.

(3) assess and specify the present and probable future condition of, and the maximum sustainable yield and optimum yield from, the fishery, and include a summary of the information utilized in making such specification;

Discussion: The conditions of stocks proposed for inclusion in the Aquaculture FMU are described in Section 5. The Council's preferred alternative would include 55 species in the Aquaculture FMU. Most of the species would be reef fishes. Only four of those species are undergoing overfishing (red snapper, gag, gray triggerfish, and greater amberjack) and three are overfished (red snapper, gray triggerfish, and greater amberjack). The maximum sustainable yield and optimum yield estimates for the aquaculture fishery are summarized in Sections 4.9 and 6.10. Optimum yield is equal to maximum sustainable yield. Optimum yield is estimated to be 64 million pounds.

(4) assess and specify—

> **(A) the capacity and the extent to which fishing vessels of the United States, on an annual basis, will harvest the optimum yield specified under paragraph (3),**
> **(B) the portion of such optimum yield which, on an annual basis, will not be harvested by fishing vessels of the United States and can be made available for foreign fishing, and**
> **(C) the capacity and extent to which United States fish processors, on an annual basis, will process that portion of such optimum yield that will be harvested by fishing vessels of the United States;**

Discussion: Because no aquaculture industry currently exists in the Gulf, it is currently unknown whether or not permitted aquaculture operations will produce OY, as specified in Action 9. The Council's preferred OY is 64 mp and it is expected that this will be easily produced and processed by domestic entities. It is estimated that 5 to 20 aquaculture operations could produce this OY in the Gulf over the short-term. However, at least at the onset of the aquaculture program, OY is unlikely to be achieved until the fishery develops and operations start business. For more discussion of OY, see Sections 4.9 and 6.10.

(5) specify the pertinent data which shall be submitted to the Secretary with respect to commercial, recreational, charter fishing, and fish processing in the fishery, including, but not limited to, information regarding the type and quantity of fishing gear used, catch by species in numbers of fish or weight thereof, areas in which fishing was engaged in, time of fishing, number of hauls, economic information necessary to meet the requirements of this Act, and the estimated processing

capacity of, and the actual processing capacity utilized by, United States fish processors;

Discussion: Actions 2, 5, 6, and 8 specify the pertinent data that shall be submitted to the Secretary with respect to the aquaculture fishery. These actions require data for permit issuance, siting, allowable gears, and permit review and monitoring.

(6) consider and provide for temporary adjustments, after consultation with the Coast Guard and persons utilizing the fishery, regarding access to the fishery for vessels otherwise prevented from harvesting because of weather or other ocean conditions affecting the safe conduct of the fishery; except that the adjustment shall not adversely affect conservation efforts in other fisheries or discriminate among participants in the affected fishery;

Discussion: No proposed regulatory requirements would prevent access to the fishery or affect the safe conduct of the fishery. Actions 2 and 8 do allow the RA to modify use it or lose it provisions and recordkeeping and reporting requirements during and after catastrophic conditions.

(7) describe and identify essential fish habitat for the fishery based on the guidelines established by the Secretary under section 305(b)(1)(A), minimize to the extent practicable adverse effects on such habitat caused by fishing, and identify other actions to encourage the conservation and enhancement of such habitat;

Discussion: As mentioned in Section 6.5.3. the EFH provisions of the MSFMCA would need to be addressed in this FMP for any species added to the Aquaculture FMU that are not currently managed by the Council (or NOAA Fisheries Service). However, because cultured species would be restricted and maintained within artificial environments (hatchery and offshore enclosures) throughout their life history, the description and identification of EFH is not directly relevant to any cultured species exclusive to the aquaculture FMU. Essential fish habitat for Council managed species has already been identified and described in GMFMC (2004) and these designations are hereby incorporated by reference as the only EFH in existence for the species subject to potential culture. Therefore, this FMP addresses the EFH provisions by specifying procedures for minimizing the adverse affects of aquaculture operations. Siting criteria specified in Sections 4.6 and 6.7 and requirements for allowable aquaculture systems in Sections 4.5 and 6.6 are intended to minimize or prevent damage to EFH. Additionally, offshore aquaculture would be prohibited from occurring in numerous areas identified as EFH. These areas include: HAPCs, marine reserves, marine protected areas, and coral areas. Other critical habitats (e.g., seagrasses) would also be considered during case-by-case review.

(8) in the case of a fishery management plan that, after January 1, 1991, is submitted to the Secretary for review under section 304(a) (including any plan for which an amendment is submitted to the Secretary for such review) or is prepared

by the Secretary, assess and specify the nature and extent of scientific data which is needed for effective implementation of the plan;

Discussion: Actions 2, 5, 6, and 8 specify the nature and extent of scientific data needed for effective implementation and monitoring of the aquaculture program. Much of this data and information will be collected by or provided to NOAA Fisheries Service. Other pertinent scientific data, such as water quality monitoring, will be provided to other federal agencies in compliance with their regulations.

(9) include a fishery impact statement for the plan or amendment (in the case of a plan or amendment thereto submitted to or prepared by the Secretary after October 1, 1990) which shall assess, specify, and analyze the likely effects, if any, including the cumulative conservation, economic, and social impacts, of the conservation and management measures on, and possible mitigation measures for—

> **(A) participants in the fisheries and fishing communities affected by the plan or amendment;**
> **(B) participants in the fisheries conducted in adjacent areas under the authority of another Council, after consultation with such Council and representatives of those participants; and**
> **(C) the safety of human life at sea, including whether and to what extent such measures may affect the safety of participants in the fishery;**

Discussion: A fishery impact statement is included in Section 9 of this FMP.

(10) specify objective and measurable criteria for identifying when the fishery to which the plan applies is overfished (with an analysis of how the criteria were determined and the relationship of the criteria to the reproductive potential of stocks of fish in that fishery) and, in the case of a fishery which the Council or the Secretary has determined is approaching an overfished condition or is overfished, contain conservation and management measures to prevent overfishing or end overfishing and rebuild the fishery;

Discussion: Aquaculture operations will harvest all cultured fish and invertebrates produced, excluding losses due to natural mortality. Because the harvest and yield of cultured animals is separate from that of wild stocks, it would not be possible to overharvest the animals. Therefore, thresholds for determining overfishing and overfished status are not directly applicable to the cultured fish themselves. However, it is conceivable that some level of aquaculture in the Gulf EEZ could result in adverse impacts to wild stocks, which could result in overfishing and depletion of such stocks. Therefore, Action 9 proposes to use status criteria for wild stocks to determine if offshore aquaculture in the Gulf EEZ is adversely affecting wild populations, causing them to become overfished or undergo overfishing.

(11) establish a stadardized reporting methodology to assess the amount and type of bycatch occurring in the fishery, and include conservation and management measures that, to the extent practicable and in the following priority—

(A) minimize bycatch; and

(B) minimize the mortality of bycatch which cannot be avoided;

Discussion: Action 8 includes numerous recordkeeping and reporting requirements for monitoring marine mammal and protected species bycatch associated with aquaculture. Actions 5 and 6 provide for case-by-case review with NOAA programs and offices for allowable aquaculture sites and systems. This review will help to minimize impacts of allowable systems and siting locations on bycatch and bycatch mortality of wild species. Action 8, Preferred Alternative 2(n) specifies allowable gears for harvesting broodstock. Requests for harvesting broodstock will need to be authorized by the RA. Broodstock will be harvested in limited quantities, likely resulting in limited bycatch and bycatch mortality of wild fish.

(12) assess the type and amount of fish caught and released alive during recreational fishing under catch and release fishery management programs and the mortality of such fish, and include conservation and management measures that, to the extent practicable, minimize mortality and ensure the extended survival of such fish;

Discussion: The Aquaculture FMP only pertains to commercial operations; therefore, there are no fish recreationally caught or released alive.

(13) include a description of the commercial, recreational, and charter fishing sectors which participate in the fishery, including its economic impact, and, to the extent practicable, quantify trends in landings of the managed fishery resource by the commercial, recreational, and charter fishing sectors;

Discussion: The Affected Environment (Section 5) contains a description of the types of commercial aquaculture firms likely to operate in the fishery. Sections 6-8 include discussions of economic impacts resulting from the proposed regulatory actions in this FMP. No landings data are presented for the Gulf, because no aquaculture operations currently exist. Landings information is provided for firms operating in U.S. waters outside the Gulf.

(14) to the extent that rebuilding plans or other conservation and management measures which reduce the overall harvest in a fishery are necessary, allocate, taking into consideration the economic impact of the harvest restrictions or recovery benefits on the fishery participants in each sector, any harvest restrictions or recovery benefits fairly and equitably among the commercial, recreational, and charter fishing sectors in the fishery and;

Discussion: Rebuilding plans are not applicable to cultured species, therefore, there is no need to allocate harvest restrictions or recovery benefits among sectors. The aquaculture fishery will be comprised of a single sector – permitted commercial offshore aquaculture operators. Action 9 includes measures to ensure that one permittee does not obtain an excess share of the overall OY for the fishery.

(15) establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability.

Discussion: Proposed NOAA Fisheries Service ACL guidelines state the following: "There are limited circumstances that may not fit the standard approaches to specification of reference points and management measures set forth in these guidelines. These include, among other things, conservation and management of ESA-listed species, harvests from aquaculture operations, and stocks with unusual life history characteristics (e.g. Pacific salmon, where the spawning potential for a stock is spread over a multi-year period). In these circumstances, Councils may propose alternative approaches for satisfying the National Standard 1 requirements of the Magnuson-Stevens Act than those set forth in these guidelines. Councils should document their rationale for any alternative approaches for these limited circumstances in an FMP or FMP amendment, which will be reviewed for consistency with the Magnuson-Stevens Act."

The Council's Aquaculture FMP sets an annual catch limit in Action 9 of 64 mp (= OY). Action 9 also limits a person, corporation, or other entity from producing more than 20 percent of the total annual OY (= 12.8 mp). The caps on production should be sufficient to constrain landings to less than or equal to the OY. If however, this limit is exceeded NOAA Fisheries Service would issue a control date, after which entry into the aquaculture fishery may be limited or prohibited. The control date would serve as an accountability measure while the Council initiates review of the OY proxy and aquaculture program.

6.14 Mitigation Measures

Regulations for implementing the NEPA require environmental impact statements include appropriate mitigation measures not already included in the proposed action or alternatives (40 CFR 1502.14(f) and 1502.16(h)). The preferred alternatives in this FMP would establish a permit process for commercial aquaculture in the Gulf. The impacts of offshore marine aquaculture are described in detail for each action in Sections 4, 6, and 7. Each action and its subsequent alternatives propose measures to mitigate the impacts of offshore marine aquaculture. No additional measures are proposed to mitigate the impacts of aquaculture. The following discussion summarizes the mitigation measures proposed in each action.

6.14.1 Action 1: Aquaculture permit requirements, eligibility, and transferability

This action considers whether or not to develop a permitting system for offshore aquaculture in the Gulf. **Alternative 1** would require an EFP and would likely continue to constrain development of commercial aquaculture in the EEZ. **Preferred Alternative 2** and **Alternative 3** would require either a single aquaculture permit (**Alternative 2**) or an operating and siting permit (**Alternative 3)** to conduct aquaculture. In order to obtain permit(s) under either **Alternative 2** or **3**, applicants must also meet various application and operational requirements summarized in Action 2. Review of applications for these permits would likely require more administrative effort to review than would an EFP, because this FMP would require many additional requirements than are currently required under an EFP. These permit requirements will also likely cost the applicant more than would an EFP, although applicants would no longer be required to develop extensive environmental assessments for their proposed project. These administrative costs and costs to the applicant are mitigated by the positive effects on the administrative, physical, and biological environments which would result from such a thorough evaluation of a permit before it was issued.

6.14.2 Action 2: Application requirements, operational requirements, and restrictions

Alternative 1 would not specify application or operational requirements for aquaculture operations. **Alternative 2** would maintain the same permit requirements as required by an EFP. **Preferred Alternative 3** would require applicants obtain an assurance bond and would prohibit genetically modified and transgenic species. Additionally, **Preferred Alternative 3** would require collection of broodstock from U.S. waters of the Gulf and identification of an aquatic animal health expert. Requirements under **Preferred Alternative 3** are the most comprehensive of any of the alternative in Action 2 and would require the most time for the applicant to prepare and the agency to review. **Preferred Alternative 3** would also cost the applicant substantially more because the company would be required to obtain an assurance bond for permit issuance. The negative administrative and economic effects to the applicant and NOAA Fisheries Service are mitigated by the positive effects on the administrative, physical, and biological environments resulting from completion of a permit with such conditions and the assurance that aquaculture structures will be removed in the event an operation terminates.

Other permit conditions, including requirements for environmental monitoring, may be required by other agencies, such as the EPA. These monitoring requirements are intended to assess the impacts of an aquaculture operation and if necessary correct potential problems. Water quality and feed monitoring requirements would be specified by the EPA and may require operations to met pre-defined water quality standards. Other permit requirements would have to be met as specified by the ACOE. These monitoring requirements are intended to assess the impacts of aquaculture operations on marine resources, and if necessary, will assist managers in developing regulations to mitigate environmental impacts if they occur.

6.14.3 Action 3: Duration of the permit

The duration of permit issuance is primarily an economic consideration, although it could have ramifications to the physical and biological environments if a permit is not regularly reviewed for compliance with governing regulations. Actions 2 and 8 in this FMP require operations comply with several operational, recordkeeping, and reporting requirements. These requirements will alert NOAA Fisheries Service of potential problems occurring at a facility and provide them with a basis for either revoking a permit or requiring a facility to change its business practices in order to prevent unacceptable impacts to the biological, physical, and ecological environments. An aquaculture permit would remain valid for the period indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulatory requirements.

Alternative 2(d) would allow for the longest permit duration (indefinite) and therefore be most beneficial to aquaculture operations seeking to obtain financial backing. **Alternative 1** would provide the shortest permit duration (1 year with a possibility of renewal) and would likely continue to constrain commercial aquaculture production from developing in the Gulf. **Alternatives 2(a-c)** provide intermediate permit durations ranging from 5 to 20 years. Although the 10-year preferred permit duration would provide less financial benefits (more difficult to obtain financing and less desirable to investors) than longer permit durations, the negative effects of this alternative are believed to be mitigated by the benefits of more frequent permit review.

6.14.4 Action 4: Species allowed for aquaculture and included in the aquaculture fishery management unit

Alternative 1, which would not preclude culture of exotic species or the culture of genetically modified native species in the Gulf EEZ, could have negative effects on the administrative, biological, physical, and ecological environments as described in Section 6.5 unless such introductions were based on a scientific risk analysis. **Alternatives 2, 3,** and **4** would not allow aquaculture of exotic species and differ from each other only in the particular native species which could be cultured. **Alternative 4** would allow for the culture of all marine species in the Gulf managed by the Council with the exception of shrimp species and coral species (there currently is a separate permitting system for live rock) and would request that NOAA Fisheries Service develop concurrent rulemaking to allow aquaculture of highly migratory species. Any negative economic effects to the applicant from limiting the number of species that could be cultured would be mitigated by the positive effects of keeping non-native and/or genetically modified species out of the Gulf in the event of escapement.

In addition to those species allowed for aquaculture, non-target species may be affected by aquaculture activities. These species could include protected resources and non-target fishes used for fishmeal. Impacts to protected species would be mitigated through ESA consultations. ESA statutes and regulations prohibit the take, import or export, possession, sale, delivery, or transport of all endangered species and most threatened species. Impacts to non-target species, such as menhaden, will be mitigated by potential adjustments to management measures following periodic stock assessments.

6.14.5 Action 5: Allowable marine aquaculture systems

Alternative 1 would not specify allowable aquaculture systems, and would not provide for NOAA Fisheries Service to specifically evaluate proposed systems. **Alternative 2** would allow applicants to use cages and net pens for aquaculture.
Preferred Alternative 3, would allow for case-by-case review of each aquaculture system by NOAA Fisheries Service. **Preferred Alternative 3** would allow for technological innovations that may provide added protection to the physical and biological environments. The negative effect of limiting the type of system an applicant could use would be mitigated by the positive benefits to the administrative, biological, physical, and ecological environment of allowing only robust systems to be deployed in the Gulf EEZ. Additionally, **Preferred Alternative 3** would mitigate negative effects to applicants by allowing future designs of aquaculture systems that have greater structural integrity. The more reliable the system, the less potential for environmental impacts incurred by the permittee.

6.14.6 Action 6: Marine aquaculture siting requirements and conditions

Alternative 1 would rely on NOAA Fisheries Service's review of site permits issued by the ACOE to evaluate proposed aquaculture sites. **Alternatives 2** and **3** would provide NOAA Fisheries Service with authority to use either pre-permitted aquaculture zones or to evaluate a proposed aquaculture site on a case-by-case basis, rather than relying solely on the review and comment procedures of another agency (**Alternative 1**). This would allow NOAA Fisheries Service to disapprove aquaculture sites proposed for aquaculture, which may have been previously approved by the ACOE. In addition, Alternative 3 would require permit applicants to conduct a baseline assessment at their proposed site prior to applying for a permit. If the applicant receives a permit, then subsequent environmental monitoring would also be required. The baseline assessment and monitoring would have to be conducted in accordance with NOAA Fisheries Service's guidance and procedures. Development of guidance and procedures will be coordinated with the ACOE, EPA, and other federal agencies. **Alternative 3** may duplicate to an extent the ACOE's siting requirements, but this duplication is expected to mitigate potential environmental impacts to the physical and biological environments since NOAA Fisheries Service and the ACOE have different authorities and management objectives. Additionally, **Preferred Alternative 3** will involve case-by-case review for siting. Although this is expected to increase the amount of time needed to review a permit application relative to **Alternatives 1** or **2**, this inconvenience to the applicant and increased administrative costs to the government is mitigated by the detailed site-specific evaluation allowed.

6.14.7 Action 7: Restricted access zones for marine aquaculture facilities

Alternative 1 would not establish restricted access zones around offshore aquaculture facilities, while **Preferred Alternative 2** would establish restricted access zones around marine aquaculture facilities where fishing activities are prohibited. The economic burden to fishermen of being excluded from these zones could be substantial. Some fishermen may view restricted access zones as a form of marine protected area, where fishing is prohibited. It is well known that many fish aggregate around structures, and the aquaculture systems could attract fish from outside such a zone and keep fishermen from catching them. These negative economic effects are expected to be mitigated by proper siting of facilities; therefore **Alternative 2** is preferred.

6.14.8 Action 8: Recordkeeping and reporting

Keeping records and making reports to NOAA Fisheries Service and other federal agencies, as described in **Preferred Alternative 2,** could be seen as an administrative burden to aquaculture companies. **Alternative 1**, which would not require such recordkeeping and reporting, would not incur such a burden. However, if such records were not kept and reports were not made, problems with an aquaculture facility could result in negative effects to the administrative, economic, biological, physical, and ecological environments and go undetected and unresolved. Therefore, the benefits of prevention and review of environmental impacts are expected to mitigate any administrative and economic burdens suffered by the aquaculture operations.

6.14.9 Action 9: Biological Reference Points and Status Determination Criteria

Action 9 proposes two alternatives for setting biological reference points and status determination criteria. **Alternative 1** would not establish biological reference points and status criteria for the aquaculture fishery, while **Preferred Alternative 2** would. The MSFCMA requires these criteria and reference points be estimated and established. Establishing such benchmarks will mitigate the potential for legal challenges incurred if they are not implemented. Setting OY at 64 million pounds is expected to allow an aquaculture industry to develop in the Gulf. The Council is taking a precautionary approach to setting OY and limiting production. The lower OY is set, the more environmental impacts would be prevented or mitigated. The Council's preferred OY is intended to provide a balance between environmental considerations and socio-economic considerations. If OY is determined to be set to high in the future, then procedures established in Action 10 would be used to adjust OY and minimize or mitigate environmental impacts.

6.14.10 Action 10: Framework Procedures

Action 10 proposes three alternatives. **Alternative 1** would not specify framework procedures, while **Alternatives 2** and **3** would. By not specifying framework procedures, the Council would be required to implement changes to aquaculture management measures through a full plan amendment. This would result in a timely process for implementing regulatory changes and could result in additional negative impacts to the environment as changes are slowly approved and implemented. **Alternatives 2** and **3** would rely on an Aquaculture AP to annually review the aquaculture program. Both of these alternatives would provide regular oversight of ongoing aquaculture activities and operations and help to mitigate environmental, social, and economic impacts if they are determined to occur. The AP would provide recommendations for review and approval by the Council. Recommendations could then be sent to the RA for approval. The major differences between these two alternatives are that a regulatory amendment would be required for **Alternative 3** and the Panel/Council would have broader authority for making changes to aquaculture regulations through the framework process specified in Alternative 3. For both alternatives, timelier implementation of regulations is expected to mitigate shorter public comment periods.

6.15 Cumulative Effects Analysis (CEA)

NEPA mandates federal agencies assess not only the indirect and direct impacts associated with regulatory actions, but also the cumulative impacts associated with those actions. NEPA defines a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 C.F.R. 1508.7). Cumulative effects can either be additive or synergistic. A synergistic effect is when the combined effects are greater than the sum of the individual effects.

This following CEA is based upon guidance offered in CEQ (1997). The report outlines 11 items for consideration in drafting a CEA for a proposed action. These items include:

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.
2. Establish the geographic scope of the analysis.
3. Establish the timeframe for the analysis.
4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.
5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.
6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.
7. Define a baseline condition for the resources, ecosystems, and human communities.
8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.
9. Determine the magnitude and significance of cumulative effects.
10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.
11. Monitor the cumulative effects of the selected alternative and adapt management.

The CEA for the biophysical environment will follow these 11 steps. Cumulative effects on the biophysical environment and the socio-economic environment will be analyzed separately.

1. Identify the significant cumulative effects issues associated with the proposed action and define the assessment goals.

The CEQ cumulative effects guidance states this step is accomplished through three activities. The three activities are as follows:

I. The direct and indirect effects of the proposed actions.

   Direct and indirect effects of the proposed actions are summarized in Sections 6.2 through 6.9.

II. Which resources, ecosystems, and human communities are affected?

   The resources, ecosystems, and human communities affected by this action are described in Section 5.0. These include:

   1. Managed resources (allowable aquaculture species)
   2. Non-target fisheries (menhaden and other fishes potentially used for feed)
   3. Habitat, including essential fish habitat
   4. Protected resources
   5. Gulf fishing communities

III. Which effects are important from a cumulative effects perspective?

   The effects most important from a cumulative effects perspective are described in this CEA.

2. Establish the geographic scope of the analysis.

The immediate areas affecting managed resources, non-target fisheries, habitat, and protected resources are waters of the Gulf, including both state and federal waters.

Most species managed by the Council are distributed in waters off the Yucatan, throughout the Gulf, to the waters off North Carolina. Some species, such as mackerel or cobia, migrate throughout this range seasonally, while others, such as gray triggerfish, have high site fidelity. HMS, such as tunas, and various protected species are managed by NOAA Fisheries Service HMS Division and occur throughout the world, including waters of the Gulf. Most species have pelagic larvae, thus, some exchange of fish between regions could occur. However, larval movement patterns are not well understood. Within the Gulf, genetic and life history data suggests multiple stocks or subpopulations of the same species may exist (e.g. mackerel and red snapper).

Aquaculture products are currently sold worldwide and products ultimately produced in the Gulf will likely be sold in markets similar to those where wild caught products are sold. Therefore markets both around and outside the Gulf are expected to purchase and sell aquaculture products. However, most if not all aquaculture species would be landed in the Gulf and therefore would primarily affect local fishing communities. The immediate areas affecting humans would include fishing communities primarily along the Gulf coast and to a lesser extent the South Atlantic coast. Although offshore aquaculture operations would only be sited in the Gulf, many species managed by the Gulf Council occur in the South Atlantic. Production of cultured fish may therefore affect those South Atlantic fishing communities that harvest wild species that are also cultured in the Gulf.

3. Establish the timeframe for the analysis.

Sections 2.2 and 5.3 describe the history of management for aquaculture nationally and in the Gulf. A national policy on aquaculture was first approved in 1980 through the passage of the NAA. The NAA was reauthorized in 1985 and in subsequent Farm Bills. Legislation specific to offshore aquaculture was proposed for Congressional consideration in 2005 and 2007. In the Gulf, the first offshore finfish aquaculture operation was an experimental operation in Texas state waters in the late 1980s and early 1990s. The first applicant to propose an offshore finfish aquaculture operation in federal waters of the Gulf was Seafish Mariculture L.L.C., which received an EFP from NOAA Fisheries Service in October 1997 to culture red drum, greater amberjack, and red snapper. This aquaculture project was later terminated in July 1999. To date, Seafish Mariculture is the only business that has successfully received an EFP for aquaculture in federal waters of the Gulf, although several other businesses have made inquires to NOAA Fisheries Service on how to apply for an EFP.

The timeframe for the CEA should take into account both historical efforts to establish regional and national aquaculture programs, as well as future considerations if this FMP and its subsequent regulations are approved and implemented by NOAA Fisheries Service. The timeframe for the CEA begins in 1980, with the passage of the NAA, and extends through 2019, which is ten years after this FMP would first be approved and implemented. The end of the CEA also corresponds to the preferred duration of aquaculture permits as described in Action 3.

4. Identify the other actions affecting the resources, ecosystems, and human communities of concern.

This FMP proposes to include species from five of the Council's seven FMPs in the Aquaculture FMU. Only corals and shrimp would not be included in the FMU. Regulations that alter the allowable harvest of wild species managed under the Reef Fish, CMP, red drum, stone crab, and spiny lobster FMPs may alter the characteristics and operations of aquaculture facilities. When reduction in harvest of wild caught species occurs, a positive economic effect on the cultured conspecifics would be expected, while conversely, increases in the wild caught fish would be expected to create a depressed value of aquaculture conspecifics. However, it is difficult to say with certainty if these trends would hold true for all species, some, or even none. Changes in value would largely depend on the health and status of wild fisheries and the amount of similar cultured species produced by aquaculture.

Other actions that affect aquaculture are those regulations which would be imposed and subsequently altered by other agencies with regulatory authority in the EEZ under various laws or existing authority. The EPA may affect aquaculture facilities by altering or imposing water quality parameters for offshore aquaculture under Section 318 of the Federal Water Pollution Control Act. The EPA must also approve chemicals and pesticides used in open ocean aquaculture. Additionally, FDA regulations may affect an aquaculture facilities' ability to use various chemicals or therapeutics for pest and pathogen control, as well as allowable levels of those agents for human consumption.

Similarly, the ACOE, through authority of Section 10 of the Rivers and Harbors Act of 1899, can affect aquaculture facilities by their review of the siting of such facilities in navigable waterways. Under the authorities of the Fish and Wildlife Coordination Act, the ESA of 1973, the MBTA, and the MMPA of 1972, the USFWS may review and comment on any project authorized, licensed or funded by the federal government with respect to effects on fish and wildlife.

More recently, the MMS published proposed regulations for alternative uses of energy related structures under the authority of the Energy Policy Act of 2005. This Act gives the Secretary of the Interior authority to issue a lease, easement, or right-of-way on the OCS for activities that use energy facilities for other (non-energy related) authorized marine-related purposes, such as aquaculture. If a stock is not managed through a FMP, NOAA Fisheries Service may not have direct authority to permit or prohibit the activity under the MSFCMA. However, consultation requirements under the ESA and EFH provisions of the MSFCMA would still apply.

Since March 2003, the NOAA Fisheries Service SERO has reviewed more than 20 applications for construction and operation of liquefied natural gas (LNG) terminals to be located in coastal and federal waters of the Gulf. Of particular concern among LNG proposals are those facilities that propose open loop, or once-through, systems that would use sea water as the medium to heat and regasify LNG. In these cases, each facility would use 100 to 250 million gallons of sea water per day. The sea water would be cooled during the regasification process and treated with chemical additives to prevent biofouling. These aspects of LNG facility operation are likely to adversely affect EFH or species managed under the MSFCMA and species listed for protection under the ESA. The greatest concern with open loop systems in the Gulf is the loss of eggs and larval life stages, with potential impacts on valued fish stocks for which rebuilding programs are in place or being developed. Other important issues include ecosystem impacts, impacts to National Marine Sanctuary resources, and impacts in coastal waters that fall within state jurisdiction. In a February 18, 2004, memorandum from the SEFSC to the SERO, it was estimated that the operation of even a single offshore open loop facility could result in the mortality of five billion fish eggs and larvae per year for the life of the project and concluded that "[t]he negative impacts to fishery species and living marine resources in the Gulf from a single [open-loop] facility are potentially severe, and cumulative impacts from multiple facilities must be considered a threat to fishery resources."

As of early 2008 three facilities had been constructed in the Gulf region; two onshore closed loop facilities and one offshore open loop facility. Additional facilities have received regulatory approvals including two offshore facilities (one closed loop and one open loop) and twelve on-shore closed loop facilities. Although approved, due to market capacity limitations it is expected that less than half of the proposed facilities will be constructed.

Lastly, the USCG has authority to require aquaculture-related structures be marked with appropriate lights and signals and the MMS is currently proposing regulations that would allow for alternative uses of oil and gas platforms. Offshore aquaculture has been identified as one potential alternative use.

Natural disasters and economic change can also affect resources, ecosystems, and communities. Such events include diseases outbreaks, red tides, changes in economic conditions, foreign imports, high fuel prices, hurricanes and storm events, and hypoxia. These disasters and economic changes can negatively affect the profits of aquaculture operations and fishermen. They can also damage existing infrastructure and reduce resource availability. However, aquaculture operations, unlike wild fisheries, will function as private businesses with successes and failures determined largely by business plans and the resilience of the operation to the above events. Compliance with the actions and alternatives proposed in this FMP will allow for environmentally sound and sustainable aquaculture. However, additional stresses could be placed on wild fisheries if operations impact the environment as described in Section 6.1. To prevent or minimize impacts from aquaculture, the alternatives proposed herein are intended to mitigate environmental and socio-economic impacts. Mitigation measures are described in detail in Section 6.14.

5. Characterize the resources, ecosystems, and human communities identified in scoping in terms of their response to change and capacity to withstand stress.

This step should identify the trends, existing conditions, and the ability to withstand stresses of the environmental components. According to the CEQ guidance describing stress factors, there are two types of information needed. The first is the socioeconomic driving variables identifying the types, distribution, and intensity of key social and economic activities within the region. The second is the indicators of stress on specific resources, ecosystems, and communities.

CEA factor 4 above describes the various stresses affecting the resources, ecosystems, and human communities of concern. Fishermen face numerous economic stresses. These manifest themselves as either additional costs to fishing, or from reducing ex-vessel prices for harvested fish. Added costs include increases in such items as fuel, ice, food, and insurance. Factors reducing ex-vessel prices for fishermen include market gluts, increases in imported fish, or fish health issues. Changes in revenue and increased operating costs are two indicators of socioeconomic stress. In recent years, the additional stresses of overfishing, hurricanes, and fuel prices have resulted in marginal profits and losses in revenue forcing many fishermen to leave fisheries and seek more stable sources of employment. Fishermen targeting healthier stocks and with lower expenses are more resilient to the stresses described above. In contrast those fishermen relying on stocks that are frequently subject to overfishing and stringent management regulations, or that have greater expenses relative to other fishermen, are less resilient to various stresses making them more likely to seek other jobs. Because aquaculture operators would only rely on a small number of broodstock from wild stocks, they are more likely to be resilient to stresses such as overfishing of wild stocks. However, other stresses may affect aquaculture operations such as the ability to economically compete with wild caught fish, environmental factors which may diminish culture productivity (e.g., red tide, changes in temperature or dissolved oxygen), storm events, and large up-front financial investments.

Indicators of stress to the biological environment include reductions in population abundance and habitat degradation. As mentioned above, the Council and NOAA Fisheries Service evaluate the status of wild stocks relative to various pre-defined benchmarks and implement necessary management measures to maintain sustainable resources. The susceptibility to stress depends on a species productivity and life history. In general, longer lived, slower-growing species, such as many reef fishes, are more susceptible to stresses (overfishing, becoming overfished), then shorter-lived, more fecund species. As a result, the time to rebuild these populations is often much longer and reductions in harvest are much greater. For aquaculture operations, a species life history will affect the potential success of an operation and how profitable it may be. Faster growing species that are less susceptible to disease and command higher market prices will provide the fewest stresses to aquaculture operations. Similar, the location of a facility will be a critical aspect to its success or failure. For instance, facilities located in areas where hurricanes are more likely to occur or where current conditions are less optimal may incur more stresses due to lower production and potential for facility damage then facilities not located in these areas.

Wild stocks are another resource that could be potentially impacted by aquaculture operations through escapement of fish or disease outbreaks. Additionally, non-target species, such as menhaden, could be negatively affected if demand increases for fish meal. The stresses placed on wild stocks and their resilience to these stresses are largely contingent on wild fishery regulatory restrictions and the environmental regulations imposed on facilities. This FMP proposes numerous measures intended to mitigate impacts on the biological, physical, and ecological environments (Section 6.14). All of these measures are intended to reduce stresses on wild stocks by preventing or minimizing escapement, disease, entanglements, and habitat degradation. The status of wild stocks, both managed and non-target species, is regularly monitored through both state and federal stock assessments. These stock assessments allow managers to adapt to changes in fishing practices and adjust management to conserve natural resources. As a result, any stresses resulting from aquaculture on wild stocks above and beyond those stresses by domestic fisheries will be addresses through adjustments in Council fishery management plans (including this FMP) and federal/state regulations.

6. Characterize the stresses affecting these resources, ecosystems, and human communities and their relation to regulatory thresholds.

This section examines whether resources, ecosystems, and human communities are approaching conditions where additional stresses could have an important cumulative effect beyond any current plan, regulatory, or sustainability threshold (CEQ 1997). Sustainability thresholds can be identified for some resources, which are levels of impact beyond which the resources cannot be sustained in a stable state. Other thresholds are established through numerical standards, qualitative standards, or management goals. The CEA should address whether thresholds could be exceeded because of the contribution of the proposed action to other cumulative activities affecting resources.

The MSFCMA requires federal fishery management plans to prevent overfishing and achieve optimum yield on a continuing basis. For many Council and HMS managed stocks, status determination criteria and benchmarks have been established to evaluate the status of a stock or stock complex. Currently, four species in the Gulf are undergoing overfishing (gag, gray triggerfish, red snapper, and greater amberjack) and three species are overfished (red snapper, gray triggerfish, and greater amberjack). The remainder of Council managed species are either healthy or their status is unknown. Several HMS species are also overfished and/or overfishing as indicated in Section 5.2.3.2. Many of these species are not likely to be cultured, such as billfishes and sharks. Thirteen ESA-listed species are known to occur in the Gulf and six species are considered candidates for listing as endangered or threatened. Several non-target species, such as menhaden, which are not managed by the Gulf Council may be affected by this action.

Stresses affecting each of these resources include directed fishing mortality, habitat loss and degradation, increasing demand for food and feed, and environmental changes (e.g., red tide, hurricanes, changes in temperature, etc.). The status of many of these species is regularly assessed through periodic assessments and their status is determined relative to pre-defined criteria. The status of Gulf fish stocks, endangered and threatened species, and HMS is summarized in Section 5.0 relative to pre-defined benchmarks. When fisheries are determined to be undergoing overfishing or are overfished, NOAA Fisheries Service and/or the Councils are required by the MSFCMA to implement conservation and management measures to prevent overfishing and rebuild overfished stocks. States and interstate compacts may also impose regulations to control fishing mortality and harvest. The recent amendment to the MSFCMA requires Councils and NOAA Fisheries Service to establish annual catch limits and accountability measures to end overfishing of all stocks by either 2010 or 2011. For endangered and threatened species, the ESA prohibits take, import or export, shipment, or sale of any endangered species and most threatened species.

Stresses affecting fishing communities include additional regulatory restrictions, competition from foreign seafood imports, coastal development, loss of infrastructure, and rising fuel prices. All of these stresses have placed a greater burden on fishermen and fishing communities that threaten their short- and long-term sustainability. In the past several years, the Council has implemented numerous regulations to end overfishing of reef fishes. The Council has also approved several rebuilding plans to increase stock biomass and abundance of reef fishes. These regulations have resulted in lower allowable catch levels, more restrictive trip limits, and limited access. Although the net benefit of these regulations is expected to result in more abundant and stable fisheries in the long-term, they have the unavoidable adverse effect of negatively affecting profits and value in the short-term. As a result, the cumulative effect of more restrictive regulations, coastal development, higher fuel prices, and natural disasters has led many fishermen to leave the industry in recent years and seek more stable forms of employment.

Developing an environmentally sound and sustainable aquaculture program is intended to alleviate some of these stresses. To the extent that development of an aquaculture industry may cause additional stresses (e.g., escape of cultured fish, nutrient loading, etc), the Council's preferred alternatives in this FMP are intended to minimize these stresses to the extent practicable (see Section 6.14 Mitigation Measures). The environmental permitting, reporting, recordkeeping and siting conditions associated with the proposed aquaculture program are consistent with the Council's policy to encourage environmentally responsible marine aquaculture. These conditions are intended to ensure the operations of all offshore aquaculture facilities permitted in the Gulf are consistent with the MSFCMA National Standards (Section 6.12) and do not compromise Council objectives for wild fisheries. As discussed in Section 3 (Purpose and Need), open ocean aquaculture will assist NOAA Fisheries Service and the Council in optimizing yield above levels achieved solely from wild stocks, providing the greatest net benefit to the Nation with respect to food production, while taking into account necessary environmental protections needed to sustain Council and NOAA Fisheries Service managed fisheries native to the Gulf. Aquaculture may also help reduce fishing mortality on Council and HMS managed stocks by providing an alternate source of food instead of overfished wild stocks and stocks undergoing overfishing. Aquaculture may also provide additional job opportunities for local fishing communities, especially those fishing communities most affected by federal and state management restrictions.

7. Define a baseline condition for the resources, ecosystems, and human communities.

The purpose of defining a baseline condition for the resource and ecosystems in the area of the proposed action is to establish a point of reference for evaluating the extent and significance of expected cumulative effects.

The status of Council managed resources are summarized in the annual status report to Congress on the Status of U.S. Fisheries (NOAA Fisheries Service 2007). The baseline status of Council managed species is also described in section 5.0 of this FMP. Gag, gray triggerfish, red snapper, and greater amberjack are undergoing overfishing in the Gulf and red snapper, gray triggerfish, and greater amberjack are overfished. The remainder of Council managed species are either healthy or their status is unknown. Additionally, several HMS species are overfished and/or undergoing overfishing (Section 5.2.3.2). Many of these species are not likely to be cultured, such as billfishes and sharks. Additionally many ESA-listed species or candidate species for ESA-listing are known to occur in the Gulf (Section 5.2.3.3).

The status and health of EFH is extensively described in GMFMC 2004 and GMFMC 2005. The Council, NOAA Fisheries Service, and other federal agencies have designated numerous areas in the Gulf to protect and conserve EFH. These areas protect EFH from a wide variety of direct impacts, including: loss of fishing gear, restricted use of certain fishing gears, and damage from anchors. Section 5.1 in this FMP describes numerous environmentally sensitive areas where aquaculture could be restricted. In addition, Action 6 will require NOAA Fisheries Service conduct case-by-case reviews of aquaculture sites. The EPA already imposes monitoring requirements for NPDES permits to collect baseline data. Baseline data for a site, and plans for monitoring environmental impacts will also be required by NOAA Fisheries Service to evaluate localized changes to the benthos, water column, and biological environment.

Section 5.3.3 describes baseline conditions for fishing communities throughout the Gulf. The Generic Essential Fish Habitat Amendment (GMFMC 2004) provides more extensive characterization of fishing-dependent communities throughout the Gulf. The communities that will be affected as a result of developing offshore aquaculture in the Gulf are difficult to project at this time. There is no information available that describes where firms will have their headquarters, where their supplies will be purchased, where employees will be hired or live, where the offshore facilities will be located, or how social conditions will change.

8. Identify the important cause-and-effect relationships between human activities and resources, ecosystems, and human communities.

Cause-and-effect relationships for various aspects of offshore marine aquaculture and measures proposed in this FMP to address these potential effects are summarized in Table 6.12.1.

Table 6.12.1 The cause-and-effect relationship of aquaculture activities and proposed regulatory actions.

Cause	Potential Effect	Measures to Address Potential Effects
non-native species	competition with native species, loss of biodiversity, economic damage, transmit disease, degrade habitat	prohibit use of species not native to the Gulf - Action 4
Genetic modification	changes in wild population genetic structure if fish escape	prohibit use of genetically modified and transgenic species for aquaculture - Action 2
improper siting	habitat degradation, reduced water quality, increased entanglements of wildlife, user conflicts, navigational hazard, decreased water quality	case-by-case review when siting a facility - Action 6; compliance with ACOE, EPA, and USCG permitting requirements
reduced water quality	reduced biological and ecological productivity, increased risk of infectious disease	case-by-case review when siting a facility by NOAA Fisheries Service - Action 6; compliance with EPA standards - Action 2
improper aquaculture system construction	increased entanglement and injuries of wildlife; habitat degradation	case-by-case review when permitting allowable aquaculture systems - Action 5
abandoned equipment	habitat degradation, navigational hazards	require assurance bond for structure removal - Action 2
permit duration	too long - increased potential for environmental impacts not being discovered; too short - problems with procuring capital	annual reporting and recordkeeping requirements - Action 8; operational requirements - Action 2; periodic on-site visits by NOAA Fisheries Service staff; EPA monitoring standards
escapement	genetic modification and competition with native, wild stocks	Regular inspection of allowable aquaculture systems - Action 2; Use of native, non-genetically modified stocks - Action 4; Notification of escapement - Action 8
speculative entry	large number of permits issued; permittees have no intent of using permits	use-it or lose-it requirement - Action 2
allowing offshore aquaculture	potential loss or increase in jobs to local communities, increased risks of localized environmental impacts, poaching of wild fish, competing uses	review social and economic data over time as the aquaculture industry develops; regular monitoring and permit requirements - Actions 2 and 8; appropriate siting - Action 6; Aquaculture Advisory Panel – Action 10.

9. Determine the magnitude and significance of cumulative effects.

It is difficult to predict the magnitude and significance of cumulative effects at this time, because it is unknown how many aquaculture operations will apply for permits in the near future. The following discusses the magnitude and significance of cumulative effects relative to past, present, and reasonably foreseeable future actions. For purposes of discussion, cumulative effects are discussed in the context of Action 1 (permit or do not permit a regional aquaculture program).

Past actions affecting aquaculture are described in Section 2.2 and Section 5.3. Since 1980, the U.S. has had a national aquaculture policy. However, to date there have been only limited offshore aquaculture operations; most of which have occurred in state and not federal waters. In the Gulf, the current permitting framework (EFPs) is not conducive to the development of an aquaculture industry. Additionally, the U.S. is increasingly importing a larger share of seafood to meet domestic demand. Allowing a regional aquaculture program to develop will increase the supply of domestic seafood, while minimizing or preventing environmental impacts on wild fisheries, habitat, and water quality. Although not allowing a regional permitting program to develop would provide the least risk to the biological and social/economic environments, actions considered in this FMP are intended to mitigate such impacts, to the extent practicable. Under a best-case scenario, numerous (5-20) aquaculture operations would be permitted in the Gulf over the next 10 years. These operations would have environmentally sound aquaculture systems, pose minimal or no impacts to localized water quality and wildlife, be sited in areas that prevent or significantly reduce the likelihood of habitat degradation and user conflicts, and culture large amounts of native, non-genetically modified fish from the Gulf helping to reducing fishing pressure on wild stocks and increase OY . In order to accomplish this best case scenario, the Council has selected numerous preferred alternatives in this FMP to mitigate or prevent negative environmental effects. These are described in greater detail in Section 6.14. The worst-case scenario would occur if potential effects in Table 6.12-1 occur. However, the Council and NOAA Fisheries Service have proposed numerous monitoring, recordkeeping, and reporting requirements to ensure these potential effects are prevented, or mitigated if they occur.

Presently, there are no proposed aquaculture operations applying for EFPs in the Gulf, although several firms have inquired about obtaining an EFP in the last few years. National aquaculture legislation has been considered by Congress in recent years. A 2005 bill came under criticism because of the perceived lack of environmental safeguards. A bill resubmitted to Congress in 2007 addressed at least some of these criticisms; however, the Congressional session ended before Congress acted on the bill. Even if similar legislation is re-introduced and enacted soon, it is expected to take several years to implement a national aquaculture program. The bill that was proposed in 2007 would exempt aquaculture from the definition of “fishing” and provide for consultations with fishery management councils. This type of legislation would potentially override the actions proposed in this FMP; however, it is unknown whether or not proposed national legislation would have greater or less environmental standards and requirements than those proposed in this FMP

Other actions being considered by the Council and NOAA Fisheries Service that were recently implemented or are expected to be implemented in the foreseeable future include: 1) Measures to end overfishing of red snapper (Amendment 27/14 to the Reef

Fish and Shrimp FMPs), 2) modifications to shrimp trawl bycatch reduction device criteria, 3) measures to address overfishing of gag, gray triggerfish, and greater amberjack (Amendments 30A and 30B to the Reef Fish FMP), and 4) measures to increase red grouper TAC (Amendment 30B to the Reef Fish FMP). The Council is also developing an amendment, which would develop a grouper limited access privilege program in the Gulf. If approved, a limited access program could be established as early as January 2010. A majority of the above mentioned amendments are intended to reduce mortality on wild stocks and rebuild overfished fisheries. These actions will have negative effects on fishermen and fishing communities in the short-term, with positive benefits accruing as stocks rebuild. Additionally, the MSFCMA will require the Council and NOAA Fisheries Service to implement annual catch limits and accountability measures for most managed stocks by 2010 or 2011. Annual catch limits and accountability measures are intended to prevent or greatly reduce the risk of overfishing and are expected to have positive biological benefits. However, they will also likely impose more restrictive catch levels on many fisheries resulting in negative social and economic impacts over the short-term. To the extent that catch limits and accountability measures can prevent overfishing and assist in rebuilding overfished stocks, they should have positive long-term benefits to both the biological and socio-economic environments.

Open-ocean aquaculture will allow yield to be optimized at levels above those achieved solely by wild stocks, providing the greatest net benefit to the Nation with respect to food production, while taking into account necessary environmental protections needed to sustain Council and HMS managed fisheries native to the Gulf. In addition to increasing OY, aquaculture may also help reduce fishing mortality on Council and HMS managed stocks by providing an alternate source of food instead of overfished wild stocks and stocks undergoing overfishing. The FMP includes several recordkeeping and reporting requirements to prevent or mitigate impacts to habitat and protected resources (Sections 4.2, 4.5, 4.6, and 4.8). Additionally, assessments will be conducted periodically for non-target species, such as menhaden, to determine if wild stocks are being managed at sustainable levels. If offshore aquaculture results in increased demand for fishmeal from species such as menhaden then states and interstate compacts may need to impose more restrictive regulations to protect these wild-prey species. Fishing mortality and abundance for these species, as well as managed species, will be determined periodically by assessments and established targets and thresholds.

10. Modify or add alternatives to avoid, minimize, or mitigate significant cumulative effects.

The cumulative effects of developing a regional aquaculture permitting system on the socioeconomic environment are expected to be positive, although some negative social and biological impacts may result if aquaculture is not conducted in an environmentally sustainable manner. To prevent or minimize impacts associated with aquaculture, the actions and alternatives in this FMP include various measures to mitigate impacts. Such measures include:

- Action 2: Requiring aquaculture permit holders to obtain an assurance bond for removal of structures if an operation terminates; identification of an aquatic animal health expert; prohibition on use of genetically modified, and transgenic species; emergency disaster plans; broodstock harvested only from U.S. waters of the Gulf.
- Action 4: Use of only native Gulf species for aquaculture
- Action 5: Evaluate proposed aquaculture system on a case-by-case basis to ensure reliable offshore growing system technology is used to provide environmental safeguards.
- Action 6: Prohibit siting facilities in marine reserves, artificial reef zones, coral areas, marine protected areas, and HAPCs; review proposed sites on a case-by-case basis; space facilities at minimum 3 km from one another; require benthic surveys of a site during review.
- Action 8: Require the following recordkeeping and reporting requirements:
    - Report disease outbreaks, escapement, and entanglements of marine mammals and protected species.
    - Maintain harvest and sale records and feed labels.
    - Obtain prior approval for harvesting broodstock.
    - Submit an annual standardized report describing recordkeeping and reporting requirements.

In addition to these measures, NOAA Fisheries Service staff will conduct site visits at facilities to ensure aquaculture facilities are operating properly and not causing unacceptable impacts to the biological or ecological environments. If, at any time, permit conditions or recordkeeping and reporting requirements are not being met, NOAA Fisheries Service could initiate an on-site inspection to determine the operations impact and, if needed, revoke the operation's permit prior to its expiration.

For non-target species that may be indirectly affected by this action (e.g., menhaden used as fishmeal for aquaculture), stock assessments may be conducted periodically by NOAA Fisheries Service or state management agencies to determine if stocks are being managed at sustainable levels. If non-target stocks are not being managed at sustainable levels, states or interstate compacts may impose regulations to reduce fishing mortality, constrain harvest and rebuild overfished stocks.

Socioeconomic impacts will depend largely on whether or not cultured products supplant domestic, wild caught fish in the marketplace and displace fishing communities (e.g., job losses/increases, price competition). Currently, foreign imports represent a majority of seafood consumed in the U.S. Domestic aquaculture will increase the supply of fresh U.S. fish. However, the extent to which cultured fish will compete with domestic, wild fisheries is unknown at this time. If cultured fish supplant wild harvest, then fishing communities reliant on the harvest of wild fish may be negatively affected. Alternatively, if aquaculture increases job opportunities for local fishing communities, then net economic and social benefits may result. Until socioeconomic impacts of domestic aquaculture are better understood, there is no way to mitigate potential future impacts.

11. Monitor the cumulative effects of the selected alternatives and adapt management.

The effects of the proposed actions will be monitored through the submission of periodic reports to NOAA Fisheries Service and other agencies, such as the EPA and ACOE. Action 2 requires aquaculture permit applicants to meet numerous operating requirements and restrictions. Additionally, Action 8 requires permit holders to maintain various records and submit various reports to NOAA Fisheries Service regarding issues ranging from disease outbreaks to entanglement of protected resources. This information, as well as water quality data provided to the EPA, will allow NOAA Fisheries Service and other federal agencies to monitor the cumulative effects of the preferred alternatives and make management adjustments, as necessary.

6.16 Unavoidable Adverse Effects

Administrative Costs
Implementing and administering a permitting program for aquaculture will result in additional unavoidable costs to federal agencies, particularly NOAA Fisheries Service Southeast Region. Although NOAA Fisheries Service Southeast Region currently issues EFPs, only one EFP has been issued to an aquaculture operation in the last 10 years and only two other EFPs have been considered for issuance. The numerous permit requirements, records, and reports will require additional workload for NOAA Fisheries Service staff. Costs to other federal agencies, such as the ACOE, EPA, MMS, USDA, and USCG may also increase because of additional review and administration to issue siting, lease, chemical (drug, pesticide, and biologics), pollution discharge, and navigational permits.

Loss of Fishing Grounds
The development of offshore aquaculture will require the production facility to have access to the portion of the ocean where they operate. The exclusive use of an area means that the offshore aquaculture firms will compete for space in federal waters with other activities, such as recreational and commercial fishing. Conflicts between aquaculture firms and commercial or recreational fishers could arise if the aquaculture site is a desirable fishing area or if the site attracts fish (Section 6.1.5.1). Action 6 establishes siting criteria by which NOAA Fisheries Service will evaluate a proposed aquaculture site and Action 7 would establish a restricted access zone around a facility. To the extent practicable, historical and important fishing grounds will be taken into consideration when approving or disapproving a particular facilities location. However, in some instances the loss of fishing areas may be unavoidable given the numerous other siting criteria that will be considered by NOAA Fisheries Service and the ACOE.

While empirical evidence is sparse, available information suggests that loss of fishing areas may be very limited. As discussed in the Sustainable Marine Aquaculture Task Force report (2007), several offshore facilities are currently operating in Hawaii. These operations lease a total of 193 acres which equates to an average of 64 acres per operation. If future operations in the Gulf are of a similar size to those currently operating in Hawaii, one can conclude that the amount of open space occupied by these structures will be exceedingly small relative to the total available area; even with a large number of operations.

Localized Water Quality and Benthic Changes

Section 6.1.3 discusses the effects of effluents from marine aquaculture facilities. Although the effects of aquaculture operations in the deep water environment are significantly fewer than those near-shore, impacts still exist and are unavoidable. Impacts are primarily related to two factors: 1) Increased organic loading on the benthos, and 2) nutrient enrichment of the water column. The EPA regulates water quality through NPDES permits, while NOAA Fisheries Service has authority to protect and conserve EFH. Action 2 will require aquaculture applicants to abide by EPA feed management and water quality standards. Additionally, NOAA Fisheries Service will use siting criteria to avoid or minimize any adverse affects of aquaculture facilities on areas of critical and essential fish habitat. However, because aquaculture and in particular cage culture will involve feeding and maintaining fish in a contained area, localized small-scale impacts to water quality and benthos are unavoidable and mitigated to the extent possible.

Exclusive Use of a Public Resource

During public comment periods throughout the development of this FMP numerous constituents voiced concerns about providing aquaculture operations exclusionary use of public resources. Siting and permitting in this FMP will afford aquaculture operations the privilege to conduct aquaculture at a specified site in the Gulf EEZ. However, siting of a facility will be contingent on ACOE and NOAA Fisheries Service review. An operation would be provided use of a particular site for the duration of their permit, unless revoked before it expires or is renewed. Although an aquaculture operation may occupy both the water column and benthos at a particular site within the EEZ, the operation would not be provided ownership of the site, nor would they be leasing the site. With regard to biological resources, wild broodstock used for aquaculture would have to be accounted for when managing commercial quotas, TACs, and pending annual catch limits. The number or amount of fish used for aquaculture would be contingent on NOAA Fisheries Service approval, as specified in Action 8.

Fishing Communities

It is not well-known whether aquaculture will positively or negatively benefit fishing communities. Positive impacts could include a localized influx of business and increased jobs, while negative impacts could include increased price competition with wild-caught fish and loss of domestic fishing jobs. The severity and direction of the impact will to some extent depend on the species cultured, the degree of participation of the local fishing and seafood industry, and location of an aquaculture facility relative to a fishing community. Unavoidable adverse impacts to fishing communities will therefore occur if in fact aquaculture operations depress wild-caught fish prices and create competition for fishing-industry jobs.

As noted in the Sustainable Marine Aquaculture Task Force report (2007), "[a] large question looming as we begin to farm the sea is how will it transform coastal communities? Fitting into coastal communities will be a major challenge for the marine aquaculture industry as it expands into new areas and interacts with a variety of stakeholders. Coastal communities in many areas suitable for aquaculture have traditionally depended on fisheries and have, in recent decades, increasingly depended on tourism. The jobs and revenue that aquaculture brings have been welcomed in some coastal communities, including some hit hard by the decline in wild fisheries. Others, however, have rejected aquaculture development (p. 22)."[12] However, it is difficult to identify those communities along the Gulf coast which would "welcome" offshore aquaculture and which communities would oppose it without an in-depth social analysis of the individual communities and their perceptions regarding offshore aquaculture. As noted in the Sustainable Marine Aquaculture Task Force report (2007), one reason for opposition to aquaculture operations located in near shore waters is visual impact concerns. Given that net pens and cages are likely to be submerged and out of site of land, opposition due to aesthetic concerns may be relatively minor. The report also suggests that competition for space with other uses (e.g., recreational boating and fishing) has also generated opposition. Given the relatively limited amount of ocean space that will likely be required for even a sizeable number of these facilities, however, calls into question the amount of opposition that would likely to be forthcoming if an offshore aquaculture industry is developed.

6.17 Relationship Between Short-term Uses and Long-term Productivity

Developing a successful, environmentally sound aquaculture industry will allow optimum yield and long-term productivity to increase over time. Increasing the domestic supply of seafood will assist in alleviating the seafood import deficit while providing the U.S. with a safer, sustainable supply of seafood. Additionally, potential benefits of developing an aquaculture permit program over the long term could include decreased pressure on wild fish stocks and increased opportunities for employment in Gulf coast communities. Because an aquaculture industry currently does not exist in the Gulf, short-term uses will largely stem from the creation of profitable aquaculture operations. Initial financial investments for offshore aquaculture operations are often substantial and require many years before an operation is profitable and there is a return on one's investment. If an operation can succeed financially over the short-term, then the social and economic environments will benefit from the long-term productivity of sustainably-produced aquaculture products that comply with stringent federal environmental standards.

6.18 Irreversible and Irretrievable Commitments of Resources

Freeman (1992) defines irreversible commitments as "those that cannot be reversed, except perhaps in the long term." These would include such instances where ore was removed from a mine or a species went extinct. Irretrievable commitments are "those

12 In general, the discussion provided in the Sustainable Marine Aquaculure Task Force report (2007) is assumeed to relate observations of nearshore facilities (given the fact that there are few offshore facilities).

that are lost for a period of time" such as when the right-of-way of a road running through a forest is lost from timber production.

Alternatives and actions in this FMP are largely intended to prevent irreversible commitments. Measures include preventing non-native, genetically modified, and transgenic species from being used for aquaculture, inspection of cultured species for disease prior to stocking, case-by-case review of aquaculture systems and siting criteria, and various recordkeeping and reporting requirements. Irreversible commitments that could potentially result from aquaculture include habitat damage or degradation if aquaculture structures are damaged or destroyed during storm events. In the event of escapement, native, non-genetically modified cultured species are expected to prevent negative biological and ecological impacts to wild stocks. An irretrievable commitment resulting from aquaculture would be the temporary loss of fishing grounds where an aquaculture facility is sited Fishing grounds would be lost for the period of time the permit is issued. However, siting criteria will assist NOAA Fisheries Service in identifying sites that minimize losses of important fishing grounds and other habitat.

6.19 Any Other Disclosures

CEQ guidance on environmental consequences (40 CFR §1502.16) indicates the following elements should be considered for the scientific and analytic basis for comparisons of alternatives. These are:

a) Direct effects and their significance.
b) Indirect effects and their significance.
c) Possible conflicts between the proposed action and the objectives of federal, regional, state, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned.
d) The environmental effects of alternatives including the proposed action.
e) Energy requirements and conservation potential of various alternatives and mitigation measures.
f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.
g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.
h) Means to mitigate adverse environmental impacts.

Items a, b, d, e, f, and h are addressed in Sections 4, 5, and 6. The other elements are not applicable to the actions in this document. Because this FMP concerns the management of captive marine fish and invertebrate stocks, it is not in conflict with the objectives of federal, regional, state, or local land use plans, policies, and controls (Item f).

Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures (Item g) is not a factor in this FMP. The actions taken in this FMP will affect a marine stock and its fishery, and should not affect land-based, urban environments.

6.20 Evaluation of Significance Factors

NOAA's Administrative Order 216-6 (NAO 216-6) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality regulations at 40 C.F.R. 1508.27 contain criteria for determining the significance of the impacts of a proposed action. CEQ regulations state that the significance of an action should be analyzed both in terms of "context" and "intensity." The significance of this action was analyzed based on criteria contained in both CEQ regulations and NOAA's Administrative Order 216-6. Where relevant, specific sections pertaining to each factor are identified below. These sections provide a more thorough discussion of each significance factor.

1) *Can the proposed action be expected to have a substantial impact on biodiversity or ecosystem function within the affected area (e.g., benthic productivity, predator-prey relationships, etc.)?*

<u>Discussion</u>: Allowing the development of a marine aquaculture industry in the Gulf is not expected to impact biodiversity or ecosystem function. Aquaculture operations would be allowed to take only a limited amount of wild fish for use as broodstock. The amount taken would likely pale in comparison to recreational and commercial fisheries harvest, and therefore would have no or little effect on ecosystem function. Requiring only native, non-genetically modified species to be cultured would provide an environmental safeguard in the event of escapement. Non-indigenous species or genetically modified species have been shown to compete with wild stocks, thereby affecting ecosystem function and predator-prey relationships. Additionally, localized affects around a marine aquaculture facility may occur. Studies have shown changes in nutrients, benthic diversity, and predators immediately surrounding open ocean net pens and cages (Section 6.1). Although this may result in localized changes in biodiversity and predator-prey relationships, changes on a Gulf-wide scale are not expected to be significant.

2) *Can the proposed action be reasonably expected to have a substantial adverse impact on public health and safety?*

<u>Discussion</u>: Currently, the U.S. imports 80 percent or more of its seafood. Imports are largely from foreign countries with less restrictive environmental standards than the U.S. This FMP is expected to benefit public health by allowing the development of an environmentally sound aquaculture program in the Gulf. Specific actions related to aquaculture in this FMP intended to increase public health and safety include: prohibiting the use of genetically modified, transgenic, non-native species for aquaculture (Actions 2 and 4), inspection of diseased fish prior to stocking (Action 2), allowing only structurally sound and stable aquaculture systems (Action 5) for use, and case-by-case review of aquaculture facility sites (Action 6).

3) *Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas?*

Discussion: Section 5.0 describes the physical, biological, social, economic, and administrative environments affected by this action, including important fishery resources, critical habitat, threatened and endangered species, and Gulf fishing communities. Unique characteristics of the geographic area where an aquaculture facility will be sited will be evaluated on a case-by-case basis by NOAA Fisheries Service using various criteria identified in this FMP and by other federal agencies. One of the unique characteristics of the Gulf geographic area is the predominance of oil and gas platforms (~4,000) that could be used for infrastructure of offshore aquaculture operations.

4) *Are the effects on the quality of the human environment likely to be controversial?*

Discussion: Allowing the development of a regional aquaculture permitting system is controversial. National aquaculture legislation proposed in 2005 was scrutinized in part because of concerns about adequate environmental safeguards. Commercial fishermen have expressed concerns that aquaculture products will increase competition and potentially reduce their profits. Concerns have also been expressed about impacts to water quality, the loss of fishing grounds, and habitat degradation.

5) *Are the effects on the human environment likely to be uncertain or involve unique or unknown risks?*

Discussion: Sections 6, 7, and 8 discuss the possible effects of aquaculture on the human environment. To date, most offshore aquaculture operations have been small-scale research or commercial pilot projects primarily occurring in state waters. Although effects on the human environment are well-known for projects of this magnitude, the effects of potentially permitting numerous large scale operations are less known. In many places in this FMP/PDEIS, the authors have acknowledged whether or not the possible effects of this action on the human environment are known. One benefit of this FMP is that it will require recordkeeping and reporting requirements that will allow for the possible effects of this action to be better understood in the future. Because many effects are not well understood, the Council has elected to choose alternatives which mitigate these potential negative effects on the human environment (Section 6.14).

6) *Is the proposed action likely to establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration?*

Discussion: The proposed action would set a precedent if implemented before national legislation is approved by Congress. The U.S. has had a policy on marine aquaculture since 1980, but a sustainable, economically viable aquaculture industry in the U.S. has yet to develop. This action, if implemented, would become the first federal permitting program (excluding EFPs) for offshore marine aquaculture. In doing so, the actions and preferred alternatives in this FMP would set the first standards for regulating aquaculture in federal waters and protecting the marine environment from any potential adverse effects.

7) *Are the proposed actions related to other actions with individually insignificant but cumulatively significant impacts.*

Discussion: The cumulative effects analysis (Section 6.15) provides a detailed description of the relationship of this action with past, present, and reasonably foreseeable future actions. This action is not related to any other actions that are individually insignificant but with cumulatively significant impacts.

8) *Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historical Places or cause loss or destruction of significant scientific, cultural, or historical resources.*

Discussion: The proposed actions are not expected to impact historic or cultural resources. Management measures proposed in this FMP, such as case-by-case review of aquaculture systems (Action 5) and siting criteria (Action 6), are intended to prevent loss or destruction of resources. Archeological sites, historical sites, and known wrecks would be avoided when a facility is sited by the ACOE and NOAA Fisheries Service.

9) *Can the proposed action reasonably be expected to adversely affect an endangered or threatened species, marine mammals, or critical habitat of these species?*

Discussion: Sections 5.2.3.3 and 6.1.4 discuss the potential adverse impacts on endangered and threatened species. The proposed action will alter the manner in which the fishery operates. Wild fish are primarily caught by hook-and-line or longlines, although spears and nets can be used for some species. The deployment of aquaculture systems will represent a new type of gear used in the Gulf. Additionally, aquaculture operations may be proposed in migration pathways or areas of important habitat for threatened or endangered species. NOAA Fisheries Service will prohibit the siting of operations in specific areas of the Gulf (Action 6). NOAA Fisheries Service will also conduct case-by-case reviews of proposed aquaculture sites. These reviews will involve consultations with NOAA programs and offices, such as the Protected Resources Division. This helps ensure that adverse impacts to endangered or threatened species, marine mammals, or critical habitat do not occur, or are mitigated to the extent practicable.

10) *Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?*

Discussion: Applicable laws for the proposed action are summarized in Section 10.0. This action is consistent within the requirements of the MSFCMA and will modify federal regulations. This action does not duplicate or threaten a violation of other federal, state or local laws. Several federal agencies have jurisdiction to regulate activities associated with aquaculture, including the EPA, ACOE, MMS, and USCG. This FMP proposes no action that would supersede or duplicate the regulations of these agencies. Additionally, each Gulf state has authority to regulate aquaculture within territorial waters (inshore of 3 geographic miles off Alabama, Mississippi, and Louisiana; inshore of 3 marine leagues off Florida and Texas). State, local, and federal regulations may differ, but those differences and the requirements in this action would not threaten the protection of the environment based on the actions proposed in this FMP.

11) Can the proposed action reasonably be expected to jeopardize the sustainability of any target species that may be affected by the action?

Discussion: The proposed action is not expected to jeopardize the sustainability of any target species. Limited quantities of wild fish will be taken for use as broodstock. All species used for marine aquaculture will have to be native to the Gulf and cannot be genetically modified (Actions 2 and 4). Non-indigenous species would be prohibited from being cultured. This will prevent competition for food and habitat between wild fish and non-indigenous fish in the event that cultured fish escape. Stocked fish would also have to be inspected and certified as disease free before stocking in allowable aquaculture systems.

12) Can the proposed action reasonably be expected to jeopardize the sustainability of non-target stocks?

Discussion: The proposed action is not expected to jeopardize the sustainability of non-target species. Limited quantities of wild fish will be caught as broodstock. While harvesting broodstock, small amounts of non-target species may be caught as bycatch, but the number of fish discarded would be small and comparable to a recreational or commercial fishing trip. The use of cages, net pens, or other grow-out systems may increase entanglement of fishes, marine mammals, protected species, and other non-target species. The NOAA Fisheries Service Protected Resources Division would be consulted during the review of proposed marine aquaculture systems and no systems would be improved if they are determined to jeopardize the sustainability of non-target species. Additionally, larvae, eggs, and small prey may be consumed by fish residing in net pens or cages. However, impacts are expected to be small given that natural mortality is high during the egg and larval stage for most marine species. Increased nutrient loading and water quality changes could impact habitat surrounding an aquaculture facility, but impacts are typically localized (Section 6.1) and siting criteria would be used to avoid or minimize any adverse effects on essential fish habitat. Non-target prey species, such as menhaden, would be harvested and used for fish meal. The proposed action is not expected to jeopardize the sustainability of prey stocks given that they are periodically assesses by NOAA Fisheries Service and managed by states and interstate compacts.

13) *Can the proposed actions reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the M-SFCMA, and identified in FMPs.*

Discussion: No, the proposed actions are not expected to significantly damage or impact habitat. The physical environment affected by actions in this FMP is described in Section 5 and impacts to the physical environment are discussed in Section 6 and Actions 5 and 6. The Council's preferred alternative in Action 6 would require NOAA Fisheries Service to review a proposed marine aquaculture facility site on a case-by-case basis. Aquaculture operations would also be prohibited in specific areas, such as marine reserves, artificial reef zones, SMZs, MPAs, HAPCs, and coral areas (Action 6). Additional criteria may also be required by other federal agencies. These criteria are intended to prevent, or minimize to the extent practicable, impact to EFH and bottom habitat in general.

14) *Are significant social and economic impacts interrelated with natural and environmental effects?*

Discussion: Section 6.1 describes the potential biological impacts that may result from this action. Measures proposed in this FMP are intended to prevent or mitigate such impacts (Section 6.14), although some unavoidable adverse impacts may occur (Section 6.16). To the degree that the proposed measures prevent or mitigate environmental impacts, no significant social and economic impacts are expected to occur in relation to natural and environmental effects. Social and economic impacts are likely to be related to potential increased economic competition and public opposition to aquaculture by some stakeholders.

15) *Is the proposed action reasonably expected to result in the introduction or spread of non-indigenous species?*

Discussion: No, the Council's preferred alternatives in Actions 2 and 4 would prohibit the use of non-native, genetically modified, transgenic species for aquaculture. Only Council managed reef fishes, spiny lobster, stone crab, coastal migratory pelagics, and red drum would be allowed for aquaculture. The Council would also send a letter to NOAA Fisheries Service's HMS Division requesting concurrent rulemaking.

16) *Will the proposed action result in cumulative adverse effects that could have a substantial affect on the target or non-target species.*

Discussion: The cumulative effects of the proposed action are described in detail in Section 6.15. Significance factors 2 and 3 above describe expected impacts on target and non-target species. Cumulatively, allowing the development of an offshore aquaculture industry is not expected to adversely affect target and non-target species, although impacts to the environment may occur as described in Section 6.1. For both target and non-target stocks, numerous actions throughout this FMP are intended to mitigate or prevent negative environmental consequences. These include: prohibiting non-indigenous species and genetically modified species from being used for aquaculture, requiring extensive permitting, recordkeeping, and reporting requirements, and evaluating marine aquaculture systems and sites on a case-by-case basis.

6.21 Environmental Justice (E.O. 12898)

Federal agencies are required to conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, national origin, or income level. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence.

Section 5.4.3 describes five fishing communities along the Gulf coast. These communities were identified as key communities involved in the fishing industry based on fishing permit and employment data. The demographic information reported for these communities were derived from census data. Census data describes community-wide demographics and cannot be partitioned into just those populations that rely on federally managed Gulf fisheries. A key reason for this is the census data combines fishing occupations with farming and forestry occupations under the occupation category, and with agriculture, forestry, and hunting under the industry category. For this reason, demographic information on fishing communities is not available for use in evaluating the effects of the proposed actions on low-income and minority populations. Nevertheless, although demographics of these fishing communities are unknown, these actions would apply to all participants in the fishery, regardless of their race, color, national origin, or income level and, as a result are not considered discriminatory. The current demographic make-up of the respective fishing communities is assumed to be the result of historic cultural and economic conditions and not the result of specific historic or current management action that favored or discriminated against minority or low-income participants. Therefore, no environmental justice issues are anticipated and no modifications to any proposed actions have been made to address environmental justice issues. Additionally, none of the proposed actions are expected to affect any existing subsistence consumption patterns or raise any issues.

7.0 Regulatory Impact Review (RIR)

7.1 Introduction

The NMFS requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a regulatory action; (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives which could be used to solve the problem; and (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost effective way.

The RIR also serves as the basis for determining whether any proposed regulations are a "significant regulatory action" under certain criteria provided in Executive Order 12866 (E.O. 12866) and whether the approved regulations will have a "significant economic impact on a substantial number of small business entities" in compliance with the Regulatory Flexibility Act of 1980 (RFA).

7.2 Problems and Objectives

The purpose and need, issues, problems, and objectives of the proposed Amendment are presented in Section 1.2 and are incorporated herein by reference.

7.3 Methodology and Framework for Analysis

This RIR assesses management measures from the standpoint of determining the resulting changes in costs and benefits to society.

To the extent practicable, the net effects of the proposed measures for an existing fishery should be stated in terms of producer and consumer surplus, changes in profits, and employment in the direct and support industries. However, there is not and never has there been a Gulf offshore aquaculture fishery and there is substantial uncertainty regarding the economic impact of a future Gulf offshore aquaculture fishery on existing Gulf fisheries and on-land aquaculture producers and near shore aquaculture fisheries. However, where figures are available, they are incorporated into the analysis of the economic impacts of the different actions and alternatives.

7.4 Description of the Gulf Aquaculture Fishery

The relevant fisheries are described in Section 5.3, and are incorporated herein by reference.

7.5 Economic Impacts of Management Alternatives

Details of the economic impacts of all alternatives are included in Section 6 and are included herein by reference. The following discussion includes only the expected impacts of the preferred alternatives.

7.5.1 Action 1: Aquaculture Permit Requirements, Eligibility, and Transferability

Preferred Alternative 2: Require a NOAA Services Gulf of Mexico aquaculture permit to authorize a person to:

- **Deploy or operate an offshore aquaculture facility in the Gulf of Mexico EEZ. An offshore aquaculture facility means an installation or structure, including any allowable aquaculture systems (including moorings), hatcheries, equipment, and associated infrastructure used to hold, propagate, and rear allowable aquaculture species in the Gulf of Mexico EEZ under authority of a Gulf Aquaculture Permit; and,**
- **Sell, only at the first point of sale, or attempt to sell an allowable aquaculture species cultured at an offshore aquaculture facility in the Gulf of Mexico EEZ.**

Persons issued a Gulf Aquaculture Permit for the activities authorized above would also be authorized to:

- **Harvest or designate hatchery personnel or other entities to harvest and retain onboard a vessel wild live broodstock of an allowable aquaculture species native to the Gulf of Mexico for offshore aquaculture, regardless of where broodstock were harvested or possessed in U.S. waters of the Gulf of Mexico. Offshore aquaculture means all activities, including the operation of an offshore aquaculture facility, involved in the propagation and rearing of allowable aquaculture species in the Gulf EEZ. (Note: additional requirements for harvesting broodstock are specified in Action 8, Preferred Alternative 2(n)).**
- **Possess or transport fish or invertebrates in or from the Gulf EEZ to be cultured at an aquaculture facility (e.g., broodstock, fingerlings) or possess or transport fish or invertebrates from an aquaculture facility for landing ashore and sale.**

Require a Gulf aquaculture dealer permit to receive cultured organisms from the Gulf of Mexico EEZ. However, an owner or operator of an aquaculture facility with a Gulf Aquaculture Permit may purchase juvenile fish from a hatchery located in the Gulf EEZ without obtaining a dealer permit. Requirements for obtaining a dealer permit are specified in 50 CFR 622.4(a)(4)(iii) and 50 CFR 622.4(b). (Reporting requirements are specified in Table 4.1.2)

Landing of allowable aquaculture species cultured in the Gulf of Mexico EEZ is prohibited at non-U.S. ports, unless first landed at a U.S. port.

In addition, require any vessel, aircraft, or vehicle authorized for use in aquaculture operations have a copy of the Gulf Aquaculture Permit onboard. Each copied permit must include an original signature of the Gulf Aquaculture Permit holder.

Eligibility for a Gulf of Mexico aquaculture permit is limited to U.S. citizens or permanent resident aliens.

A Gulf of Mexico aquaculture permit is:
(a) transferable (Preferred);
(b) not transferable.

Action 1 would create an offshore aquaculture permit that would authorize a U.S. citizen or permanent resident alien to place cages, pens, platforms, and other structures in waters of the Gulf EEZ; sell products cultured in the Gulf EEZ; harvest wild broodstock and aquaculture of species native to the Gulf of Mexico; propagate and rear species; and possess and transport young fish (or shellfish) to and market-size fish or shellfish from the Gulf EEZ. While Action 1 would simply establish the permit that would enable the development of offshore aquaculture in the Gulf EEZ, the development of the industry would be expected to potentially lead to a variety of direct and indirect economic effects. These effects are discussed in the following paragraphs.

As discussed in the previous section, the U.S. has a seafood trade deficit that is expected to increase. Aside from remedies such as tariffs to reduce exports or policies that encourage consumers to reduce spending on imported seafood, increasing domestic production can reduce and potentially eliminate the deficit, and technological change can increase production possibilities. Aquaculture — on-land, nearshore and offshore — is such a technological change. As described in Section 5.3, commercial aquaculture of fish and shellfish has been proven to expand countries' levels of seafood production significantly beyond their historical levels of wild-caught production. For example, cobia and Almaco jack are successfully cultured in the U.S., and their culture is expanding the country's production of edible fishery products and exported products. Also, for example, tilapia is being commercially produced in recirculating tanks in places, such as Midwestern farms, that a decade ago would have been considered unthinkable.

Aquaculture has three competitive advantages over wild-caught fishing. First, it can produce volumes of fish that are not biologically or economically possible or sustainable in U.S. wild-caught fisheries. Examples are the planned production by Virginia Cobia Farms of one million pounds of cobia in 2009, with expansion in time to 5 million and ultimately 100 million pounds (Section 5.3.4.1), and Australis Aquaculture's production of barramundi in Massachusetts (www.thebetterfish.com). Second, aquaculture is not limited by season, so it can provide consistent supply throughout the year (Rubino 2008). Third, because the aquaculture operation controls what the growing fish eat, product quality can be improved to avoid ciguatera poisoning and high levels of methyl mercury or other contaminants that may be found in wild-caught fish. For example, Kona Blue states on its website (www.kona-blue.com/ourfish.php) that its kampachi has no detectable traces of mercury or polychlorinated biphenyls (PCBs).

A representative of an existing commercial offshore aquaculture operation is Kona Blue, which produces Almaco jack, a species native to the Gulf and would be allowed for aquaculture by this alternative. According to the September 10, 2007, Draft Supplemental Environmental Impact Assessment for an Expanded Production Capacity and Extended Farm Lease for Kona Blue's Offshore Open Ocean Fish Farm Project off Unualoha Point, Kona, Hawaii, at that time the company was producing approximately 13,000 pounds per week (677,857 pounds annually), and employing 49 professional and semi-professional employees. The company has planned to expand and increase production of its Kona Kampachi by deploying 8 net pens, each 6,200 cubic meters in volume, and increasing the number of employees to 59. Each net pen would be able to produce 1,489 tonnes (about 14.9 million pounds) of fish each year and combined the company would produce 11,912 tonnes (about 26.3 million pounds) annually. For comparative purposes, from 1997 through 2007, annual U.S. commercial landings of wild-caught Almaco jack never exceeded 187,000 pounds and in the Gulf averaged only 53,000 pounds annually. In 2007, Kona Blue produced more than ten times the average annual Gulf production of Almaco jack, and its expanded operation could produce about 495 times the average annual landings of Almaco jack in the Gulf from 1997 through 2007.

Although the operation profile of Kona Blue may be unique to the conditions under which that company operates, which would include management, location, species cultured, and operating environment, among other things, the production characteristics provided above can be used to illustrate the aquaculture production potential in the Gulf that might be accommodated by this action. With the exception of the estimate of number of operations expected to emerge within the first 10 years of this action, the following example assumes only the implementation of this action and not any other actions in this proposed FMP that might constrain the aquaculture industry. The relevance of this will be noted where appropriate. It is currently assumed that 5 to 20 offshore aquaculture operations could emerge in the Gulf EEZ within the first 10 years of this proposed FMP. Assuming no restrictions on individual firm or total industry production (Section 6.10 for a discussion of the potential production caps that may be established under Action 9), each of these operations could be projected to employ up to 59 professional and semi-professional staff and produce up to 26.3 million pounds annually. Collectively, all operations would have 295 to 1,180 employees, pay salaries and benefits of from $17.5 million to $74 million ($3.7 million per operation; average salary and benefits estimates derived from the Kona Blue assessment), and produce from 131 million to 525 million pounds of product per year. Assuming an average price of fresh product of $4.00 per pound, one operation would generate annual revenues of approximately $105 million, and the 5 to 20 operations combined would generate product valued from $0.5 billion to $2.1 billion annually. Caveats to these totals would include, among other potential factors, potential production caps imposed by Council action, price effects of increased cultured product supply, and the effects of culturing different species with different production profiles. Nevertheless, despite these caveats, an increase in domestic production of seafood as a result of offshore aquaculture production would be expected to provide local enterprise and job opportunities, including opportunities for commercial fishermen and the seafood industry, as well as reduce the seafood trade deficit and increase national income and welfare.

Commercial offshore aquaculture's contribution to the increase in the volume of seafood would also be expected to create an increase in the scale and/or number of entities that buy seafood at the first point of sale. This in turn would generate additional employment in and income from the wholesale seafood, seafood processing, and retail seafood industries.

To produce about 1,500 tons per net pen, as in the Kona Blue example, it is estimated that 3,300 tons (approximately 7.25 million pounds) of feed would be required, which for 8 net pens combines to 26,400 tons (approximately 59.2 million pounds) of feed, annually. The combined 5 to 20 Gulf offshore aquaculture operations would require from 291 million to 1,164 million pounds of feed, annually. At an estimated price of $1,500 per ton ($0.68 per pound), the combined 5 to 20 operations would purchase from $198 million to $792 million of feed, annually. Hence, Gulf offshore aquaculture operations would be expected to increase demand for fish feed and other aquaculture-supporting products and services, which in turn would be expected to generate additional increases in employment and revenues and income from these industries. It should be noted that this discussion assumes the required feed, particularly that of marine origin, such as menhaden, is available and harvested from sustainably managed domestic and/or international fisheries. Thus, it is presumed that the increased demand for feed will not induce overfishing or other adverse conditions for wild stocks, with associated adverse economic effects. Management of these stocks, however, is outside the scope of this proposed FMP.

A common concern with the development of aquaculture is the competition of cultured product with wild product harvested by local fishermen. If offshore aquaculture operations sell their products to dealers who also buy from fishermen, offshore aquaculture may be in direct competition with fishermen. A fundamental concept of neoclassical economic theory is that an increase in the number of producers causes an increase in supply, and an increase in supply typically causes a decrease in the market price, *ceteris paribus*. Consequently, the price received by Gulf and other fishermen could fall and fall dramatically, depending upon the increase in supply caused by offshore aquaculture. That in turn would reduce fishermen's revenues from sales of those species, *ceteris paribus*.

Actual competition would be expected to be dependent upon the species cultured, the markets targeted by offshore aquaculture operations, and the season of production and harvest. While species differentiation exists, with some individual species or species groupings having greater name recognition than others, and different species groupings having different flavor and/or texture characteristics, (for example tuna, salmon, mackerel, and general white fish are likely easily recognized as distinct groupings) at a certain level all fish species have the capacity to be consumption substitutes, with associated market effects, for any other fish species. Similarly, meat in general is a substitute for seafood and vice versa as protein sources in our diet. Nevertheless, the competitive pressure of a particular offshore cultured product on the market price of a wild-harvested and/or presently cultured species will be influenced by the extent to which the product is a substitute for the wild-harvested and/or presently cultured species. The competitive pressure would be expected to be the greatest if both were the same species, marketed at the same time to or through the same market channels/outlets, and marketed in the same product form, and decline the more dissimilar these considerations are. Although the production example above was based on Almaco jack, the two species expected to be the most likely candidates for offshore culturing in the Gulf are red drum and cobia, both species that do not have significant commercial fisheries. The EEZ, in both the Gulf and South Atlantic, is closed to the commercial harvest of red drum, and only limited commercial harvest is allowed in state waters. Similarly, while commercial harvest of cobia in the EEZ is allowed, cobia harvests are not significant, with U.S. annual commercial landings from 1987 through 2007 ranging from a high of 429,378 pounds in 1996 to a low of 165,682 pounds in 2005 (NOAA Fisheries Service, Accumulated Landings System). In just the Gulf, annual landings ranged from a high of 263,969 pounds in 1996 to a low of 86,447 pounds in 2007, and have exhibited an overall declining trend since 1997. Therefore, offshore aquaculture operations that produce these two species would not be expected to directly compete against fishermen; however, they would be expected to directly compete with onland and nearshore aquaculture producers of these same species. To the extent that competition occurs, it can be reduced through selection of market outlet. Offshore aquaculture operations can reduce competition between themselves and fishermen by not selling to the same dealers that buy wild-caught fish, instead selling directly to restaurants and other establishments. Competition can be further reduced by selling cultured product during the off season for wild harvests, increasing market demand for the species in particular and for seafood in general, or developing and marketing different product forms.

It should also be noted that the potential for ex-vessel price to fall because of offshore aquaculture is, should there be direct competition, also dependent upon other factors. For example, if dealers' demand for fish and shellfish increases, the increase in demand could cause the ex-vessel price paid to fishermen to remain constant or increase despite the increase in supply caused by offshore aquaculture (see Knapp 2008b for discussion that marketing of aquaculture can increase consumer demand). Similarly, price competition exists from supplies other than from offshore aquaculture. On-land and/or nearshore aquaculture production could develop where it otherwise does not currently exist, or increase where it has already begun, thereby increasing supply and causing the price received by both fishermen and aquaculture operations to fall. Similarly, foreign producers of seafood have the potential to flood the U.S. market with low priced products, adversely affecting both domestic fishermen and aquaculture producers. Nonetheless, regardless of the sources of increased supply, a potential economic cost of the development of offshore aquaculture is declines in the ex-vessel prices of commercial species and losses of fishing and fishing-related revenues, incomes, employment and businesses.

In addition to potential price effects, if any of the cultured species have domestic fisheries that are managed under an IFQ program, the values of IFQ shares, and the value of the overall IFQ program, would decline with any fall in the ex-vessel price of wild-harvested fish, as would the resale value of fishing gears and vessels that target those species. As with non-IFQ fisheries, such adverse economic impacts, should they develop, would be expected to result in an increase in fishermen going out of business, which would further reduce historical fishing community incomes and employment derived from supporting wild-caught fisheries.

In addition to the potential effects thus far discussed, another potential effect of the development of offshore aquaculture is related to market power. If offshore aquaculture operations compete directly with fishermen, their competitive advantage of higher quantity and quality and consistent supply could result in long-term contractual arrangements and/or vertical integration with dealers, dominant market shares, and anticompetitive behaviors such that fishermen are unable to sell some or all of their landings to these dealers or are offered a substantially lower price. This would reduce fishing and fishing-related revenues, income and employment and corresponding economic opportunities, which would adversely affect fishermen, their families, and fishing communities.

If direct competition results in losses of employment and revenues to those presently in the marine fishing industry, it can been argued that former fishermen could work for the offshore aquaculture operators by tending the container systems, transporting fish and equipment to and from the offshore site, or performing other aquaculture work. As a result, it is possible that alternative employment opportunities could mitigate some to all of the economic losses to these fishermen, their families and communities.

It is reasonable to expect that offshore aquaculture operations would generate negative externalities; however, the magnitude of these externalities would be dependent upon additional regulatory actions, if any, that would restrict offshore aquaculture operations in order to protect both the human and biological environment. Action 1 would not restrict Gulf offshore aquaculture, with the exception of limiting allowable aquaculture species to those native to the Gulf. Hence, without additional restrictions, offshore aquaculture firms could produce genetically modified or transgenic species (if authorized by the FDA), abandon equipment, introduce disease to wild stocks, and engage in other environmentally damaging activities that are not regulated by other federal agencies. The resulting economic to fishermen, their families and communities could be beyond measure if native stocks, livelihoods, and fishing communities were permanently lost and essential habitats destroyed. Additional actions to prevent or reduce the likelihood or severity of these externalities are included in this proposed FMP and are discussed in subsequent sections. However, even if additional actions are designed to reduce the economic magnitude of negative externalities, negative externalities are unlikely to be totally avoided and would be created by offshore aquaculture production.

Action 1 would not restrict the duration of time when or the location where an offshore aquaculture can operate, though both considerations are addressed by subsequent actions in this proposed FMP. Without such restriction, an offshore aquaculture operation could place cages, pens and platforms anywhere it wanted in the Gulf EEZ and occupy an area or areas of the EEZ indefinitely, thereby enclosing that area and precluding all other activities. This would create the possibility that offshore aquaculture operations could site themselves in historical fishing areas, which would displace fishermen from use of some or all of those areas and cause economic losses of some or all landings, incomes and employment, which could be economically upsetting to fishermen, their families and fishing communities.

There are potential benefits and other costs of legal enclosure of areas of the EEZ, depending upon one's point of view. First, it can be argued that giving offshore aquaculture operations "like-ownership" of an area of the EEZ is beneficial because it is consistent with the goal of creating an "ownership society" (http://www.whitehouse.gov/news/releases/2004/08/20040809-9.html) and the neoclassical economic belief that common-property ownership of a natural resource is not environmentally or economically sustainable and private-property ownership is necessary for natural resource conservation (Gordon 1954, Scott 1955, Hardin 1968, Shamshak and Anderson 2008). However, ethnographical and other research in sociology, anthropology, and psychology has shown common ownership of a natural resource can be sustainable and private ownership can destroy a natural resource (Cass and Edney 1978; Acheson 1979, 1981; McCay and Acheson 1987; Ostrom 1990; Kollock 1998). Under this perspective, an offshore aquaculture permit that would enclose areas of the EEZ would have socio-economic costs because it would privatize what was common wealth, transferring wealth from the public to private offshore aquaculture interests.

Action 1 would restrict eligibility for a Gulf Aquaculture Permit to U.S. citizens or permanent resident aliens and prohibit the landing of cultured product in non-U.S. ports. This eligibility restriction is consistent with those under IFQ programs. The economic benefit of this restriction is that it is consistent with the economic values of the Americanization of the EEZ. The effect of the prohibition against foreign landing is that it precludes an entity from landing cultured product in a foreign country, then exporting it to the U.S. In other words, without this prohibition, the U.S. could import seafood that was produced by offshore aquaculture in the Gulf. The net effect of this requirement is unknown. Landing at a foreign port could be desired by offshore aquaculture operations to take advantage of lower processing costs or, potentially, to land the product closer to its intended market. Subsequent import of this product may still be possible at an advantageous producer and U.S. consumer price; however, that would increase, not decrease, the seafood trade deficit. A required first landing at a U.S. port simply ensures that the economic activity associated with the initial landing remains in the U.S. (product could still be landed in the U.S., exported for processing, then imported for consumption at a viable consumer price). Whether the U.S. landing requirement results in a net economic gain to the U.S. would be dependent upon the specific circumstances of the species produced and associated consumer and labor markets, and cannot be predicted.

Under this action, an aquaculture permit would be transferrable. A transferable permit would generate a direct economic benefit to owners of the permit because the permit would become a marketable asset for the duration of the permit. According to neoclassical economic theory, owners of a privately owned productive asset have the incentive to preserve or increase the value of that asset. Thus, it follows that Gulf offshore aquaculture operations would act to preserve the economic value of the permit by engaging in practices that would not damage the long-term production capacity allowed by the permit. Also, it is theorized that transferable permits encourage economically efficient producers to acquire existing and inefficient operations, which would increase production of the Gulf offshore aquaculture fishery. By taking ownership of an existing permit, an efficient producer would not have to apply for a new permit and incur the time and costs to do so. Moreover, the economically efficient producer could begin operations at the newly acquired facility immediately after it purchased the permit and, hence, reduce start-up time and associated costs.

Although Action 1 would allow transfer of the aquaculture permit, the site of the aquaculture operation would have to remain fixed. Requiring that the operation site remain fixed would be expected to eliminate potential problems associated with inappropriate site location or potential strategic behavior by entities with current site locations for other activities. A specific example is oil and gas platforms. If oil and gas platforms are allowed to serve as aquaculture sites, permit transferability with site change might provide an opportunity for owners of these sites to delay or totally avoid the costs of currently required dismantling after extraction activities cease. While such delay would increase the wealth to the platform owners by avoiding the platform dismantling costs, the presumed environmental and other associated economic benefits to society of platform removal would be delayed or potentially never realized.

In summary, the previous paragraphs illustrate some of the potential benefits and costs that could be associated with the development of an offshore aquaculture industry in the Gulf EEZ. Although scenarios can be hypothesized, based on specific assumptions, that alternatively demonstrate clear incremental or net benefits and costs, at the individual, local, regional, and national level, such scenarios, while potentially illustrative "what if's", would be purely speculative. USDOC (2008b) provides discussion of the potential effects of offshore aquaculture. While it is logically inarguable that the development of offshore aquaculture would result in all costs and no benefits, or the converse, the extent to which any benefits or costs develop depends on the overall structure of the system, the checks and balances established, and the flexibility of the system to recognize and respond to adverse developments. In essence, the goal of this proposed FMP is to create an operating environment that best enables the realization of the benefits while minimizing the costs. Action 1 would allow the development of an offshore aquaculture industry in the EEZ, with associated potential costs and benefits, by establishing a necessary permitting system. The permitting system would not in itself, however, satisfy all the structural, procedural, or administrative management needs of the aquaculture system and, thus, would not significantly control (other than from the perspective of a conclusion that no industry could develop without a central permitting system) the actual occurrence or development of any specific benefit or cost. The occurrence of these effects would depend on the full suite of actions implemented under the proposed FMP, as well as the implementation of the plan over time in reaction to developments internal and external to the fishery. Nevertheless, again, to reiterate, Action 1 would simply enable the development of an offshore aquaculture industry in the Gulf EEZ by establishing a necessary permitting system. In addition to the consideration of the potential costs and benefits of an offshore aquaculture industry discussed thus far, the establishment of a permitting system imposes certain operational costs which are the subject of the following paragraphs in this section.

Under this action, two types of permits would be required, an aquaculture permit and a dealer permit. Although permit application costs exist for other current Gulf federal permits, an application cost and estimated time of preparation for the aquaculture permit application is unknown at this time (see Action 2 for discussion of the alternative application requirements). A permit cost is determined by the time required for review and processing of the application. Due to the potential amount of information required for the permit application (Action 2), and the associated review time, the permit cost could be in the thousands of dollars. An actual cost has not yet been determined. However, even if the cost were thirty, forty, or fifty times the cost of other Gulf permits, the permit cost would be expected to be minor relative to the overall expenditures required to prepare a business plan and establish a viable aquaculture business.

At present, an annual dealer permit (OMB No. 0648-0205) is required to receive the following species harvested in the Gulf EEZ: reef fish, sharks and swordfish. All applications must include a payment of a non-refundable application fee of $50.00 for the first fishery and $12.50 for each additional fishery requested on the application. It is estimated that the time required to complete the average application for an annual dealer permit is 20 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and reviewing the collection of information (page 4 of Federal Permit Application for an Annual Dealer Permit). Presently, certain fisheries have mandatory reporting requirements. Under Action 1, anyone who purchases cultured organisms from the Gulf EEZ would be required to have a Gulf aquaculture dealer permit. The annual cost of this requirement would be $12.50, if the buyer already has an annual dealer permit, and $50, if not.

7.5.2 Action 2: Application Requirements, Operational Requirements, and Restrictions

Preferred Alternative 3 establishes application requirements, operational requirements, and restrictions (Section 4.2 for a list of these requirements) for Gulf Aquaculture Permits.

Action 2 would establish specific application requirements and operational requirements and restrictions. Overall, these requirements and restrictions are expected to reduce the magnitude of negative externalities and associated economic costs that would be produced by an unrestricted offshore aquaculture industry. For example, the application requirements would prohibit the use and processing of genetically modified or transgenic organisms and requires posting of an assurance bond sufficient to cover the costs of removal of all components of the aquaculture facility. Also, for example, the operational requirements and restrictions would mandate inspection of animals and certification that they are free of reportable pathogens prior to stocking in an offshore aquaculture container system, establish feed monitoring practices, and reduce the set of drugs, pesticides and biologics that can be used.

7.5.3 Action 3: Duration of the Permit

Preferred Alternative 2b: Aquaculture permits are effective for:
- 10 years and may be renewed in 5 year increments

A Gulf Aquaculture Permit remains valid for the period indicated on the permit unless it is revoked, suspended, or modified pursuant to subpart D of 15 CFR part 904 for non-compliance with applicable aquaculture regulatory requirements or the aquaculture facility is sold and the permit has not been transferred.

Action 3 would make the aquaculture permit effective for 10 years with renewal opportunity in 5-year increments. Renewal requirements have not been specified. Hence, renewal could be automatic, which would allow the permit to be effective indefinitely. Conversely, there may be renewal requirements that effectively limit the ultimate life of a permit. Regardless of the renewal requirements, this action would require the periodic time and costs associated with permit renewal.

The cessation of aquaculture operations when their permits expire and are not renewed would open the aquaculture sites to alternative uses. This would include access to normal fishing activities, and the associated economic benefits, that might have existed prior to the use of the site as an aquaculture site.

7.5.4 Action 4: Species Allowed for Aquaculture and Included in the Aquaculture Fishery Management Unit

Preferred Alternative 4: Allow the aquaculture of all species native to the Gulf of Mexico that are managed by the Council and included in a Council FMP management unit, except those species in the shrimp and coral FMP management units, and include these species in the Aquaculture Fishery Management Unit. The Council will send a letter to NOAA Fisheries Service requesting development of concurrent rulemaking to allow aquaculture of highly migratory species.

This action would limit the number of native species allowed for aquaculture and hatchery operations in the Gulf EEZ in order to reduce the magnitude and range of negative externalities and associated economic costs that can be produced by the introduction of cultured species to the marine environment. Gulf fishermen could experience commercial damages if offshore aquaculture operations directly compete with them by producing the same or substitute species.

7.5.5 Action 5: Allowable Marine Aquaculture Systems

Preferred Alternative 3: The NOAA Fisheries Service RA will evaluate each proposed aquaculture system on a case-by-case basis and approve or deny use of the proposed system for offshore marine aquaculture in the Gulf EEZ. To assist the RA in evaluating the structural integrity of a proposed aquaculture system, an applicant would be required to submit to the RA documentation (e.g., engineering analyses, computer and physical oceanographic model results) sufficient to evaluate the ability of the aquaculture system(s) (including moorings) to withstand physical stresses associated with major storm events, e.g. hurricanes, storm surge. The NOAA Fisheries Service RA will also evaluate the proposed aquaculture system and its operations based on potential risks to essential fish habitat, endangered or threatened marine species, marine mammals, wild fish or invertebrate stocks, public health, or safety. The RA may deny use of a proposed aquaculture system or specify conditions for using an aquaculture system based on a determination of such significant risks. The RA's evaluation will be based on information provided by the applicant as well as consultations with NOAA Fisheries Service and NOAA offices/programs. If the RA denies use of a proposed aquaculture system or specifies conditions for its use, the RA shall provide the determination and the basis for it, in writing to the applicant.

Action 5 identifies the process and criteria that would be used to determine whether a specific system should be approved or not and has the potential flexibility to allow the use of a system that best or better meets the operation's production goals, while addressing the need to reduce potential negative externalities and associated economic costs associated with the introduction of aquaculture systems into the marine environment. Examples of these externalities are the damages caused by systems that are inadequate to withstand adverse weather and risks to protected species, habitat, property, and public health.

7.5.6 Action 6: Marine Aquaculture Siting Requirements and Conditions

Preferred Alternative 3 establishes various criteria for siting marine aquaculture facilities (Section 4.6 for a list of these criteria)

Action 6 would restrict the areas where offshore aquaculture can occur, the distance between sites, and the total area of each site. Site placement restriction would be expected to reduce the magnitude of the negative externalities and associated economic costs that may be created by unrestricted site location. This action would reduce and may eliminate offshore aquaculture operations from being sited within historical and increasing fishing areas, thus reducing the costs to fishermen, their families and communities associated with reduced harvests and/or higher operating expenses to fishermen. The restriction on the distance between aquaculture sites would be expected to reduce the density of offshore aquaculture. While this restriction would increase the costs of transiting from one affiliated facility to another, reducing the density of sites reduces the potential for cumulative externality effects, such as combined effluent flows, larger exclusion areas that would need to be transited around, etc. The site size requirement would be expected to reduce the environmental problems, and associated economic costs, of production concentration by allowing systems to be rotated within the area of the site.

7.5.7 Action 7: Restricted Access Zones for Marine Aquaculture Facilities

Preferred Alternative 2: Create a restricted access zone for each aquaculture facility. The boundaries of an aquaculture facility's restricted access zone shall correspond with the coordinates on the approved ACOE Section 10 permit. No recreational and no commercial fishing other than offshore aquaculture may occur in the restricted access zone. No fishing vessels may operate in or transit through the restricted access zone unless the vessel has on board a signed copy (i.e., a permit with an original signature and not a copy of the signature) of the facilities' aquaculture permit onboard. The permittee must mark the restricted access zone with a floating device such as a buoy at each corner of the zone. Each floating device must clearly display the aquaculture facility's permit number and the words "RESTRICTED ACESSS" in block letters at least 6 inches in height and in a color that contrasts with the color of the floating device.

Action 7 would create a restricted access area around each aquaculture facility, based on the ACOE siting permit, and require a facility to mark its borders. No fishing could occur within the zone/area. This action would reduce the risk of damages and associated costs caused by use of fishing gear or other equipment or a vessel strike. The prohibition on fishing in the restricted access zone would apply to fishermen, both commercial and recreational, as well as the aquaculture facility owner, employees, and contracted personnel. Thus, while the costs associated with accidental gear, vessel, or system damage would be reduced, the prohibition on all fishing would be expected to reduce the potential economic benefits of fishing in these areas. Action 7 could represent foregone increased benefits from fishing in areas surrounding a facility if the systems become fish attractants. Any reduction in economic benefits to commercial or recreational fishermen would be expected to have spill-over consequences to their families, communities, and associated fishing businesses. The restricted access zones may provide additional benefits in further assisting in reducing density-related externalities. Site operators would be required to incur the cost of marking their restricted access zones and maintaining these markings.

7.5.8 Action 8: Recordkeeping and Reporting

Preferred Alternative 2 would establish various recordkeeping and reporting requirements for aquaculture permittees (Section 4.8 for a list of these requirements)

Action 8 would establish 17 recordkeeping and reporting requirements that are important to reducing the incidence and severity of events that could adversely affect the human and biological environments. Consequently, this action would be expected to reduce the adverse economic effects of these events. Although these recordkeeping and reporting requirements likely constitute or are consistent with general business practices, their requirement could impose an additional expense on the aquaculture operation.

7.5.9 Action 9: Biological Reference Points and Status Determination Criteria

Preferred Alternative 2: Establish the following new biological reference points and status determination criteria for aquaculture in the Gulf of Mexico EEZ:

> **The proxy for MSY is: 64 mp ww;**
>
> **The proxy for OY is the total yield harvested by all permitted aquaculture operations annually, but not to exceed: 64 mp ww (equal to MSY);**
>
> **No individual, corporation, or other entity can be permitted to produce more than: 20 percent of the maximum level of OY.**

Action 9 would establish biological reference points and status determination criteria for aquaculture in the Gulf. Both MSY and OY proxies would equal 64 million pounds whole weight. This action would also establish a cap on the production by an individual company of 20 percent. Finally, it would require NOAA Fisheries Service to publish a control date if aquaculture production exceeds the OY, after which entry into the fishery may be limited or restricted.

While both the MSY and OY represent target capacities, the OY level itself is the reference point that would place the operational restriction on the industry. In general, an OY value of 64 million pounds would be expected to result in lower economic benefits to the aquaculture operations and associated industries than would result from unrestricted aquaculture production and lower potential economic costs to Gulf fishermen, their families, communities and associated industries that could result from direct competition with unlimited aquaculture production.

The 20-percent individual, corporation, or other entity production cap of this action would increase the number of aquaculture entities that can exist in the Gulf EEZ by limiting industrial concentration. The cost of this restriction to offshore aquaculture operations is lost economic benefits from economies of scale and/or scope that derive from higher levels of production. Action 9 reduces the risk of economic damages from high market concentration and anti-competitive behavior of dominant offshore aquaculture operations, and, at the same time, increases the potential for spread of aquaculture activities and associated economic costs and benefits across the Gulf.

As stated earlier in this document, Virginia Cobia Farms, an inland aquaculture company, produced its first crop of cobia in May of 2007, estimated at about 100,000 pounds, which is a level of production equivalent to 56 percent of the total commercial landings of wild caught cobia in 2007. The company plans to produce one million pounds in

2009, which represents a level of production greater than 5 times that of the 2007 wild catch. The company's long-range plans are to expand to 100 million pounds. This is to illustrate that offshore aquaculture operators would not be the only competitors with fishermen. If Virginia Cobia Farms expands production as planned, it would produce more seafood than all Gulf offshore aquaculture operations combined. Nonetheless, offshore aquaculture operations could compete directly with Gulf fishermen as described in Section 6.2.3 and because of their competitive advantages could cause ex-vessel seafood prices to fall. Action 9 reduces the potential economic costs that could result from offshore aquaculture competing directly with fishermen by reducing both the amount they could offer to dealers and the ratio of cultured product to commercial landings.

7.5.10 Action 10: Framework Procedures

Preferred Alternative 2 specifies framework procedures for modifying biological reference points (MSY, OY) and management measures for offshore marine aquaculture in the Gulf of Mexico EEZ.

Action 10 would establish a flexible regulatory process that could adapt to ongoing changes in the offshore aquaculture industry, which could both support the developing industry and reduce negative externalities and associated economic costs caused by the industry. Costs incurred by NOAA Fisheries Service would include participating in AP meetings, review of AP and Council recommendations, preparation of a *Federal Register* notice, and preparing a regulatory amendment.

7.6 Public and Private Costs of Regulations

The preparation, implementation, enforcement, and monitoring of this or any Federal action involves the expenditure of public and private resources which can be expressed as costs associated with the regulations. Costs associated with this FMP include, but are not limited to Council costs of documentation preparation, meeting, public hearings, and information dissemination; NMFS administration costs of document preparation, meetings and review, and annual law enforcement costs. The Council and NMFS costs for this proposed FMP are estimated to be approximately $600,000 each or a total of approximately $1.2 million.

7.7 Determination of Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is expected to result in: (1) an annual effect of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or State, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights or obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this executive order.

Based on the information provided above, this action is not expected to have an adverse effect of $100 million or more and has been determined to not be economically significant. However, because offshore aquaculture in the EEZ is a controversial issue and this action would create the first aquaculture FMP, this action has been determined to be significant for purposes of E.O. 12866.

8.0 Initial Regulatory Flexibility Analysis

8.1 Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA does not contain any decision criteria; instead, the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of the alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure that the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct a regulatory flexibility analysis for each proposed rule. The regulatory flexibility analysis is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. In addition to analyses conducted for the RIR, the initial regulatory flexibility analysis provides: (1) a description of the reasons why action by the agency is being considered; (2) a succinct statement of the objectives of, and legal basis for the proposed rule; (3) an identification, to the extent practicable, of all relevant Federal rules which may duplicate, overlap, or conflict with the proposed rule; (4) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (5) a description of the projected reporting, record-keeping, and other compliance requirements of the final rule, including an estimate of the classes of small entities which will be subject to the requirements of the report or record; and (6) a description of significant alternatives to the proposed rule which accomplish the stated objectives of applicable statues and which minimize any significant economic impact of the proposed rule on small entities.

8.2 Statement of Need for, Objectives of, and Legal Basis for the Proposed Rule

The purpose and need, issues, problems, and objectives of the proposed FMP are presented in Sections 1, 2, and 3, and are incorporated herein by reference.

8.3 Identification of Federal Rules which may Duplicate, Overlap, or Conflict with the Proposed Rule

The preferred alternative for Action 1 of the Gulf Aquaculture FMP states that a Gulf Aquaculture Permit entitles a person to "land allowable aquaculture species cultured in the Gulf EEZ at a U.S. port". According to 46 CFR 67.21(a) "a fishery endorsement entitles a vessel to land its catch, wherever caught, in the United States." Action 2 also includes several provisions referencing regulations of other agencies, but regulatory requirements specified in this FMP would not necessarily be duplicative of those requirements. No other potentially duplicative, overlapping or conflicting rules have been identified.

8.4 Description of the Projected Reporting, Record-keeping and Other Compliance Requirements of the Proposed Rule, Including an Estimate of the Classes of Small Entities which will be Subject to the Requirement and the Type of Professional Skills Necessary for the Preparation of the Report or Records.

This proposed action would require entities that seek to locate offshore aquaculture operations in the Gulf of Mexico EEZ to apply for a Gulf of Mexico Aquaculture permit and, if approved, to comply with application and operational requirements and restrictions of that permit (Action 1, Alternative 2; Action 2, Alternative 3) and, once approved, to renew the permit at 5-year increments after the first 10 years in order to continue operations (Action 3, Alternative Two). In addition to these requirements, potential offshore aquaculture operations would be required to use allowable native species native to the Gulf of Mexico (Action 4, Alternative 4) allowable marine aquaculture systems (Action 5, Alternative 3), comply with siting requirements and conditions (Action 6, Alternative 3), mark its restricted access zone with a floating device at each corner of the zone (Action 7, Alternative 2), comply with specific recordkeeping and reporting requirements (Action 8, Alternative 8), and individually not produce more than 20 percent of 64 million pounds whole weight of cultured fish and shellfish (Action 9, Alternative 2e .

Although permit application costs exist for other current Gulf federal permits, an application cost and estimated time of preparation for the aquaculture permit application is unknown at this time. A permit cost is determined by the time required for review and processing of the application. Due to the potential amount of information required for the permit application, and the associated review time, the permit cost could be in the thousands of dollars. The cost of the permit would be determined prior to implementation of the final rule if the proposed rule is approved.

The skill levels associated with the preparation of the required documentation for the aquaculture permit application and recordkeeping and reporting requirements will vary from those of highly skilled professionals, such as biologists, engineers, animal health specialists, and accountants, for example, to less skilled laborers and production staff. However, all skill levels are expected to be equivalent to those required for the normal development of a business plan for a marine aquaculture operation and subsequent implementation and operation of said business. Hence, the application, recordkeeping and reporting requirements are not expected to necessitate the expertise of personnel beyond those whom would be typically employed by a marine aquaculture business.
The operational requirements, however, are expected to increase the operating costs of an entity that engages in offshore aquaculture in the Gulf of Mexico EEZ. With respect to the compliance requirements associated with operation siting and restricted zone

marking, these costs are also expected to fall within the customary costs of normal business operation.

This proposed action would also require any person that intends to purchase cultured organisms from the Gulf EEZ at the first point of sale to apply for and be issued a Gulf aquaculture dealer permit. At present, an Annual Dealer Permit (OMB No. 0648-025) is required to receive reef fish, sharks and swordfish harvested in the Gulf EEZ. This proposed action would add cultured organisms to the above list of species. All applications must include a payment of a non-refundable application fee of $50.00 for the first fishery and $12.50 for each additional fishery requested on the application. It is estimated that the time required to complete the average application for an annual dealer permit is 20 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and reviewing the collection of information (Page 4 of Federal Permit Application for an Annual Dealer Permit). Hence, the annual cost and time incurred by an entity that seeks to purchase cultured organisms from the Gulf EEZ would be either $50.00 or $12.50 and 20 minutes. No special skills are expected to be required to prepare this permit application.

Commercial and for-hire fishing businesses would be required to comply with the prohibition against fishing in areas of the Gulf EEZ where offshore aquaculture operations are sited, including the restricted access zones around these operations to reduce the potential for unintentional system, gear, or vessel damage. Such compliance would not be expected to require special navigational of vessel operation skills.

8.5 Description and Estimate of the Number of Small Entities to which the Proposed Rule will Apply.

This proposed rule would directly affect entities that have or seek to locate offshore aquaculture operations in the Gulf of Mexico EEZ and purchase cultured organisms from the Gulf EEZ at the first point of sale. At present, there are no entities, large or small, that have offshore aquaculture operations in or purchase cultured organisms from the U.S. Gulf of Mexico Exclusive Economic Zone. However, entities in the following industries may seek to locate aquaculture or hatchery operations in the Gulf EEZ: Finfish Farming and Fish Hatcheries (NAICS 112511), Shellfish Farming and Shellfish Hatcheries (NAICS 112512), and Other Aquaculture (NAICS 112519). All of these industries have an SBA size standard of $0.75 million in annual receipts. NOAA Fisheries Service estimates from 5 to 20 offshore fish farms may be established in the Gulf EEZ within the next 10 years.

Posadas and Bridger's (2004) estimate of the costs of entering the offshore aquaculture industry in the Gulf greatly exceeds the $0.75 million revenue size standard of businesses in aquaculture and hatcheries. Their model for a 6-cage operation, which is considered to be the smallest that is economically viable, requires an initial fixed investment of $2.89 million, consisting of $1.5 million for an aquaculture support vessel, $0.96 million for six cages and associated equipment, $0.33 million for land and onshore support facilities, and $0.1 million for service vessels. They also estimate minimum variable costs that exceed $1.28 million to produce 1,188,000 pounds (540,000 kilograms) of 11.6-lb (5.25-kg) cobia every nine months. This evidences that those who seek to locate an offshore aquaculture operation in the Gulf EEZ will not be small businesses. It is similarly expected that those who seek to locate an offshore hatchery in the Gulf EEZ will be affiliated with offshore grow-out operations and will not be small businesses. Nonetheless, NOAA Fisheries Service encourages comment regarding its conclusion that no small entities would seek an offshore aquaculture permit in the Gulf of Mexico.

This rule would also directly affect those entities that purchase cultured organisms from the Gulf EEZ at the first point of sale because they would be required to obtain an Annual Dealer Permit. Such entities are expected to be Fish and Seafood Merchant Wholesalers (NAICS 424460), Fresh and Frozen Seafood Processors (NAICS 311712), Supermarkets and Other Grocery (NAICS 445110), Fish and Seafood Markets (NAICS 445220), Warehouse Clubs and Superstores (NAICS 452910) and Full-Service Restaurants (NAICS 722110). The SBA size standards for the wholesalers and processors are 100 employees and 500 employees, respectively. A supermarket or other grocery is a small business if its annual receipts do not exceed $27 million, and, similarly, a fish and seafood market is a small business if its annual receipts do not exceed $7 million. A full-service restaurant is a small business and a warehouse club and superstore is a small business if its annual receipts do not exceed $6.5 million and $25 million, respectively. Because there are presently no organisms cultured in the Gulf EEZ, there is much uncertainty regarding the numbers of small businesses that will be directly affected by the Annual Dealer Permit requirement.

This proposed rule would create restricted access zones that could directly affect entities that engage in for-hire and commercial fishing by prohibiting their fishing vessels from operating in or transiting through these zones. Businesses that engage in for-hire and commercial fishing are in the following industries: Finfish Fishing (NAICS 114111), 114112 (Shellfish Fishing), 114119 (Other Marine Fishing) and 487210 (Scenic and Sightseeing Transportation that includes charter boat fishing). All of the commercial fishing industries (NAICS 114111, 114112, and 114119) have an SBA size standard of $4.0 million in annual receipts, and the for-hire fishing industry’s size standard is $6.5 million in annual receipts. It is assumed that all of the for-hire and commercial fishing businesses that operate in the Gulf of Mexico are small businesses.

8.6 Substantial Number of Small Entities Criterion

The proposed action is not expected to regulate a large number of small businesses that engage in finfish and shellfish fishing because the locations of the restricted access zones are expected to be outside historical and increasingly used fishing areas. Similarly, the number of small businesses who seek to purchase cultured product at the first point of sale is not expected to be substantial.

8.7 Economic Impact Significance Criterion

The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Does the proposed rule place a substantial number of small entities at a significant competitive disadvantage to large entities?

Profitability: Does the proposed rule significantly reduce profit for a substantial number of small entities?

Because of the financial resources expected to be required to successfully operate an offshore aquaculture business, all entities that would be expected to apply for an aquaculture permit are expected to be large business entities.

The only small entities that would be expected to be directly affected by this action are current or prospective seafood dealers and commercial and for-hire fishermen. Any entity that seeks to purchase cultured product from the Gulf EEZ at the first point of sale would be required to obtain a dealer's permit. Based on available data, all seafood dealers in the Gulf area are assumed to be small business entities. Thus, any entity that would be expected to obtain the permit and become a cultured seafood dealer is also assumed to be a small business entity. The total cost to an applicant for a dealer's permit would be an estimated 20 minutes to complete the application and either $50 or $12.50 for the cost of the permit, depending upon whether the entity applies for one or more permits (separate dealer permits are required for some fisheries). Neither the annual cost nor the preparation time would constitute a significant adverse economic impact on these entities.

Commercial and for-hire fishing businesses would be prohibited from fishing in areas where offshore aquaculture operations are sited, including the restricted access zones around these operations to reduce the potential for unintentional system, gear, or vessel damage. As a result, these fishing businesses may experience adverse economic impacts in the form of reduced landings and revenues, or increased operating costs if forced to change where they customarily or increasingly fish. However, this action has provisions that enable the restriction of aquaculture sites to areas that are not important fishing grounds. As a result, it is expected that the areas where aquaculture production will develop will not include waters that are important to commercial and for-hire fishing. Thus, while the overall impact of these exclusion zones on commercial and for-hire fishing businesses cannot be determined, restricting where aquaculture operations are sited is expected to greatly reduce the incidence and magnitude of any adverse economic impacts on these small entities.

No other potential direct adverse economic impacts on small entities have been identified.

8.8 Description of Significant Alternatives

This proposed rule is not expected to have a significant adverse economic impact on a substantial number of small entities. However, a discussion and comparison of the alternatives for each action is presented below.

Three alternatives, including the status quo no-action alternative, were considered for the action to establish permit requirements and restrictions. The proposed rule would establish specific application requirements and operational requirements and restrictions. The no-action alternative would not establish any application or operational requirements and restrictions for commercial aquaculture and hatchery operations in the Gulf EEZ, which could result in significant negative externalities and adverse economic impacts. The third alternative would establish permit requirements and restrictions identical to the application and issuance requirements of an EFP. However, EFP requirements are insufficient to address the potentially significant negative externalities that could result from long-term commercial aquaculture and hatchery operations. The proposed rule would be the most transparent and most burdensome on offshore aquaculture and hatchery operations of the alternatives considered. However, among the alternatives considered, the proposed rule is expected to be the most effective in reducing the incidence and severity of the costs of potential negative externalities created by commercial offshore aquaculture and hatcheries.

Two alternatives, one with four sub-alternatives, were considered for the action to specify the duration of a Gulf of Mexico Aquaculture permit. The proposed rule (one of the sub-alternatives of the second alternative) would establish a permit that is effective for 10 years and renewable in 5-year increments. The first alternative would establish a permit that is effective for one year, unless otherwise specified in the permit or a superseding notice or regulation, which was considered to be of an insufficient duration to allow the development of commercial offshore aquaculture. Two of the sub-alternatives would establish permit durations of 5 and 20 years without renewal, which were also considered to be of insufficient duration to encourage the development and sustainability of commercial offshore aquaculture. The last sub-alternative would establish a permit of indefinite duration, which would be expected to create the greatest benefit to offshore aquaculture and hatchery operations. However, a permit of indefinite duration would indefinitely prevent others from benefitting from the use of the areas where the aquaculture and hatchery operations were located, as well as eliminate the review opportunity enabled by a periodic permit renewal requirement.

Four alternatives, including the status quo no-action alternative, were considered for the action to specify the species allowed for aquaculture and included in the Aquaculture Fishery Management Unit (FMU). The proposed rule would allow the aquaculture and inclusion in the Aquaculture FMU all species native to the Gulf of Mexico that are managed by the Gulf Council, except shrimp and corals. The no-action alternative would allow the aquaculture of any species native to the Gulf of Mexico and not develop an Aquaculture FMU. The no-action alternative would increase the possibility of economic harm relative to the proposed rule to Gulf fishermen as a result of market competition with Gulf offshore fish and shellfish farms. The third alternative would restrict the set of allowable species for aquaculture and inclusion in the Aquaculuture FMU to species native to the Gulf of Mexico and in the reef fish, red drum, and coastal migratory pelagics FMPs. This alternative would allow the smallest number of species to be aquacultured among the alternatives considered, which could result in the smallest economic benefit to offshore aquaculture operations and, conversely, the smallest amount of direct competition with Gulf fishermen. The fourth alternative would allow the aquaculture and inclusion in the Aquaculture FMU of all species native to the Gulf that are managed by the Council, except goliath and Nassau grouper, shrimp, and corals. This alternative would allow the aquaculture of more species than the third alternative but fewer species than the no-action alternative. The proposed rule would allow for the aquaculture of the second largest number of species among the alternatives considered, which represents, potentially, the second highest economic benefit to offshore aquaculture operations and second highest potential economic costs to Gulf fishermen as a result of market competition and other externalities. The species prohibitions of the proposed rule, however, are consistent with the understanding that shrimp aquaculture is more appropriate for land-based systems and coral harvest, except as allowed under a liverock permit, is prohibited in the Gulf EEZ.

Three alternatives, including the status quo no-action alternative, were considered for the action to specify marine systems allowable for aquaculture in the Gulf EEZ. The proposed rule would specify the process and criteria that would be used for system approval, but would not specify allowable systems. The no-action alternative would rely on existing NMFS authority to approve or disapprove specific systems based on unspecified evaluation criteria and determination of appropriateness. The absence of specified evaluation criteria could result in the approval of systems that result in unanticipated adverse environmental and economic consequences relative to the more systematic process and criteria of the proposed rule. The third alternative would limit the set of allowable systems to cages and pens. Although this alternative is the most transparent among the alternatives considered in that the system options are fewer and, therefore, more easily evaluated by both the public and agency, this restriction could potentially deny the use of more economically and environmentally beneficial production systems. The proposed rule would have the potential flexibility of allowing the use of a system that best meets an operation's production goals, while addressing the need to reduce potential negative externalities that could result from the aquaculture operation. Three alternatives, including the status quo no-action alternative, were considered for the action to establish marine aquaculture and hatchery siting requirements and conditions. The proposed action would restrict the areas where aquaculture and hatcheries can occur, the distance between sites, and the total area of each site in the Gulf EEZ. The no-action alternative would allow offshore aquaculture and hatchery facilities to be located anywhere the Army Corps of Engineers would permit, potentially including historical or recently important fishing areas. This alternative would have the greatest potential of directly impacting fishing by allowing aquaculture and hatchery operations to be located in important harvest areas. The third alternative would establish marine aquaculture zones and restrict aquaculture and hatchery sites to these zones. Although the third alternative would establish zones that do not conflict with important fishing areas, this alternative would reduce the flexibility of site location, which could require the use of inferior sites with higher start-up and operational costs. Also, confining aquaculture and hatchery operations to designated zones could result in density problems with associated environmental and economic costs. The proposed rule would give aquaculture and hatchery operations greater flexibility in locating their operations than the third alternative, and would be expected to reduce or eliminate the siting of aquaculture and hatchery facilities in important fishing areas, which would reduce or eliminate any direct costs incurred by commercial and for-hire fishing businesses that fish in these important areas.

Three alternatives, including the status quo no-action alternative, were considered for the action to establish restricted access zones around aquaculture facilities. The proposed rule would create a restricted access zone around each aquaculture and hatchery facility in the Gulf EEZ. These restricted access zones would correspond with the coordinates on the approved ACOE siting permit. Fishing would be prohibited in these restricted access zones and no recreational or commercial fishing vessel, unless in service for the facility, could operate in or transit through these zones. Additionally, each facility would be required to mark the boundaries of its restricted access zone. The no-action alternative would not establish restricted access zones or restrict fishing around aquaculture and hatchery facilities and would be expected to result in the largest risk, among the alternatives considered, of a fishing vessel colliding with or fishing gear damaging an aquaculture facility. As a result, the no-action alternative would be expected to have the greatest likelihood among the alternatives considered of resulting in injury to personnel and losses of cultured and wild-caught fish, equipment and vessels. The third alternative would establish buffer zones of varying uniform distances from aquaculture facilities. However, the boundaries of these zones would not be required to be marked, which could make detection of the boundaries difficult, thereby diminishing their utility. The third alternative could also result in buffer zones that are larger than the restricted access zones that would be established by the proposed rule, thereby increasing the area where fishing would be prohibited, resulting in potentially increased adverse economic impacts on fishermen compared to the proposed rule.

Two alternatives, including the status quo no-action alternative, were considered for the action to establish recordkeeping and reporting requirements for offshore aquaculture. The proposed rule would establish 17 recordkeeping and reporting requirements on aquaculture operations. Although these requirements are expected to increase the operating costs of aquaculture operations, these requirements are considered to be necessary to manage the aquaculture fishery and reduce the incidence and severity of adverse environmental events. The no-action alternative would not establish any recordkeeping or reporting requirements or impose any additional costs on aquaculture operations. However, the absence of mandatory reporting and record-keeping requirements would be expected to decrease the ability to effectively monitor the conduct of the aquaculture industry and reduce the incidence and severity of adverse environmental events.

Two alternatives, including the status quo no-action alternative, and multiple sub-alternatives were considered for the action to establish biological reference points and status determination criteria for offshore aquaculture. The proposed rule would establish biological reference points and status determination criteria for aquaculture by setting the Maximum Sustainable Yield (MSY) and Optimum Yield (OY) at 64 million lbs, and limiting an individual entities production to 20 percent of the OY. The proposed rule would also require NMFS to publish a control date, after which entry into the aquaculture fishery could be limited or restricted, if industry production exceeded the OY. The no-action alternative would not establish biological reference points, status determination criteria, or limit the production of individual entities. Because the specification of biological reference points and status determination criteria are mandatory components for an FMP, the no-action alternative would not support the development of an aquaculture industry in the Gulf EEZ and would not achieve the Council's objectives. Three of the biological reference point sub-alternatives would establish MSYs and OYs that are less than those of the proposed rule, ranging from 16 to 36 million lbs, while one sub-alternative would establish higher levels, 190 million lbs. The lower values would be expected to result in lower economic benefits to the aquaculture industry and lower potential indirect costs to fishermen in competitive markets and associated industries compared to the proposed rule, while the higher values would be expected to result in the reverse. The two sub-alternative production caps would establish lower caps than the proposed rule, limiting the production by an individual entity to either 5 or 10 percent of the OY. Each of these sub-alternatives would be expected to result in lower economic benefits to aquaculture producers and associated businesses because the lower caps may adversely affect the ability to take advantage of greater economies of scale. Conversely, the lower the cap, the greater the number of potential individual aquaculture producers and an associated potential for increased economic and social benefits derived from increased competition. The 20-percent cap in the proposed rule was selected as a reasonable limit on production concentration while still enabling the potential realization of economy-of-scale benefits.

Three alternatives, including the status quo no-action alternative, were considered for the action to specify an organizational framework for modifying the aquaculture biological reference points, status determination criteria, and management measures. The proposed rule would establish framework procedures that would support the development and implementation of timely changes as necessary in response to changing aquaculture technologies or unforeseen fishery and environmental conditions. The no-action alternative would not specify framework procedures, which would result in a requirement for the development of a full plan amendment in order to develop and implement necessary changes to the Aquaculture FMP. Requiring the development of a full plan amendment in order to develop and implement necessary changes to the FMP would result in the delay of management action, potentially resulting in increased adverse environmental and economic effects relative to the proposed rule, and would not achieve the Council's objectives. The third alternative would establish framework procedures just for changing the biological reference points. This alternative would limit the Council's ability to make timely changes for the broader category of management actions that the proposed rule would support and, as a result, would also be expected to potentially result in increased adverse environmental and economic effects compared to the proposed rule. The proposed rule would give the Council and NMFS the greatest amount of flexibility among the alternatives considered in responding to changing fishery conditions, such as aquaculture technologies and practices, which would support the development and implementation of timely regulatory changes and the greatest net economic benefits to offshore aquaculture producers and Gulf fishermen.

9.0 Fishery Impact Statement

Introduction

The MSFCMA requires that FMPs address the impacts of any management measures on the participants in the affected fishery and those participants in other fisheries that may be affected directly or indirectly through the inclusion of a fishery impact statement [MSFCMA section 303(a)(9)]. National Standard 8 requires that FMPs consider the impacts upon fishing communities to the extent practicable to assure their sustained participation and minimize adverse economic impacts upon those communities [MSFCMA section 301(a)(8)]. Consideration of social impacts is a growing concern as fisheries experience increased participation and/or declines in stocks. With an increasing need for management action, the consequences of such changes need to be examined to minimize the negative impacts experienced by the populations concerned to the extent practicable. Expected effects of the proposed actions in this FMP are included in Section 6.0 and incorporated herein by reference.

Scope of FMP and Environmental Impacts of Preferred Alternatives

The purpose of this Aquaculture Fishery Management Plan (FMP) is to develop a regional permitting program which would allow for the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf of Mexico. This FMP, including the PEIS, would serve as the basis for evaluating the effects of issuing a permit for Gulf aquaculture operations. The preferred alternatives in this FMP outline permit requirements, restrictions, and eligibility (Actions 1 and 2), permit duration (Action 3), allowable species and systems (Actions 4 and 5), requirements and conditions for siting of aquaculture operations (Action 6), restricted access zones (Action 7), requirements for recordkeeping and reporting (Action 8), biological reference points (Action 9), and framework procedures aquaculture operations (Action 10). The following paragraphs summarize the expected impacts of these actions, with a more detailed discussion provided in Section 6.0.

The measures for siting and operating offshore marine aquaculture facilities are expected to have some direct as well as indirect impacts on the physical, biological, ecological, social, and administrative environments. The effects of Action 1 (permit requirements) and Action 2 (conditions and restrictions) are primarily administrative in nature, yet the results of these actions could also have indirect effects on the physical, biological, and ecological environments. There are no direct or indirect biological, physical, or ecological impacts expected for Action 3 (establishes permit duration) since an operation can be terminated if found not to be complying with aquaculture regulations. There are potential adverse socioeconomic impacts associated with Action 1 and Action 3, since those lacking an aquaculture permit would not be able to benefit from sited areas for traditional fishing and/or other purposes. Both Action 4 and Action 5 (determining species and systems allowable for aquaculture activities, respectively), could have direct and indirect impacts on the administrative environment (e.g., increased administrative costs) as well as the physical, biological, and ecological environments (e.g., reduction in the extent of fishing pressure on native stocks resulting from aquaculture production). Action 5 may also result in socioeconomic consequences by privatizing areas of the Gulf EEZ for aquaculture purposes.

Additional burdens on the administrative environment resulting from Actions 6, 7, 8, 9, and 10 are expected as a result of increased reporting, recordkeeping, and monitoring requirements. Indirect positive effects of Actions 6 (siting for aquaculture operations) and 7 (determining restricted access zones) on the physical, biological and economic environments may result from the review of proposed aquaculture sites as well as the reduction of gear and user conflicts. Direct negative socioeconomic effects of Action 7 may result from a reduction in the area available for commercial or recreational fishing and vessel transiting, as well as additional costs incurred by the permit applicant to mark restricted access zones.

The requirements of Actions 8 (recordkeeping and reporting) and Action 9 (establishing biological reference points) as well as the framework procedures described in Action 10 are intended to help prevent or mitigate impacts to the physical, biological, and ecological environments. Direct socioeconomic impacts are expected for Action 8 and Action 10 as a result of substantially greater costs to the permittee, the Council and NOAA Fisheries Service, respectively. For Action 9, socioeconomic impacts would be governed by where the production cap is set, since the amount an operation could produce would directly impact operating costs and the amount of economic benefits to the operation. Increased administrative burden is expected, either directly or indirectly, as a result of Actions 8, 9, and 10; however, these impacts may represent a trade-off between increased administrative burden and the long-term/short-term impacts of offshore aquaculture operations, timely review, and implementation of regulatory measures.

10.0 Other Applicable Laws

The MSFCMA (16 U.S.C. 1801 et seq.) provides the authority for fishery management in federal waters of the EEZ. However, fishery management decision-making is also affected by a number of other federal statutes designed to protect the biological and human components of U.S. fisheries, as well as the ecosystems within which those fisheries are conducted. This Aquaculture FMP is an integrated document that includes analyses necessary for the NEPA, the RFA, and Executive Order 12866.

NEPA requires all federal actions to evaluate environmental impacts of proposed actions, and for those impacts to be assessed and reported to the public. For this FMP, the Council conducted an EIS. The primary purpose of an EIS "shall provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives, which would avoid or minimize adverse impacts or enhance the quality of the human environment (Part 1502.1 CEQ)." Part 1502.2 of the CEQ regulations specifies how agencies should prepare an EIS to achieve the above stated purpose.

The RFA requires federal agencies to assess the impacts of regulatory actions implemented through notice and comment rulemaking procedures on small businesses, small organizations, and small governmental entities, with the goal of minimizing adverse impacts of burdensome regulations and record-keeping requirements on those entities. These analyses, which describe the type and number of small businesses affected, are provided in Section 8.0. These analyses are published in the *Federal Register* in full or in summary for public comment and submitted to the chief counsel for advocacy of the Small Business Administration.

To comply with E.O. 12866, NOAA Fisheries Service prepares an RIR for all fishery regulatory actions that either implement a new fishery management plan or significantly amend an existing plan. RIRs provide a comprehensive analysis of the costs and benefits to society associated with proposed regulatory actions, the problems and policy objectives prompting the regulatory proposals, and the major alternatives that could be used to solve the problems. These analyses can be found in Section 7.0 of this FMP.

Other major laws affecting federal fishery management decision-making are summarized below.

10.1 Administrative Procedures Act

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, NOAA Fisheries Service is required to publish notification of proposed rules in the *Federal Register* and to solicit, consider and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day wait period from the time a final rule is published until it takes effect.

10.2 Coastal Zone Management Act

Section 307(c)(1) of the federal Coastal Zone Management Act (CZMA) of 1972, as amended, requires federal activities affecting any land or water use or natural resource of a state's coastal zone be conducted in a manner consistent, to the maximum extent practicable, with approved state coastal management programs. The requirements for such a consistency determination are set forth in NOAA regulations at 15 C.F.R. part 930, subpart C. When proposing an action determined to directly affect coastal resources managed under an approved coastal zone management program, NOAA Fisheries Service is required to provide the relevant state agency with a determination that the proposed action is consistent with the enforceable policies of the approved program to the maximum extent practicable at least 90 days before taking final action. Once this FMP is approved and submitted to the Secretary of Commerce, NOAA Fisheries Service, in cooperation with the Council, will determine if this action is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, Mississippi, and Texas to the maximum extent possible. This determination will be submitted to the responsible state agencies under Section 307 of the CZMA.

10.3 Data Quality Act

The Data Quality Act (DQA) (Public Law 106-554), effective October 1, 2002, requires the government to set standards for the quality of scientific information and statistics used and disseminated by federal agencies. Specifically, the Act directs the Office of Management and Budget (OMB) to issue government wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." Such guidelines have been issued, directing all federal agencies to create and disseminate agency-specific standards to: (1) Ensure information quality and develop a pre-dissemination review process; (2) establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and (3) report periodically to OMB on the number and nature of complaints received. Pursuant to Section 515 of Public Law 106-554, this information document will undergo a pre-dissemination review by the Southeast Regional Office Sustainable Fisheries Division prior to dissemination and will be available from the agency.

10.4 Endangered Species Act

The Endangered Species Act (ESA) of 1973, as amended, (16 U.S.C. Section 1531 et seq.) requires that federal agencies use their authorities to conserve endangered and threatened species. The ESA requires NOAA Fisheries Service, when proposing a fishery action that "may affect" critical habitat or endangered or threatened species, to consult with the appropriate administrative agency (itself for most marine species, the USFWS for all remaining species) to determine the potential impacts of the proposed action. Consultations are concluded informally when proposed actions "may affect, but are not likely to adversely affect" endangered or threatened species or designated critical habitat. Formal consultations, including a biological opinion, are required when proposed actions may affect and are "likely to adversely affect" endangered or threatened species or adversely modify designated critical habitat. If jeopardy or adverse modification is found, the consulting agency is required to suggest reasonable and prudent alternatives.

10.5 Rivers and Harbors Act of 1899

Section 10 of the Rivers and Harbors Act (33 U.S.C 403) prohibits the creation of structures not authorized by Congress that obstruct navigable waters of the United States. The Act provides the Chief of Engineers and Secretary of War authority to authorize the building of structures in any port, roadstead, haven, harbor, canal, navigable river, or other water of the United States, outside established harbor lines, or where no harbor lines have been established. Title 33 CFR Section 322 prescribes the policies, practices, and procedures the ACOE follows when reviewing permits to authorize certain structures or work affecting navigable waters of the United States.

10.6 Clean Water Act

The Clean Water Act (CWA) (33 *U.S.C.* 1251-1387) is intended to maintain and restore waters of the United States. The CWA authorizes water quality and pollution research, provides grants for sewage treatment facilities, sets pollution discharge and water quality standards, addresses oil and hazardous substances liability, and establishes permit programs for water quality, point source pollutant discharges, ocean pollution discharges, and dredging or filling of wetlands or waters of the United States. The U.S. ACOE and the EPA both have permitting authority under the CWA.

Title 40 CFR Parts 122-124 implement the EPA's NPDES Program under sections 318, 402, and 405 of the CWA. Water quality and effluent standards and criteria for the NPDES are described in 40 CFR, Parts 125, 129, 133, 136, 400-471, and 503. The EPA also published a final rule on August 23, 2004 (69 F.R. 162) establishing CWA effluent limitations, guidelines, and new point source pollution standards for concentrated aquatic animal production facilities, including facilities that produce 100,000 pounds or more per year of aquatic animals in net pens or submerged cage systems.

Pursuant to Section 404 of the CWA, the ACOE has authority to issue permits regulating the discharge of dredged or fill material into U.S. waters. Title 33 CFR Section 323 prescribes the policies, practices, and procedures the ACOE follows when reviewing permits to authorize the discharge of dredged or fill material. The intent of the CWA Section 404 program and its 404(b)(1) guidelines is to prevent destruction of aquatic ecosystems unless the action will not individually or cumulatively adversely affect the ecosystem. NOAA Fisheries Service may provide comments to the ACOE regarding impacts to marine resources of proposed activities and can recommend methods for avoiding such impacts.

10.7 National Marine Sanctuaries Act

The National Marine Sanctuaries Act (NMSA) (16 U.S.C. 1431 et seq.) directs the Secretary of Commerce to designate and manage areas of the marine environment with nationally significant aesthetic, ecological, historical, or recreational values as national marine sanctuaries. Regulations implementing the NMSA can be found at 15 CFR Part 922. These regulations serve to safeguard resources within sanctuary boundaries and include prohibitions or limitations on some activities, such as discharge and disturbance of the seabed. These regulations also provide the National Marine Sanctuary Program with authority to issue permits to allow certain activities beneficial to sanctuaries that would otherwise be prohibited.

10.8 National Invasive Species Act

This act reauthorized and amended the Non-indigenous Aquatic Nuisance Prevention and Control Act of 1990 (P.L. 101-646). The act was originally passed in response to the zebra mussel invasion of the Great Lakes and required ships heading for the Great Lakes to exchange their ballast water at sea. In 1996, the act was reauthorized and all vessels arriving from outside the 200-mile U.S. EEZ were encouraged to exchange their ballast water. The Act requires all ships report whether or not they exchanged their ballast water.

10.9 National Aquaculture Act

The National Aquaculture Act was implemented in 1980. The purpose of the Act was to promote aquaculture in the United States by: 1) declaring a national aquaculture policy; 2) establishing and implementing a national aquaculture development plan; 3) establishing the Department of Agriculture as the lead federal agency with respect to the coordination and dissemination of national aquaculture information; and 4) encouraging aquaculture activities and programs in both the public and private sectors of the economy. The act states "aquaculture has the potential for reducing the U.S. trade deficit in fisheries products, for augmenting existing commercial and recreational fisheries and for producing other renewable resources, thereby assisting the United States in meeting its future food needs and contributing to the solution of world resource problems." The act also established the Joint Subcommittee on Aquaculture (JSA). The JSA coordinates federal government activities relating to aquaculture. The National Aquaculture Improvement Act amended this Act in 1985 and designated the Secretary of Agriculture as the permanent chair of the JSA. The secretaries of Commerce, Agriculture, and Interior comprise the JSA Executive Committee.

10.10 Outer Continental Shelf Lands Act

The Outer Continental Shelf Lands Act was created in 1953. The Act defined the Outer Continental Shelf (OCS) as all submerged lands between the seaward extent of state coastal waters and the seaward extent of federal jurisdiction. The purpose of the Act was to assure national security and reduce dependence on foreign sources. The Secretary of the Interior is responsible for the administration of mineral exploration and development of the OCS. The Act provides the Secretary of the Interior authority to grant leases through competitive bids and to promulgate regulations consistent with the provisions of the Act. The 1978 amendments to the Act provided for cancellation of leases or permits if continued activity is likely to cause serious harm to life, including aquatic life. These amendments also stipulated that economic, social, and environmental values of renewable and nonrenewable resources are to be considered in managing the OCS.

10.11 National Sea Grant College and Program Act

The National Sea Grant College and Program Act was established in 1966, and has been subsequently amended several times. The act authorized the establishment of Sea Grant colleges and programs. The intent of the Act was to initiate and support educational and research programs related to the development of marine resources. Aquaculture was one of the few fields of research specifically identified by the Act and Sea Grant has provided more support to aquaculture than any other area of research. The Act declared that aquaculture could substantially benefit the U.S. by providing greater economic opportunities, new sources of food, and new means for the development of marine resources. In 1976, the Act was amended and Sea Grant became a part of NOAA.

10.12 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 *U.S.C.* 661-666c) requires wildlife, including fish, receive equal consideration and be coordinated with other aspects of water resource development. This is accomplished via consultation with the USFWS, NOAA Fisheries Service and appropriate state agencies, whenever any body of water is proposed to be modified in any way and a federal permit or license is required. These agencies determine: (1) the possible harm to fish and wildlife resources; (2) the measures needed to both prevent the damage to and loss of these resources; and (3) the measures needed to develop and improve the resources, in connection with water resource development.

10.13 Executive Orders

10.13.1 E.O. 11987: Exotic Organisms

This Executive Order requires federal agencies, to the extent permitted by law, to: 1) restrict the introduction of exotic species into the natural ecosystems on lands and waters owned or leased by the United States; 2) encourage states, local governments, and private citizens to prevent the introduction of exotic species into natural ecosystems of the U.S.; 3) restrict the importation and introduction of exotic species into any natural U.S. ecosystems as a result of activities they undertake, fund, or authorize; and 4) restrict the use of federal funds, programs, or authorities to export native species for introduction into ecosystems outside the U.S. where they do not occur naturally. The Secretaries of Agriculture and Interior are authorized to allow the importation of exotics and the export of native species if natural ecosystems will not be adversely affected.

10.13.2 E.O. 12866: Regulatory Planning and Review

Executive Order 12866: Regulatory Planning and Review, signed in 1993, requires federal agencies to assess the costs and benefits of their proposed regulations, including distributional impacts, and to select alternatives that maximize net benefits to society. Section 5.0 herein, provides a comprehensive analysis of the costs and benefits to society of proposed action.

10.13.3 E.O. 12630: Takings

The Executive Order on Government Actions and Interference with Constitutionally Protected Property Rights that became effective March 18, 1988, requires that each federal agency prepare a Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment. A takings implication assessment will be prepared at the appropriate time.

10.13.4 E.O. 13089: Coral Reef Protection

The Executive Order on Coral Reef Protection requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems; and, to the extent permitted by law, ensure that actions that they authorize, fund or carry out do not degrade the condition of that ecosystem. This FMP identifies numerous areas where coral reefs occur and is intended to ensure proposed actions do not degrade these coral reef areas (Action 6).

10.13.5 E.O. 13112: Invasive Species

The Executive Order on invasive species established an Invasive Species Council and specified the duties of federal agencies whose actions may affect the status of invasive species. The Order requires federal agencies to use relevant programs and authorities to 1) prevent the introduction of invasive species, 2) detect and respond rapidly to control the spread of such species, 3) monitor invasive species populations accurately and reliably, 4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded, 5) conduct research to prevent introduction, and 6) promote education on invasive species. The Invasive Species Council oversees the implementation of the order, has prepared an invasive species management plan, develops guidance to federal agencies, and encourages planning and action at local, regional, and national levels.

10.13.6 E.O. 13132: Federalism

The Executive Order on Federalism requires agencies in formulating and implementing policies, to be guided by the fundamental Federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states. No Federalism issues have been identified relative to the proposed action. Therefore, preparation of a Federalism assessment under Executive Order 13132 is not necessary.

10.13.7 E.O. 13158: Marine Protected Areas

This Executive Order requires federal agencies to consider whether their proposed action(s) will affect any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural or cultural resource within the protected area. This action would prohibit aquaculture in marine reserves and marine protected areas.

10.13.8 E.O. 12898: Federal Actions to Address Environmental Justice in Minority and Low-Income Populations

This Executive Order requires federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. Impacts of aquaculture and commercial fishing on subsistence fishing are a concern in fisheries management; however, there are no such implications from the action proposed in this FMP.

10.14 Marine Mammal Protection Act

The MMPA established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the U.S. Under the MMPA, the Secretary of Commerce (authority delegated to NOAA Fisheries Service) is responsible for the conservation and management of cetaceans and pinnipeds (other than walruses). The Secretary of the Interior is responsible for walruses, sea and marine otters, polar bears, manatees, and dugongs.

Part of the responsibility that NOAA Fisheries Service has under the MMPA involves monitoring populations of marine mammals to make sure they stay at optimum levels. If a population falls below its optimum level, it is designated as “depleted,” and a conservation plan is developed to guide research and management actions to restore the population to healthy levels.

In 1994, Congress amended the MMPA, to govern the taking of marine mammals incidental to commercial fishing operations. This amendment required the preparation of stock assessments for all marine mammal stocks in waters under U.S. jurisdiction, development and implementation of take reduction plans for stocks that may be reduced or are being maintained below their optimum sustainable population levels due to interactions with commercial fisheries, and studies of pinniped-fishery interactions.

10.15 Paperwork Reduction Act

The Paperwork Reduction Act (PRA) of 1995 (44 U.S.C. 3501 et seq.) regulates the collection of public information by federal agencies to ensure that the public is not overburdened with information requests, that the federal government's information collection procedures are efficient, and that federal agencies adhere to appropriate rules governing the confidentiality of such information. The PRA requires NOAA Fisheries Service to obtain approval from the OMB before requesting most types of fishery information from the public.

10.16 Small Business Act

The Small Business Act of 1953, as amended, Section 8(a), 15 U.S.C. 634(b)(6), 636(j), 637(a) and (d); Public Laws 95-507 and 99-661, Section 1207; and Public Laws 100-656 and 101-37 are administered by the Small Business Administration. Because most businesses associated with fishing are considered small businesses, NOAA Fisheries Service, must make an assessment of how those regulations will affect small businesses. Implications to small businesses are discussed in Section 8, herein.

10.17 Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Provisions

The amended MSFCMA requires adverse effects to EFH caused by fishing be minimized to the extent practicable and identify other actions to encourage the conservation and enhancement of that EFH. Each existing, and any new FMPs must describe and identify EFH for the fishery, minimize to the extent practicable adverse effects on that EFH caused by fishing, and identify other actions to encourage the conservation and enhancement of that EFH. Under separate action, the Council approved a Generic EFH Amendment, including an EIS, during January 2005. The EFH Amendment describes and identifies EFH for Gulf fisheries; (2) identifies other actions to encourage the conservation and enhancement of such EFH; and (3) identify measures to minimize to the extent practicable the adverse effects of fishing on such EFH. The actions proposed within this FMP that effect EFH will be reviewed on a case-by-case basis to determine the range of potential impacts on EFH as indicated in Section 4 and 6 under siting criteria (Action 6).

10.18 Animal Health Act of 2002

The Animal Health Act of 2002 (7 U.S.C. 8301 et seq.) provides the authority to the Secretary of Agriculture to administer and promulgate animal health regulations for the prevention, control, and management of infectious diseases for all animals, except humans. The focus of the Act is the management of diseases in cultured animals but the scope also includes diseases management in wildlife that have the potential to impact cultured/farmed animals.

11.0 References

Acheson, J.M. 1979. Variations in traditional inshore fishing rights in Maine lobstering communities. Pages 253-276 *in* R.Anderson, editor. North Atlantic Maritime Culture, Mouton Publishers, The Hague.

Acheson, J.M. 1981. Anthropology of fishing. Annual Review of Anthropology 10:275-316.

Ackefors, H. 2000. Review of Swedish regulation and monitoring of aquaculture. Journal of Applied Ichthyology 16(4-5):214-223.

Ahrenholz, D.W. 1981. Recruitment and exploitation of Gulf menhaden, *Brevoortia patronus*. Fishery Bulletin 79:325-335.

Ahrenholz, D.W. 1991. Population biology and life history of the North American Menhadens, *Brevoortia* spp. Marine Fisheries Review 53 (4):3–19.

Alarcon, J.A., A Magoulas, T. Georgakopoulos, E. Zouros, and M.C. Alvarez. 2004. Genetic comparison of wild and cultivated European populations of gilthead sea bream (*Sparus aurata*). Aquaculture 230:65-80.

Alonso, M. K., E.A. Crespo, S.N. Pedraza, N. A. Garcia, and M. A. Coscarella. 2000. Food habits of the South American sea lion, *Otaria flavescens*, off Patagonia, Argentina. Fishery Bulletin 98:250-263.

Alston, D.E. A. Cabarcas, J. Capella, D. D. Benetti, S. Keene-Meltzoff, J. Bonilla, and R. Cortés. 2005. Environmental and Social Impact of Sustainable Offshore Cage Culture Production in Puerto Rican Waters. Department of Marine Sciences, PO Box 9013, University of Puerto Rico, Mayagüez Campus. Mayagüez, PR 00681-9013 USA. Final Report. 4 April, pp. 9–12. National Oceanic and Atmospheric Administration (NOAA), United States Department of Commerce. http://www.lib.noaa.gov/docaqua/reports_noaaresearch/finaloffshorepuertorico.pdf

AMTC (Atlantic Menhaden Technical Committee). 2006. Stock assessment report for Atlantic menhaden. Report prepared for the Atlantic Menhaden Management Board. 139 pp.

Amos, K., and A. Appleby. 2001. Atlantic salmon (*Salmo salar*) in the Pacific Northwest: Assessing risk of impact on wild Pacific salmon. In: Proceedings of the International Conference on Risk Analysis in Aquatic Animal Health. C.J. Rogers, editor. World Organization for Animal Health (Office International des Epizooties – OIE), Paris.

Amos, K., and G. Olivier. 2002. Disease interactions between wild and cultured fish. Bulletin of the European Association of Fish Pathologists 22(2):94-102.

Anderson, J.L. 2002. Aquaculture and the Future: Why Fisheries Economists Should Care. Marine Resource Economics 17:133-151.

Anderson, J., and G. Shamshak. 2008. Future Markets for Aquaculture Products. Pages 231 – 243 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities (Pre-Publication copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, Maryland. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

ANZECC (Australian and New Zealand Environment and Conservation Council). 1992. Australian water quality guidelines for fresh and marine waters. National Water Quality Management Strategy Paper No. 4. Canberra.

Arnold, M. 1992. Natural hybridization as an evolutionary process. Annual Review of Ecology and Systematics 23:237–261.

Associated Press State and Local Wire. April 7, 2005. Kona offshore fish farm stocked; fish to be ready by fall.

Atlanta Journal Constitution, The. October 29, 2008, Fish of the Future.

Auburn University Marine Extension and Research Center (2001) plus this link to the reference list. http://d276864.h39.zee-hosting.com/pdf/masgp/01-002-02.pdf

Baltz, D.M. 1991. Introduced fishes in marine systems and inland seas. Biological Conservation 56:151–177.

Barlow, S.M., and I.H. Pike. 1999. Fish meal and oil to the year 2010. World Aquaculture 99, April 26-May 2, 1999. Sydney, Australia (Abstract only).

Barnaby, R., and S. Adams. 2002. Aquaculture: Opportunity or Threat to Traditional Capture Fishermen? Pages 71-78 *in* R.R. Stickney and J.P. McVey, editors. Responsible Marine Aquaculture. CABI Publishing, New York, New York.

Barton, N. 1979. The dynamics of hybrid zones. Heredity 43:341– 359.

Barton, N.H., and G.M. Hewitt. 1985. Analysis of hybrid zones. Annual Review of Ecology and Systematics 16:113–148.

Barton, N.H., and G.M. Hewitt. 1989. Adaptation, speciation and hybrid zones. Nature 341:497–503.

Baumgartner, M.F., K.D. Mullin, L.N. May, and T.D. Leming. 2001. Cetacean habitats in the northern Gulf of Mexico. Fishery Bulletin 99:219-239.

Bax, N., J.T. Carlton, A. Mathews-Amos, R.L. Haedrich, F.G. Hogwarth, J.E. Purcell, A. Rieser, and A. Gray. 2001. The control of biological invasions in the world's oceans. Conservation Biology 15:1234–1246.

Beamish, R., S. Jones, C. Neville, R. Sweeting, G. Karreman, S. Saksida, and E. Gordon. 2006. Exceptional marine survival of pink salmon that entered the marine environment in 2003 suggests that farmed Atlantic salmon and Pacific salmon can coexist successfully in a marine ecosystem on the Pacific coast of Canada. ICES Journal of Marine Science 63:1326-1337.

Benetti, D.D., M.R. Orhun, I. Zink, F.G Cavalin, B. Sardenberg, K. Palmer, B. Denlinger, D. Bacoat, and B. O'Hanlon. 2007. Aquaculture of cobia *Rachycentron canadum* in the Americas and the Caribbean. Pages 57-77 *in* I.C. Liao and E.M. Leano, editors. Cobia Aquaculture: Research, Development, and Commercial Production, Asian Fisheries Society, Manila, Philippines, World Aquaculture Society, Louisiana, USA. The Fisheries Society of Tiawan, Keelung, Tiawan, and National Tiawan Ocean University, Keelung,Tiawan.

Benetti, D.D., M.R. Orhun, B. Sardenberg, B. O'Hanlon, A. Welch, R. Hoenig, I. Zink, J.A. Riviera, B. Denlinger, D. Bacoat, K. Palmer, and F. Cavalin. 2008. Advances in hatchery and grow out technology of cobia *Rachycentron canadum* (Linnaeus). Aquaculture Research. 39:701-711.

Benetti, D. 2008. University of Miami, personal communication.

Bergstad, O.A., and A. Folkvord. 1997. Dispersal of tagged juvenile turbot *Scophthalmus maximus* on the Norwegian Skagerrak coast. Fisheries Research 29:211-215.

Berntssen, M.H.G, A.K. Lundebye, and B.E. Torstensen. 2005. Reducing the levels of dioxin-like PCBs in farmed Atlantic salmon by dietary substitution of fish oils with vegetable oils; a life cycle study. Aquaculture Nutrition 11:219-232.

Beveridge, M. 2004. Cage Aquaculture. Blackwell Publishing. Oxford, United Kingdom.

Bjorn, P.A., B. Finstad, and R. Kristoffersen. 2001. Salmon lice infection of wild sea trout and Arctic charr in marine and freshwaters. Aquaculture Research 32:947-962.

Bjorn, P.A., and B. Finstad. 2002. Salmon lice, *Lepeophtheirus salmonis* (Kroyer) infestation in sympatric populations of Arctic charr, *Salvelinus alpinus* (L.), sea trout, *Salmon trutta* (L.) in areas near and distant from salmon farms. ICES Journal of Marine Science 59:131-139.

Borgatti and Buck. 2004. CRS Report to Congress. Open Ocean Aquaculture. http://www.ncseonline.org/NLE/CRSreports/04aug/RS21914.pdf.

Brooks, E.N. 2002. Assessment of little tunny, *Euthynnus alleteratus*, in the Gulf of Mexico. SFD Contribution SFD 01/02-160.

Brooks, K. 2005. The effects of water temperature, salinity and currents on the survival and distribution of the infective copepodid stage of sea lice (*Lepeophtheirus salmonis*) originating on Atlantic salmon farms in the Broughton Archipelago of British Columbia, Canada. Reviews in Fisheries Science 13:177-204

Brooks, K.M., and C.V.W. Mahnken. 2003. Interactions of Atlantic salmon in the Pacific Northwest. Environmental Fisheries Research 62(3):255-293.

Buckel, J.A., M.J. Fogarty, and D.O. Conover. 1999. Mutual prey of fish and humans: a comparison of biomass consumed by bluefish, *Pomatomus saltatrix*, with that harvested by fisheries. Fishery Bulletin 97:776-785.

Buitrago, J., M. Radal, H. Hernandez, and E. Buitrago. 2005. A single-use site selection technique, using GIS, for aquaculture planning: Choosing locations for mangrove oyster raft culture in Margarita Island, Venezuela. Environmental Management 35(5):544-556.

Burks, C., Mullin, K.D., Swartz, S.L., and A. Martinez. 2001. Cruise Results, NOAA ship Gorgon Gunter Cruise GU-01-01(11), 6 February-3 April 2001, Marine Mammal Survey of Puerto Rico and the Virgin Islands and a Study of Sperm Whales in the Southeastern Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-462, 58 p.

Campton, D. 1987. Natural hybridization and introgression in fishes. Pages 161-192 *in* N. Ryman and F. Utter, editors. Population Genetics and Fisheries Management. University of Washington Press, Seattle.

Carr, J., and F. Whoriskey. 2004. Sea lice infestation rates on wild and escaped farmed Atlantic salmon, *Salmon salar* (L.) entering the Magaguadavic River, New Brunswick. Aquaculture Research 35:723-729.

Carter, C.G., and R.C. Hauler. 2000. Fish meal replacement by plant meals in extruded feeds for Atlantic salmon, *Salmo salar* L. Aquaculture 185:299-311.

Cass, R.C., and J.J. Edney. 1978. The commons dilemma: A simulation testing the effects of resource visibility and territorial division. Human Ecology 6:371–378.

Cass-Calay, S., and M. Bahnick. 2002. Status of the yellowedge grouper fishery in the Gulf of Mexico. NMFS, Southeast Fisheries Science Center, Miami, Florida. SFD Contribution No. SFD 02/03-72. 67 pp.

Cates, R., Owner of Cates International, Inc., personal communication.

Clean Water Act. 2004. Water Pollution Prevention and Control. Environmental Protection Agency, Washington D.C.

Cicin-Sain, B., S.M. Bunsick, R. DeVoe, T. Eichenberg, J. Ewart, H. Halvorson, R.W. Knecht, and R. Rheault. 2001. Development of a policy framework for offshore marine aquaculture in the 3-200 mile U.S. ocean zone. Center for the Study of Marine Policy, University of Delaware.

Coad, B.W., 1995. Freshwater fishes of Iran. Acta Science Natational Acadademy of Science Brno 29(1):1-64.

Collard, S. 1990. Leatherback turtles feeding near a watermass boundary in the eastern Gulf of Mexico. Marine Turtle Newsletter 50:12-14.

Command, B. 2005. "Award-winning proposal." West Hawaii Today (February 7, 2005). At http://www.westhawaiitoday.com/articles/2005/02/07/features/features01.txt.

Command, B. 2008.
http://www.westhawaiitoday.com/articles/2008/10/11/local/local02.txt

Continental Shelf Associates, Inc. and Texas A&M University. 2001. Mississippi/Alabama Pinnacle Trend Ecosystem Monitoring, Final Synthesis Report. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGS BSR 2001-0007 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA OCS Study MMS 2001-080. 415 pp. plus appendices.

Corbin, J. 2006. Offshore Aquaculture in Hawaii. Powerpoint presentation. U.S. Department of Agriculture, Aquaculture Development Program. Obtained online at http://www.whoi.edu/cms/files/jmcdowell/2006/7/Corbin_Offshore_Aquaculture_Development_in_Hawaii_12248.pdf.

Council for Environmental Quality. 1997. Considering cumulative effects under the National Environmental Policy Act. Council on Environmental Policy, Executive Office of the President. 64 pp. plus appendices.http://ceq.eh.doe.gov/nepa/ccenepa/ccenepa.htm

Courtenay, W.R., and C.R. Robins. 1973. Exotic aquatic organisms in Florida with emphasis on fishes: a review and recommendations. Transactions of the American Fisheries Society 102:1-12.

Courtenay, W.R., and J.R. Stauffer. 1990. The introduced fish problem and the aquarium fish industry. Journal of the World Aquaculture Society 21:145-159.

D'Antonio, C., L.A. Meyerson, and J. Denslkow. 2001. Exotic species and conservation. Pages 57-80 *in* M.E. Soulé and G.H. Orians editors. Conservation biology; research priorities for the next decade, Island Press, Washington, DC.

Darnell, R. M., and J. A. Kleypas. 1987. Eastern Gulf shelf bio-atlas, a study of the distribution of demersal fishes and penaeid shrimp of soft bottom of the continental shelf from the Mississippi River Delta to the Florida Keys. OCS Study MMS 86-0041. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Darnell, R. M., R. E. Defenbaugh, and D. Moore. 1983. Northwestern Gulf shelf bio-atlas, a study of the distribution of demersal fishes and penaeid shrimp of soft bottoms of the continental shelf from the Rio Grande to the Mississippi River Delta. Open File Report 82-04. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Davis, M.A. 2003. Biotic globalization: does competition from introduced species threaten biodiversity? Bioscience 53:481-489.

Davis, R.W., W.E. Evans, and B. Würsig. 2000a. Cetaceans, Sea Turtles, and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume I: Executive Summary. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geologic Survey, Biological Resources Division, USGS/BRD/CR - 1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. OCS Study MMS 2000-002: 27 pp.

Davis, R.W., W.E. Evans, and B. Würsig. 2000b. Cetaceans, Sea Turtles, and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Executive Summary. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geologic Survey, Biological Resources Division, USGS/BRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. OCS Study MMS 2000-003. 346 pp.

Davis, R.W., and G.S. Fargion. 1996. Distribution and abundance of cetaceans in the north-central and western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. U.S. Dept. of the Interior, Minerals Management. Service, Gulf of Mexico OCS Region, New Orleans, La. 357 pp.

DeVoe, M.R., and C.E. Hodges. 2002. Management of Marine Aquaculture: the Sustainability Challenge *in* R.R. Stickney and J.P. McVey editors. Responsible Marine Aquaculture. CAB International.

Easley, J.E., C. Adams Jr, W. N. Thurman, and J. Kincaid. 1993. The Derived Demand for Commercially Harvested Gulf and South Atlantic King Mackerel: Partial and General Equilibrium Models. Project Report to the Gulf of Mexico Fishery Management Council, March 29, 42 pp.

Eklund, A. 1994. Status of the stocks of Nassau grouper, *Epinephelus striatus*, and jewfish, *Epinephelus itajara* – final report. Contribution MIA-94/95-15. NMFS, SEFSC, Miami, Florida. 16 pp.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp industry of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-490. 88 pp.

FAO (Food and Agriculture Organization). 1994. A global assessment of fisheries by-catch and discards. Fish Technical Paper 339, FAO, Rome, 233 pp.

FAO (Food and Agriculture Organization). 1997. FAO Database on Introduced Aquatic Species. FAO Database on Introduced Aquatic Species, FAO, Rome.

FAO (Food and Agriculture Organization). 1998. The state of world fisheries and aquaculture. FAO, Rome, 112 p.

FAO (Food and Agriculture Organization). 2005. FAO Fisheries Department, Fishery Information, Data and Statistics Unit. Fishstat Plus: Universal software for fishery statistical time series. Aquaculture production: quantities 1950–2003; Aquaculture production: values 1984–2003; Capture production: 1950–2003; Commodities production and trade: 1950–2003; Total production: 1970–2003. www.fao.org/fi/statist/FISOFT/FISHPLUS.asp.

FAO (Food and Agriculture Organization). 2007. The state of world fisheries and aquaculture 2006. FAO, Rome. Available from: http://www.fao.org/docrep/009/A0699e/A0699E00.HTM

Fernandes, T.F., and P.A. Read. 2001. Aquaculture and the management of coastal zones. Proceedings of the second MARAQUA workshop, Crete, March 2000.

Fernandes, T.F., A. Eleftheriou, H. Ackefors, M. Eleftheriou, A. Ervik, A. Sanchez-Mata, T. Scanlon, P.White, S. Cochrane, T.H. Pearson, and P.A. Read. 2001: The scientific principles underlying the monitoring of the environmental impacts of aquaculture. Journal of Applied Ichthyology 17(4):181–193.

Forristall, A. 2008. Sustainability fuels popularity at white-tablecloth locations. SeaFood Business (February 28, 2008).

Forster, J. 1996. Cost and Market Realities in Open Water Aquaculture. Pages 137-149 *in* M. Polk editor. Open Ocean Aquaculture: Proceedings of an international conference. Portland, ME. New Hampshire/Maine Sea Grant College Program. Report # UNHMP-CP-SG-96-9.

Freeman, L.H. 1992. How to write quality EISs and EAs; guidelines for NEPA documents. Shipley Associates, Bountiful, Utah. 84 pp. plus appendices.

Friedland, K.D. 1985. Functional morphology of the branchial basket structures associated with feeding in the Atlantic menhaden, *Brevoortia tyrannus* (Pisces: Clupeidae). Copeia 1985:1018-1027.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. Journal of Herpetology 17:327-344

Froese, R., and D. Pauly. 2002. FishBase. Available at http://www.fishbase.org (accessed October 15 2002).

FWRI (Florida Fish and Wildlife Research Institute). 2000. Sea Stats: Baitfish. Florida Fish and Wildlife Conservation Commission. 4 p. http://research.myfwc.com/engine/download_redirection_process.asp?file=baitfish%5F4418%2Epdf&objid=-1442&dltype=product.

Gardner, J. 1997. Hybridization in the sea. Advances in Marine Biology 31:2-78.

Gatlin, D.M. III, F.T. Barrows, P. Brown, K Dabrowski, T. G. Gaylord, R.W. Hardy, E. Herman, G. Hu, A. Krogdahl, R. Nelson, K. Overturf, M. Rust, W. Sealey, D. Skonberg, E.J. Souza, D. Stone, and R. Wilson, E. Wurtele. 2007. Expanding the utilization of sustainable plant products in aquafeeds: a review. Aquaculture Research 38:551-579.

GMFMC. 1981. Fishery management plan for the reef fish fishery of the Gulf of Mexico and environmental impact statement. Gulf of Mexico Fishery Management Council, Tampa, Florida.

GMFMC. 1990. Amendment Number 5 to the Fishery Management Plan for the Coastal Migratory Pelagic Resources (mackerels). Includes environmental assessment and regulatory impact review. March 1990. Gulf of Mexico Fishery Management Council. 33 pp. plus appendices.

GMFMC. 1992. Amendment 6 to The Fishery Management Plan for Coastal Migratory Pelagics in The Gulf of Mexico and South Atlantic Includes Environmental Assessment Regulatory Impact Review and Initial Regulatory Flexibility Analysis. June 1992. Gulf of Mexico Fishery Management Council. 35 pp. plus appendices.

GMFMC. 1994. Amendment 2 to the Fishery Management Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic including a final supplemental environmental impact statement, regulatory impact review, and initial regulatory flexibility analysis. Gulf of Mexico Fishery Management Council, Tampa, Florida. 56 pp. plus appendices.

GMFMC. 1995. Amendment 3 to the Fishery Management Plan for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic including a final supplemental environmental impact statement, regulatory impact review, and initial regulatory flexibility analysis. Gulf of Mexico Fishery Management Council, Tampa, Florida. 31 pp. plus appendices.

GMFMC. 2003. Gulf of Mexico Fishery Management Council Mariculture Policy. September 2003. 4 pp.

GMFMC. 2004. Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the following fishery management plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Stone Crab Fishery of the Gulf of Mexico, Coral and Coral Reef Fishery of the Gulf of Mexico, Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic, Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic. Gulf of Mexico Fishery Management Council, Tampa, Florida.

GMFMC. 2005. Generic Amendment 3 for addressing EFH requirements, HAPCs , and adverse effects of fishing in the following FMPs of the Gulf of Mexico: Shrimp, Red Drum, Reef Fish, Stone Crab, Coral and Coral Reefs in the GOM and Spiny Lobster and the Coastal Migratory Pelagic resources of the GOM and South Atlantic. Gulf of Mexico Fishery Management Council, Tampa, Florida.

GMFMC and SAFMC. 1982. Environmental impact statement and fishery management plan for Coral and Coral Reef resources of the Gulf of Mexico and South Atlantic. Gulf of Mexico Fishery Management Council, Tampa, Florida.

Golani, D. 1993. Trophic adaptation of Red-Sea fishes to the eastern Mediterranean environment - review and new data. Israel Journal of Zoology 39:391-402.

Golani, D. 1998. Impact of Red Sea fish migrants though the Suez Canal on the aquatic environment of the eastern Mediterranean. Transformations of Middle Eastern Natural Environments: Legacies and Lesions. Yale School of Forestry and Environmental Sciences Bulletin 103.

Golani, D., and A. Lerner. 2007. A long-term study of the sandy shore ichtyofauna in the northern Red Sea (Gulf of Aqaba) with reference to adjacent marine aquaculture facility. The Raffles Bulletin of Zoology 14:255-264.

Goldburg, R., and T. Triplett. 1997. Murky waters: environmental effects of aquaculture in the United States. Environmental Defense Fund, Washington D.C.

Goldschmidt, T., F. Witte, and J. Wanink. 1993. Cascading effects of the introduced Nile perch on the detritivorous/phytoplanktivorous species in the sublittoral areas of Lake Victoria. Conservation Biology 7:686-700.

Gonser, James. “Hawai’i aquaculture lease first in nation.” Zero Impact Productions. August 11, 2003. http://www.zeroimpactproductions.com/newsfiles/ Aquaculture.html.

Gordon, H.S. 1954. The economic theory of a common-property resource: The fishery. The Journal of Political Economy 62 (2):124-142.

GFTA (Grain and Feed Trade Association). 2008. FIN Dossier 2008: Annual review of feed grade fish stocks used to produce fishmeal and fish oil for the UK market. Available in pdf format from: http://www.gafta.com/fin/

Grosholz, E.D., and G.M. Ruiz. 1996. Predicting the impact of introduced marine species: Lessons from the multiple invasions of the European green crab *Carcinus maenas*. Biological Conservation 78:59-66.

Grosholz, E.D., G.M. Ruiz, C.A. Dean, K.A. Shirley, J.L. Maron, and P.G. Connors. 2000. The impacts of a nonindignous marine predator in a California bay. Ecology 81: 1206-1224.

Hambrey, J., and M. James. 2005. Site optimization for aquaculture operations. Final Report. 110 pp. http://www.sarf.org.uk/Project%20Final%20Reports/SARF005%20-%20Final%20Report.pdf

Hambrey, J., and T. Southall. 2002. Environmental risk assessment and communication in coastal aquaculture. Background paper and discussion document for GESAMP WG31, Nautilus Consultants, Edinburgh.

Hammond, Donald. August 14, 2001. http://saltwaterfishing.sc.gov/pdf/cobia%20report.pdf

Hao, S. 2007. “Net Gains for Hawai‘i.” HonoluluAdvertiser.com. April 15, 2007. At http://the.honoluluadvertiser.com/article/2007/Apr/15/bz/FP704150334.html.

Hardin, G. 1968. The tragedy of the commons. Science 162:1243-1248.

Hargrave, B.T., G.A. Phillips, L.I. Doucette, M.J. White, T.G. Milligan, D.J. Wildish, and R.E. Cranston. 1997. Assessing benthic impacts of organic enrichment from marine aquaculture. Water Air Soil Pollution 99:641-650.

Hardy, R.W. 2000. New developments in aquatic feed ingredients, and potential of enzyme supplements. *in* L.E. Cruz-Suarez, D. Ricque-Marie, M.Tapia-Salazar, M.A. Olvera-Novoa, and R. Civera-Cerecedo, editors. Avances in Nutricion Acuicola V. Memorias del V Simposium Internacional de Nutricion Acuicola. 19-22 Noviembre, 2000. Merida, Yucatan, Mexico.

Harvey, W.D., and L.D. McKinney. 2002. Recreational Fishing and Aquaculture: Throwing a Line into the Pond. Pages 61-70 *in* R.R. Stickey and J.P. McVey, editors. Responsible Marine Aquaculture. CAB International Publishing.

Hawaii DOA (Department of Agriculture). 2001. "State Authorizes First Ocean Leasing Agreement." (March 9, 2001).

Hawaii DLNR and DOA (Department of Land and Natural Resources and Department of Agriculture). 2003. Fifth Report to the Legislature, State of Hawaii, 2004 Regular Session: Implementation of Chapter 190D, Hawaii Revised Statutes: Ocean and Submerged Lands Leasing, December.

Hawaii DOA and DLNR (Department of Agriculture and Department of Land and Natural Resources). November 2007. Report to the Twenty-Fourth Legislature, State of Hawaii, 2008 Regular Session, Implementation of Chapter 190D, Hawaii Revised Statutes, Ocean and Submerged Lands Leasing.

Hawke, J.P., R.L. Thune, R.K Cooper, E. Judice, M. Kelly-Smith. 2003. Molecular and phenotypic characterization of strains of *Photobacterium damselae* subsp. *Piscidia* isolated from hybrid striped bass cultured in Louisiana, USA. Journal of Aquatic Animal Health 15(3):189-201.

Hedlund, S. 2004. "Legislation opens federal waters to fish farming" in Seafood Business 24 (7):1-2 (July 2004). "Domestic offshore aquaculture has a promising future: industry must overcome a few obstacles before it flourishes" in Seafood Business 23 (3): 34 (March 2007).

Helsley, C.E. 2000. Hawai'i Open Ocean Aquaculture Demonstration Program. UJNR Technical Report No. 28: 15 – 22.

Henderson, A.R., and I.M. Davies. 2001. Review of aquaculture; its regulation and monitoring in Scotland. Journal of Applied Ichthyology 16(4-5):200-208.

Hewitt, G. 1988. Hybrid zones- Natural laboratories for evolutionary studies. Trends in Ecology and Evolution 3:158–167.

Higgs, D.A., J.S. Macdonald, C.D. Levings, and B.J Dosanjh. 1995. Nutrition and feeding habits in relation to life history stage. Pages 159-317 *in* C. Groot, L. Margolis, W.C. Clarke editors. Physiological Ecology of Pacific Salmon. UBC Press, Vancouver.

Hoagland, P., H.L. Kite-Powell, and D. Jin. 2004. Business Planning handbook for the Ocean Aquaculture of Blue Mussels. Marine Policy Center. Woods Hole Oceanographic Institute, Woods Hole, MA.

Holiman, S. G. 1999. Economic summary of the Gulf of Mexico reef fish recreational fishery. October. SERO-ECON-00-02.

Holiman, S. G. 2000. Summary report of the methods and descriptive statistics for the 1997-98 southeast region marine recreational economics survey. April. SERP-ECON-00-11.

Holland, S. M., A. J. Fedler and J. W. Milon. 1999. The operations and economics of the charter and Head Boat Fleets of the Eastern Gulf of Mexico and South Atlantic Coasts. Report for NMFS, MARFIN program grant number NA77FF0553.

Honolulu Advertiser.com. Kona Blue may expand fish-farm business to Mexico's Sea of Cortez (January 18, 2008). At http://thehonoluluadvertiser.com/article/2008/Jan/18/bz/hawaii801180337.html.

Hunter, D.C., T.C. Telfer, and L.G. Ross. 2006. Development of a GIS-based tool to assist planning of aquaculture developments. Unpublished Report, Scottish Aquaculture Research Forum. 60 pp.

ICES (International Council for Exploration of the Sea). 2002-2004. Reports of Advisory Committees.

ICES. 2002. Report of the working group on environmental interactions of marine aquaculture. ICES CM 2002/F:04.

Iglesias, J., and G. Rodriguez-Ojea. 1994. Fitness of hatchery-reared turbot, *Scopthalmus maximus* L., for survival in the sea: First year results on feeding, growth and distribution. Aquaculture Research (International Symposium on Sea Ranching of Cod and Other Marine Fish Species, Arendal (Norway), 15-18 Jun 1993).

Impact Assessment, Inc. 2005. Identifying communities associated with the fishing industry in Louisiana. La Jolla, CA. Volumes 1-3. 646 p.

Jacob, S., F. L. Farmer, M. Jepson, and C. Adams. 2001. Landing a definition of fishing dependent communities: Potential social science contributions to meeting National Standard 8. Fisheries 26(10):16-22.

Jarman, C., D. Au Bellatti, and S. Mowrey. September 2004. Legal Issues Surrounding the Development of Sustainable Forms of Aquaculture in Hawai'i. Prepared for Bridging Gaps to Insure Long-Term Viability of Small Tropical Mariculture Ventures in Hawai'i and the U.S. Affiliated Islands.

Jennins, S., and J. Kaiser. 1998. The effects of Fishing on Marine Ecosystems. Advanced Marine Biology 34:201-352.

Jin, D. 2008. Economic Potential for U.S. Offshore Aquaculture. Pages *in* 117-140 J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States:

Economic Considerations, Implications & Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD: 15-50. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Jin, D., H. Kite-Powell, and P. Hoagland. 2005. Risk Assessment in Open-Ocean Aquaculture: A Firm-Level Investment-Production Model. Aquaculture Economics and Management 9:369-387.

Jones, R., G. Prosperi-Porta, E. Kim, P. Callow, and N. Hargreaves. 2006. The occurrence of *Lepeophtheirus salmonis* and *Caligus clemensi* (Copepoda: Caligidae) on three-spine stickleback *Gasterosteus aculeatus* in coastal British Columbia. Journal of Parasitology 92(3):473-480.

Kam, L.E., P. Leung, and A.C. Ostrowski. 2003. Economics of Offshore Aquaculture of Pacific Threadfin (*Polydactulus sexfilis*) in Hawaii. Aquaculture 223(2):63-87.

Kapetsky, J.M. and J. Aguilar-Manjarrez. 2007. Geographic information systems, remote sensing and mapping for the development and management of marine aquaculture. FAO Fisheries Technical Paper No. 458. 125 pp.

Karney, R. Director and biologist at Martha's Vineyard Shellfish Group, Inc., personal communication.

Kaufman, L. 1992. Catastrophic change in species-rich freshwater ecosystems; the lessons of Lake Victoria. BioScience 42(11):846-858.

Kaushik, S.J., D. Coves, G. Dutto, and D. Blanc. 2004. Almost total replacement of fish meal by plant protein sources in the diet of a marine teleost, the European seabass, *Dicentrarchus labrax.* Aquaculture 230:391-404.

Keithly, W.R., K.J. Roberts, and J.M. Ward. 1993. Effects of shrimp aquaculture on the U.S. market: An econometric analysis. Pages 125-156 *in* U. Hatch and H. Kinnucan editors. Aquaculture: Models and Economics. Boulder and Oxford: Westview Press.

Keithly, W. R., and A. Martin. 1997. "Southeast Finfish Processing Activities of Federally Managed Species; Particularly Reeffish and Potential Impacts of Regulation." Prepared for the National Marine Fisheries Service under contract #NA47FD0290.

Kirkley, J. 2008. The Potential Economic Ramifications of Offshore Aquaculture. Pages 141-159 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD.
http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Knapp, G. 2006. Economic Potential and Impacts of United States Offshore Aquaculture. Presented at Aquaculture America 2006. University of Alaska, Anchorage.

Knapp, G., C.A. Roheim, and J.L. Anderson. 2007. The Great Salmon Run: Competition Between Wild and Farmed Salmon. Traffic North America. World Wildlife Fund, Washington, D.C.

Knapp, G. 2008a. Economic Potential for U.S. Offshore Aquaculture. Pages 15-50 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Knapp, G. 2008b. Potential Economic Impacts of U.S. Offshore Aquaculture. Pages 51-72 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Kollock, P. 1998. Social dilemmas: The anatomy of cooperation. Annual Review of Sociology 24:183 – 195.

Kona Blue Water Farms, 2003. Final Environmental Assessment For An Offshore Open Ocean Fish Farm Project Off Unualoha Point, Kona, Hawaii: Prepared For Land Division, Department Of Land And Natural Resources (July 29, 2003).

Krkosek, M., M. Lewis, and J. Volpe. 2005. Transmission dynamics of parasitic sea lice from farm to wild salmon. Proceedings of Royal Society London, Serial B. 272: 689-696.

Kutti, T., A, Ervik, and P.K. Hansen. 2007a. Effects of organic effluents from a salmon farm on a fjord system. 1. Vertical export and dispersal processes. Aquaculture 262:367-381.

Kutti, T., P.K. Hansen, A. Ervik, T. Høisæter, and P. Johannessen. 2007b. Effects of organic effluents from a salmon farm on a fjord system. 2. Temporal and spatial patterns in infauna community composition. Aquaculture 262:355-366.

LaPatra, S., and S. Foott, 2006. Disease transmission from aquaculture to wild stocks: a case history in risk evaluation. World Aquaculture 37(3):53-55.

Lawson, T.B., 1995. Fundamentals of aquacultural engineering. Chapman and Hall, New York.

Leary, R. F., F.W. Allendorf, and G.K. Sage. 1995. Hybridization and introgression between introduced and native fish. Pages 91-101 *in* H.L. Schramm, Jr. and R.G. Piper, editors, Uses and effects of cultured fishes in aquatic ecosystems. American Fisheries Society Symposium 15.

Lee, H.W., J.H. Bailey-Brock, and M. McGurr. 2006. Temporal changes in the infaunal polychaete community surrounding a Hawaiian mariculture operation. Marine Ecology Progress Series 307:175-185.

Legault, C. M. and A. M. Eklund. 1998. Generation times for Nassau grouper and jewfish with comments on M/K ratios (revised). National Marine Fisheries Service. Sustainable Fisheries Division Contribution SFD-97/98-10A. 5 pp.

Levings, C.D., A. Ervik, P. Johannessen, and J. Aure. 1995. Ecological criteria used to help site fish farms in fjords. Estuaries 18(1A):81-90.

Levings, C.D., J.M. Helfield, D.J. Stucchi, and T.F. Sutherland. 2002. A perspective on the use of performance based standards to assist in fish habitat management on the seafloor near salmon net pen operations in British Columbia. DFO Canadian Science Advisory Secretary Research Document 2002/075. 59 pp.

Lewis, R.M., and C.M. Roithmayr. 1981. Spawning and sexual maturity of Gulf menhaden, *Brevoortia patronus*. Fishery Bulletin 78:947-951.

Lipton, D.W., and D.H. Kim. 2007. Assessing the Economic Viability of Offshore Aquaculture in Korea: An Evaluation based on Rock Bream, *Oplegnathus fasciatus*, Production. Journal of the World Aquaculture Society 38(4):506-515.

Lucas, L.E. 2001. Fishery management and local communities: The case of Madeira Beach, Florida. Marine Fisheries Review 63(4):32-42.

MacKenzie, K., M. Longshaw, G.S. Begg, and A.H. McVicar. 1998. Sea lice (Copepoda: Caligidae) on wild sea trout (*Salmo trutta* L.) in Scotland. ICES Journal of Marine Science 55:151-162.

Macleod, C., and S. Forbes, editors. 2004. Guide to the assessment of sediment condition at marine fish farms, Tasmania. Tasmania Aquaculture and Fisheries Institute and Aquafarm CRC.

Maroni, K. 2000. Monitoring and regulation of marine aquaculture in Norway. Journal of Applied Ichthyology 16(4-5):192-195.

Martha Vineyard Gazette. The Fisherman (August 29, 2008). http://www.mvgazette.com/article.php?18129

Martin, L., and M. Cruzan. 1999. Patterns of hybridization in the Piriqueta caroliana complex in central Florida: evidence for an expanding hybrid zone. Evolution 53:1037–1049.

Maze-Foley, K., and Mullin, K. D. 2006. Cetaceans of the oceanic northern Gulf of Mexico: Distributions, group sizes and interspecific associations. Journal of Cetacean Research and Management 8(2):203-213.

McCay, B.M., and J.M. Acheson, editors. 1987. The Question of the Commons: The Culture and Ecology of Communal Resources. University of Arizona Press.

McComb, D. G. 2002. Galveston, Texas, *in* The Handbook of Texas Online: A Digital Gateway to Texas History at the University of Texas at Austin. www.tsha.utexas.edu/handbook/online/articles/view/GG/hdg1.html.

McVicar, A.H., L.A. Sharp, A.F. Walker, and A.W. Pike. 1993. Diseases of wild sea trout in Scotland in relation to fish population decline. Fisheries Research 17:175-85.

Merrick, R.L., M.K. Chumbley, and G.V. Byrd. 1997. Diet diversity of Stellar sea lions (*Eumetopias jubatus*) and their population decline in Alaska: a potential relationship. Canandian Journal of Fisheries Aquatic Science 54:1342-1348.

Milon, J., S. Larkin, D. Lee, K. Quigley, and C. Adams. 1998. The Performance of Florida's Spiny Lobster Trap Certificate Program. Florida Sea Grant Report No. 116. State University System of Florida. Gainesville, FL (December 1998).

Minerals Management Service. 1997. Gulf of Mexico OCS Lease Sales 169, 172, 175, 178, and 182, Central Planning Area, Final Environmental Impact Statement. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, LA.

Minerals Management Service. 2002. Gulf of Mexico OCS oil and gas lease sales: 2003-2007; Central Planning Area Sales 185, 190, 194, 198, and 201; Western Planning Area Sales 187, 192, 196, and 200—final environmental impact statement. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS EIS/EA MMS 2002-052.

Monaghan, P. 1992. Seabirds and sandeels: the conflict between exploitation and conservation in the North Sea. Biodiversity Conservation 1(2):98-111.

Mooney, H.A., and E.E. Cleland. 2001. The evolutionary impact of invasive species. Proceedings of the National Academy of Sciences 98:5446-5451.

Morton A., R. Routledge, and R. Rilliams. 2005. Temporal patterns of sea louse on wild Pacific salmon relation to the fallowing of Atlantic salmon farms. North American Journal of Fisheries Management 25:811-821.

Mourente, G., J.E. Good, and J.G. Bell. 2005. Partial substitution of fish oil with rapeseed, linseed, and olive oils in diets for European sea bass (*Dicentrarchus labrax* L.) effects on flesh fatty acid composition, plasma protaglandins E_2 and $F_{2\alpha}$, immune function and effectiveness of a fish oil finishing diet. Aquaculture Nutrition 11:25-40.

MSAP. 2001a. 2001 Report of the Mackerel Stock Assessment Panel. Available from the Gulf of Mexico Fishery Management Council, Tampa, Florida 18 pp.

MSAP. 2001b. Report of the Mackerel Stock Assessment Panel on the 2001 cobia stock assessment. Available from the Gulf of Mexico Fishery Management Council, Tampa, Florida 14 pp.

Muller, R., T. Bert, and S. Gerhart. 2006. The 2006 stock assessment update for the stone crab, *Menippe sp.*, fishery in Florida. Florida Fish and Wildlife Conservation Commission, St. Petersburg, Florida. 47 p.

Mullin, K.D, National Marine Fisheries Service, Pascagoula Laboratory, personal communication 2002.

Mullin, K. D., and G. L. Fulling. 2003. Abundance of cetaceans in the southern U.S. North Atlantic Ocean during summer 1998. Fishery Bulletin 101:603-613.

Mullin, K.D., and W. Hoggard. 2000. Visual surveys of cetaceans and sea turtles from aircraft and ships, chapter 4. In: R.W. Davis, W.E. Evans, and B. Würsig (EDS.), Cetaceans, Sea Turtles and Birds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, U.S. Geologic Survey, Biological Resources Division, USGS/BRD/CR-1999-005 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. OCS Study MMS 2000-003.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers, and B. Taggart. 1991. Cetaceans on the upper continental slope in the north-central Gulf of Mexico OCS Regional Office, New Orleans, Louisiana, 108 pp.

Murphy, M., Florida Fish and Wildlife Research Institute, personal communication.

Muus, B.J., and J.G. Nielsen. 1999. Seafish. Blackwell Science, Oxford.

MWLAP (Ministry of Water, Air, and Land Protection B.C.). 2002. Finfish waste management regulation.

Nash, C.E. 2004. Achieving Policy Objectives to Increase the Value of the Seafood Industry in the United States: The Technical Feasibility and Associated Constraints. Food Policy 29:621- 641.

Nash, C.E., P.R. Burbridge, and J.K. Volkman (editors). 2005. Guidelines for ecological risk assessment of marine fish aquaculture. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-71, 90 pp.

Naylor, R. L., R. J. Goldburg, J.H. Primavera, N. Kautsky, M.C.M. Beveridge, J. Clay, C. Folke, J. Lubchenco, H. Mooney, and M.Troell. 2000. Effect of aquaculture on world fish supplies. Nature 405:1017-1024.

Naylor, R.L., S.L. Williams, and D.R. Strong. 2001. Aquaculture: a gateway for exotic species. Science 294:1655-1656.

Nicolajsen, H. 1993. Udsaetninger af pighvarrer I Limfjorden, ved Langeland og ved Nordsjaelland 1989-1992. DFH- rapport, Denmark, Nr. 453a, 1993: 1-78 (in Danish).

NMFS (National Marine Fisheries Service). 2007. Fisheries of the United States 2005. 119 pp. http://www.st.nmfs.noaa.gov/st1/fus/fus05/fus_2005.pdf

NMFS (National Marine Fisheries Service). 2007. Summary of the National Marine Aquaculture Summit. http://aquaculture2007.noaa.gov/pdf/ summitsum_web_1_08.pdf.

NMFS (National Marine Fisheries Service). 2008. Fisheries of the United States 2007. 118 pp. http://aquaculture.noaa.gov/pdf/fisheriesoftheusaqprod2007.pdf

NMFS-NOAA (National Marine Fisheries Service – National Oceanic and Atmospheric Administration). 2003a. Notice of receipt of an application for an exempted fishing permit; request for comments. Federal Register 68:146(30 July 2003):44745 – 44747.

NMFS-NOAA (National Marine Fisheries Service – National Oceanic and Atmospheric Administration). 2003b. Disapproval of Permit for Aquaculture Feasibility Study in Federal Waters off Florida Coast. Federal Register 68:246(23 December 2003):74217-74218.

NOAA. 1998. NOAA's Aquaculture Policy. February 1998. http://aquaculture.noaa.gov/pdf/17_noaaAqpolicy.pdf

NOAA. 2004. U.S. Commission on Ocean Policy. An ocean blueprint for the 21st Century. Final Report, Washington D.C. 676p. ISBN #0-9759462-0-X.

NOAA Aquaculture Program. 2008. (Revised August 24, 2008). http://aquaculture.noaa.gov/what/welcome.html

NOAA Fisheries Service. 2007. Fish stock sustainability index: summary of stock status determination changes from October 1, 2007 through December 31, 2007. Available on line at www.nmfs.gov/sfa/domes_fish/StatusoFisheries/2007/FourthQuarter/Q4-2007-FSSISummaryChanges.pdf.

NOAA Fisheries Service 2007. Report to Congress on the status of U.S. Fisheries for 2006. 28 p.

NOAA Fisheries Service 2008. Report to Congress on the status of U.S. Fisheries for 2007. 27 p.

NOAA Fisheries Service and FWS. 1991. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

O'Brien, J.M. 2008. The wonder fish. CNN Money.com, April 21, 2008. http://money.cnn.com/2008/04/15/technology/wonder_fish.fortune/index.htm.

Ogren, L.H. 1989. Distribution of juvenile and subadult Kemp's Ridley Sea Turtles: Preliminary Results from the 1984-1987 Surveys. C.W. Caillouet Jr., and A.M. Landry Jr., editors. Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A&M University Sea Grant College Program, Galveston. TAMU-SG-89-105.

O'Hanlon, B. Founder of Snapperfarm Inc., personal communication, January 2009.

Olenin, S. 2002. Baltic Alien Species Database (on line). Klaipeda. (April 9, 2002). http://www.ku.lt/nemo/intro_contents.htm

Ostrom, E. 1990. Governing the Commons. New York, NY: Cambridge University Press.

Ostrowski, A.C., J. Bailey-Brock, and P.S. Leung. 2001. Hawaii Offshore Aquaculture Research Project (HOARP) Phase II, Final Report. The Oceanic Institute (August 31, 2001).

Ottolenghi, F., C. Silvestri, P. Giordano, A. Lovatelli, and M. New. 2004. Capture-Based Aquaculture. Food and Agricultural Organization. http://govdocs.aquake.org/cgi/content/abstract/2005/115/1150180

Pálsson, G. 1991. Coastal Economies, Cultural Accounts: Human Ecology and Icelandic Discourses. Manchester: University of Manchester Press.

Pérez, J.E., C. Alfonsi, M. Nirchio, C. Muñoz, and J.A. Gómez. 2003. The introduction of exotic species in aquaculture: a solution or part of the problem? Interciencia 28(4):234-238.

Perez, O.M., T.C. Telfer, and L.G. Ross. 2005. Geographical information systems-based models for offshore floating marine fish cage aquaculture site selection in Tenerife, Canary Islands. Aquaculture Research 36(10):946-961.

Perez-Enriquez, R., and M. Takemura, K. Tabata, and N. Tniguchi. 2001. Genetic diversity of red sea bream *Pagrus major* in western Japan in relation to stock enhancement. Fisheries Science 67:71-78.

Posadas, B.C. 2004. Potential Economic Impact of Commercial Offshore Aquaculture in the Gulf of Mexico. Mississippi-Alabama Sea Grant publication MASGP 04-036.

Posadas, B. C. and C. J. Bridger, 2004. Economic Feasibility and Impact of Offshore Aquaculture in the Gulf of Mexico. Pages 109-127 *in* C.J. Bridger, editor. Efforts to Develop a Responsible Offshore Aquaculture Industry in the Gulf of Mexico: A Compendium of Offshore Aquaculture Consortium Research. Mississippi-Alabama Sea Grant Consortium, Ocean Springs, MS.

Prager. 2000. Exploratory assessment of dolphinfish, *Coryphaena hippurus*, based on U.S. landings from the Atlantic Ocean and Gulf of Mexico. NMFS, SEFSC, Beaufort, North Carolina.

Rabalais, N.N., and R.E. Turner, editors. 2001. Coastal Hypoxia: Consequences for Living Resources and Ecosystems. Coastal and Estuarine Studies 58, American Geophysical Union, Washington, D.C.

Rabalais, N.N., R.E. Turner, and W.J. Wiseman, Jr. 1999. Hypoxia in the northern Gulf of Mexico: Linkages with the Mississippi River. Pages *in* 297-322 H. Kumpf, K. Steidinger, and K. Sherman, editors. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Blackwell Science. Malden, Massachusetts.

Rabalais, N.N., R.E. Turner, and W.J. Wiseman, Jr. 2002. Gulf of Mexico hypoxia, a.k.a. “The dead zone.” Annual Review of Ecology and Systematics 33:235–263.

Randall, J.E. 1987. Introductions of marine fishes to the Hawaiian Islands. Bulletin of Marine Science 41:490–492.

Rao, K., and K. Lakshmi. 1999. Cryptic hybridization in marine fishes: significance of narrow hybrid zones in identifying stable hybrid populations. Journal of Natural History 33:1237–1259.

Rapp, P. 2006. Preliminary results from NOAA Grant NA040AR4170 – Measurement of the benthic loading and the benthic impact from an open-ocean fish farm in tropical waters. 3 pp. http://www.snapperfarm.com/2006/snapperfarmsr&dactivities.htm.

Rathbone, C.K. and J.K. Babbitt. 2000. Whitefish offals make great fish feeds. World Aquaculture 31(3):20-22.

RDSAP. 2000. Sixth report of the red drum stock assessment panel. Gulf of Mexico Fishery Management Council, Tampa, Florida. 9 pp.

REEF. 2002. Reef Environmental Education Foundation. (October 15, 2002). http://www.reef.org.

Reporter, The. Offshore Fish Farm Company Thinks Cobia is a Winner. (January 11, 2008). http://reporter.bz/index.php?option=content&task=view&id=2493&Itemid=2

Rezak, R., T. J. Bright, and D. W. McGrail. 1985. Reefs and banks of the northwestern Gulf of Mexico: Their geological, biological, and physical dynamics. John Wiley and Sons, New York. 259 pp.

Rieser, A., and S. Bunsick. 1999. Offshore Marine Aquaculture in the U.S. Exclusive Economic Zone (EEZ): Legal and Regulatory Concerns. Pages 95-99 *in* B. Cicin-Sain, R.W. Knecht, and N. Foster, editors. Trends and future challenges for U.S. National Ocean and Coastal policy. National Oceanic and Atmospheric Administration.

Roden, C.L., and K.D. Mullin. 2000. Sightings of cetaceans in the northern Caribbean adjacent waters, winter 1995. Caribbean Journal of Science, 36(3-4):280-288.

Roithmayr, C.M., and R.A. Waller. 1963. Seasonal occurrence of *Brevoortia patronus* in the northern Gulf of Mexico. Transactions of the American Fisheries Society 92:301-302.

Roques, S., D. Pallotta, J.M. Sévigny, and L. Bernatchez. 2001. Evidence for broadscale introgressive hybridization between two redfish (genus *Sebastes*) in the North-west Atlantic: a rare marine example. Molecular Ecology 10:149–165.

Rose A.S., A. Ellis, and A. Munro, 1989. The infectivity by different routes of exposure and shedding rates of *Aeromonas salmonicida* subsp. salmonicida in Atlantic salmon, *Salmo salar* L., held in seawater. Journal of Fish Disease 12(6):573-578.

Ross, L.G., Mendoza QM, E.A., and Beveridge, M.C.M. 1993. The application of geographical information systems to site selection for coastal aquaculture: an example base on salmonid cage culture. Aquaculture 112:165-178.

Rubino, M. 2008. Introduction. Pages 1-13 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Ryan, J. 2004. Farming the Deep Blue. Irish Sea Fisheries Board and Irish Marine Institute.

Scott, A. 1955. The fishery: The objectives of sole ownership. The Journal of Political Economy 63 (2):116 – 124.

Scottish Executive Central Research Unit. 2002. Review and synthesis of the environmental effects of aquaculture. The Stationery Office, Edinburgh.

SCRS. 2007. Report of the Standing Committee on Research and Statistics, ICCAT Standing Committee on Research and Statistics, October 1 – 5, 2007.

SEA (Strategic Environmental Assessment Division, NOS). 1998. Product overview: Products and services for the identification of essential fish habitat in the Gulf of Mexico. NOS, Silver Spring, Maryland; NMFS, Galveston, Texas; and GMFMC, Tampa, Florida (available at http//biogeo.nos.noaa.gov/projects/efh/gom-efh/)

Seafood Technology. 2007. Is cobia ready for prime time? Intrafish-September 2007:28.

SEDAR 3. 2003. SEDAR Peer Review of yellowtail snapper assessment, with comments on goliath grouper. SEDAR (http://www.sefsc.noaa.gov/sedar/), Charleston, South Carolina.12 pp. plus appendices.

SEDAR 6. 2004a. The hogfish in Florida: Assessment review and advisory report. (http://www.sefsc.noaa.gov/sedar/), Charleston, South Carolina. 12 pp.

SEDAR 6. 2004b. The goliath grouper in southern Florida: Assessment review and advisory report. SEDAR (http://www.sefsc.noaa.gov/sedar/), Charleston, South Carolina. 15 pp.

SEDAR 7. 2005. Stock assessment report of SEDAR 7 Gulf of Mexico red snapper. (http://www.sefsc.noaa.gov/sedar/), Charleston, South Carolina. 480 pp.

SEDAR 9. 2006a. Gulf of Mexico vermilion snapper assessment report 3. SEDAR, Charleston, South Carolina. 231 pp.

SEDAR 9. 2006b. Gulf of Mexico gray triggerfish assessment report. SEDAR, Charleston, South Carolina.

SEDAR 9. 2006c. Gulf of Mexico greater amberjack assessment report. SEDAR, Charleston, South Carolina.

SEDAR 10, 2006. Gulf of Mexico gag stock assessment report. SEDAR Charleston, South Carolina.

SEDAR 12, 2007. Gulf of Mexico red grouper stock assessment report. SEDAR, Charleston, South Carolina.

SEDAR 15A. 2008. Stock assessment report 3: South Atlantic and Gulf of Mexico mutton snapper. SEDAR, Charleston, South Carolina. 410 pp.

SEDAR 16. 2008. South Atlantic and Gulf of Mexico king mackerel stock assessment report. SEDAR, Charleston, South Carolina. 39 pp. plus annexes.

SEFSC. 2007. Final model for Gulf of Mexico gag grouper as recommended by the SEDAR Grouper Review panel: revised results and projections. September 5, 2007. Southeast Fisheries Science Center, Miami, Florida. 32 pp.

Semmens, B.X., E.R. Buhle, A.K. Salomon, and C.V. Pattengill-Semmens. 2004. A hotspot of non-native marine fishes: evidence for the aquarium trade as an invasion pathway. Marine Ecology Progressive Series 266:239–244.

SEPA (Scottish Environment Protection Agency). 2000. Regulation and monitoring of marine cage fish farming in Scotland; a manual of procedures. www.sepa.org.up.

SEPA (Scottish Environment Protection Agency). 2005. Regulation and monitoring of marine cage fish farming in Scotland; a manual of procedures. www.sepa.org.up.

Shamshak, G., and J. Anderson. 2008. Lessons from the Development of the U.S. Broiler and Catfish Industries: Implications for Offshore Aquaculture in the United States. Pages 97-115 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Shideler, G.L. 1981. Development of the benthic nepheloid layer on the south Texas continental shelf, northwest Gulf of Mexico. Marine Geology 26:289-313.

Shiganova , T.A. 1998. Invasion of the Black Sea by the ctenophore *Mnemiopsis leidyi* and recent changes in pelagic community structure. Fisheries and Oceans 7:305–310.

Sims, N., President/Co-Founder of Kona Blue Water Farms, personal communication, January 2009.

Skinner, L. Drum. Seafood Business (June 12, 2007).

Snieszko, S.F., G.L. Bullock, E. Hollis, and J.G. Boone. 1964. *Pasteurella* sp. from an epizootic of white perch (*Roccus americanus*) in Chesapeake Bay tidewater areas. Journal of Bacteriology 88:1814-1815.

Stanton, K. Kona fish farm's plans to expand spur concerns. Honolulu Advertiser (January 22, 2008).

Steinback, S., Gentner, B. and J. Castle. 2004. The economic importance of marine angler expenditures in the U.S. NOAA Professional Paper NMFS 2

Stickney, R.R., and J.P McVey. 2002. Responsible Marine Aquaculture, World Aquaculture Society, CBI Publishing, New York, New York.

Støttrup, J.G., and Paulsen, H. 1998. Stocking of marine fish a growing market for aquaculture. Farming Marine Fish beyond the Year 2000: Technological Solutions for Biological Challenges. ICES CM 1998/L: 3.

Sustainable Marine Aquaculture Task Force Report. 2007. Managing the risks report of the marine aquaculture task force, Woods Hole Oceanographic Institute (January 2007).

Sutton, S. G., R. B. Ditton, J. R. Stoll, and J. W. Milon. 1999. A cross-sectional study and longitudinal perspective on the social and economic characteristics of the charter and party boat fishing industry of Alabama, Mississippi, Louisiana, and Texas. Report by the Human Dimensions of Recreational Fisheries Research Laboratory, Texas A&M for NMFS, MARFIN program grant number NA 77FF0551.

Tacon, A.G.J., and M. Metian. 2008. Global overview on the use of fish meal and fish oil in industrially compounded aquafeeds: Trends and future prospects. Aquaculture 285:146-148.

Tacon, A.G.J., M.R. Hasan, and R.P. Subasinghe. 2006. Use of fishery resources as feed inputs to aquaculture development: trends and policy implications. FAO Fisheries Circular No. 1018, Rome, Italy. 99 pp.

Texas Online. 1998. Galveston. http://texas-online.com/graphic/galveston.

Thurston, L.D. 2007. Snapperfarm looks to increase local production from 50 tons to 750 tons. Caribbean Business 35(1):34.

Tidwell, J.H., and G. L. Allan. 2001. Fish as Food: Aquaculture's Contribution. European Molecular Biology Organization Reports 2 (11):958-963.

Tiersch, T.R., and J.A. Hargreaves. 2002. Contending with criticism: sensible responses in an age of advocacy. Pages 355-371 *in* R.R. Stickney and J.P. McVey, editors. Responsible Marine Aquaculture. CABI Publishing, London.

Traxler, G., D. Kieser, and J. Richard. 1999. Mass mortality of pilchard and herring associated with viral hemorrhagic septicemia in British Columbia, Canada. American Fisheries Society, Fish Health Section Newsletter 27(4):4-5.

Treece, Granvil. 2008. http://www.texasaquaculture.org/TxAqua.pdf

Tully, O., P. Gargan, W.R. Poole, and K.F. Whelan. 1999. Spatial and temporal variation in the infestation of sea trout (*Salmo trutta* L.) by the caligid copepod *Lepeophtheirus salmonis* (Kroyer) in relation to sources of infection in Ireland. Parasitology 119:41-51.

UNH (University of New Hampshire). 2007. Open Offshore Aquaculture informational. (May 17, 2007). http://ooa.unh.edu.

UNH Marine Aquaculture Center. 2006. CINEMar/Open Ocean Aquaculture Annual Progress Report for the period January 1, 2005 to December 31, 2005. http://ooa.unh.edu/publications/ progress_reports/2006/2006_monitoring.html.

Union Leader, The. Affordable skin-on fillets that will stand up to grilling. (July 24, 2008).

U.S. Commission on Ocean Policy. 2004. An Ocean Blueprint for the 21st Century. Final Report. Washington, D.C.

USDOC. 2008a. Fisheries of the United States 2007. Current Fishery Statistics No. 2007. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Silver Spring, MD.

USDOC. 2008b. Offshore Aquaculture in the United States: Economic Considerations, Implications & Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD, 263pp. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

USFWS and CB. (U.S. Fish and Wildlife Service and U.S. Census Bureau 2001). 2001. National Survey of Fishing, Hunting, and Wildlife-Associated Recreation. Washington, D.C. 116 pp. http://www.census.gov/prod/2002pubs/FHW01.pdf.

Valderrama, D., and J. L. Anderson. 2008. Interactions Between Capture Fisheries and Aquaculture. Pages 189-205 *in* J.L. Anderson, J.Forster, D. Jin, J.E. Kirkley, G. Knapp, C.E. Nash, M. Rubino, G. L. Shamshak, and D. Valderrama, editors. Offshore Aquaculture in the United States: Economic Considerations, Implications and Opportunities (Pre-Publication Copy). U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Silver Spring, MD. http://aquaculture.noaa.gov/pdf/econ/econ_rpt_all.pdf.

Varjopuro, R., E. Sahivirta, T. Makinen, and H. Helinen. 2000. Regulation and monitoring of marine aquaculture in Finland. Journal of Applied Ichthyology 16:148-156.

Vaughn, D.S., K.W. Shertzer, and J.W. Smith. 2007. Gulf menhaden (*Brevoortia patronus*) in the U.S. Gulf of Mexico: Fishery characteristics and biological reference points for management. Fisheries Research 83:263-275. http://www.gsmfc.org/menhaden/FishRes_Vaughan_etal_2007-GM.pdf

Verlaque, M., and P. Fritayre. 1994. Mediterranean algal communities are changing in face of the invasive alga *Caulerpa taxifolia*. Oceanology Acta 17:659–672.

Vitousek, P. M., H. A. Mooney, J. Lubchenco, and J. M. Melillo. 1997. Human domination of earth's ecosystems. Science 277:494-499.

Vondruska, J. 1999. An analysis of the demand for king mackerel. NMFS Fisheries Economics Office, St. Petersburg, Florida, SERO-ECON-99-07.

Vondruska, J., and W. O. Antozzi. 1999. U.S. markets and trade in king mackerel and other large mackerel. NMFS, Fisheries Economics Office, St. Petersburg, Florida SERO-ECON-99-08.

Waldemar Nelson International Inc. 2001. Offshore Mariculture in the Gulf of Mexico: A Feasibility Report, Louisiana Sea Grant College Program, Louisiana State University. Baton Rouge, Louisiana, 255pp.

Walford, L, and R. Wicklund. 1973. Contributions to a world-wide inventory of exotic marine and anadromous organisms. FAO Fish Tech Paper No 121, FAO, Rome.

Walker, S.J., and J.R Waring. 1998. (MECO). Model for estuaries and coastal oceans. CSIRO Marine Research Internal Report, OMR.

Waters, J. 1996. An Economic Survey of Commercial Reef Fish Vessels in the U.S. Gulf of Mexico. U. S. Department of Commerce, NOAA NMFS, Beaufort, North Carolina. 63pp. plus tables, figures and appendices.

Waters, J. R. 2002. Various tables prepared for the SEP meeting of the Gulf of Mexico Fishery Management Council on Grouper Landings in the Gulf. Beaufort, North Carolina.

Whitfield, P., T. Gardner, S.P. Vives, M.R. Gilligan, W.R. Courtenay, R. Carleton, and J.A. Hare. 2002. Biological invasions of the Indo-Pacific lionfish (*Pterois volitans*) along the Atlantic coast North America. Marine Ecology Progressive Series 235:289–297.

Wilcove, D.S., D. Rothstein, A. Dubow, E. Phillips, and E. Losos. 1998. Quantifying threats to imperiled species in the United States. BioScience 48:607–615.

Wiles, G.J., J. Bart, R.E. Beck, Jr., and C.F. Aguon. 2003. Impacts of the brown tree snake: Patterns of decline and species persistence in Guam's avifauna. Conservation Biology 17(5):1350-1360.

Williams E.H. 2001. Assessment of Cobia, *Rachycentron canadum*, in the waters of the U.S. Gulf of Mexico. NOAA Technical Memorandum NMFS-SEFSC-469, 54 pp.

Williamson, M., and A. Fitter. 1996. The varying success of invaders. Ecology 77:1661–1666.

Wilson, and McCay. 1998. Social and Cultural Impact Assessment of the Highly Migratory Species Fisheries Management Plan and the Amendment to the Atlantic Billfish Fisheries Management Plan http://www.st.nmfs.noaa.gov/st1/econ/cia/hms.pdf

Wiseman, W.J. Jr., and J. Sturges. 1999. Physical oceanography of the Gulf of Mexico: Processes that regulate its biology. Pages 77-92 *in* H. Kumpf, K. Steidinger, and K. Sherman, editors. The Gulf of Mexico Large Marine Ecosystem: Assessment, Sustainability, and Management. Blackwell Science. Malden, Massachusetts.

Youngson, A.F., A. Dosdat, M. Saroglia, and W.C. Jordan. 2001. Genetic interactions between marine finfish species in European aquaculture and wild conspecifics. Journal of Applied Ichthyology 17:153-162.

Zaret, T., and R.T. Paine. 1973. Species introduction in a tropical lake. Science 182: 449-455.

Zeiber, R. Summer 2008. Blue mussel farming as supplemental income. Gulf of Maine Times:12 (2).

12.0 List of Preparers

Gulf of Mexico Fishery Management Council

Trish Kennedy
Carrie Simmons
Wayne Swingle

NOAA Fisheries Service

Kevin Amos
Jessica Beck
Susan Bunsick
David Dale
William Fairgrieve
Brian Fredieu
Stephen Holiman
Denise Johnson
Jennifer Lee
Bruce Morehead
Colin Nash
Michael Rubino
Jason Rueter
Andy Strelcheck
Julie Weeder

Gulf States Marine Fisheries Commission

Jeff Rester

Independent Contractors

Darrell Brannan
Walter Keithly

13.0 List of Agencies, Organizations, and Persons to Whom Copies of the Statement Are Sent

Gulf of Mexico Fishery Management Council

Law Enforcement Advisory Panel
Standing Scientific and Statistical Committee (SSC)
Ad Hoc Aquaculture Advisory Panel

Other Agencies, Organizations, or Persons

Alabama Cooperative Extension Service
Alabama Department of Conservation and Natural Resources
Florida Fish and Wildlife Conservation Commission
Florida Sea Grant
Louisiana Cooperative Extension Service
Louisiana Department of Wildlife and Fisheries
Mineral Management Service
Mississippi Cooperative Extension Service
Mississippi Department of Marine Resources
NOAA Fisheries Service Southeast Regional Office
NOAA Fisheries Service Southeast Fisheries Science Center
NOAA Fisheries Service Silver Spring Office
NOAA Fisheries Service Law Enforcement
Texas Cooperative Extension Service
Texas Parks and Wildlife Department
United States Coast Guard
United States Environmental Protection Agency
United States Fish and Wildlife Service
United States Food and Drug Administration

14.0 Public Hearing Locations and Dates

July 9, 2007	Best Western	7921 Lamar Poole Rd	Biloxi	MS	39532	228-875-7111
July 9, 2007	Doubletree Beach Resort	17120 Gulf Blvd.	N. Reddington Beach	FL	33708	727-391-4000
July 10, 2007	W Hotel New Orleans	333 Poydras St	New Orleans	LA	70130	504-525-9444
July 10, 2007	City of Orange Beach Rec. Ctr	27235 Canal Rd	Orange Beach	AL	36561	251-981-6028
July 11, 2007	San Luis	5222 Seawall Blvd.	Galveston	TX	77550	409-744-1500
July 11, 2007	Embassy Suites Hotel	570 Scenic Gulf Drive	Destin	FL	32550	850-337-7000
July 12, 2007	Best Western Marina Grand	300 N. Shoreline Blvd.	Corpus Christi	TX	78401	361-883-5111

December 10, 2007	Comfort Inn North	2260 54th Ave. N.	St. Petersburg	FL	33714	727-362-0075
December 10, 2007	Hilton Hobby Airport	8181 Airport Blvd.	Houston	TX	77061	713-645-3000
December 11, 2007	Hilton Airport	901 Airline Drive	New Orleans	LA	70062	504-469-5000
December 12, 2007	Wingate Inn	12009 Indian River Rd.	Biloxi	MS	39540	228-396-0036
December 13, 2007	Ashbury Hotel	600 S. Beltline Hwy.	Mobile	AL	36608	251-344-8030
February 19, 2008	The Islander	82100 Overseas Hwy.	Islamorada	FL	33036	305-664-2031
July 21, 2008	Radisson Hotel	3820 N. Roosevelt Blvd.	Key West	FL	33040	305-294-5511
October 27, 2008	Renaissance Hotel	64 S. Water Street	Mobile	AL	36602	251-438-4000

15.0 Index

APPENDIX A – NOAA FISHERIES SERVICE EXEMPTED FISHING PERMIT (50CFR 600.745)

Sec. 600.745 Scientific research activity, exempted fishing, and exempted educational activity.

(a) Scientific research activity. Nothing in this section is intended to inhibit or prevent any scientific research activity conducted by a scientific research vessel. Persons planning to conduct scientific research activities in the EEZ are encouraged to submit to the appropriate Regional Administrator, Director, or designee, 60 days or as soon as practicable prior to its start, a scientific research plan for each scientific cruise. The Regional Administrator, Director, or designee will acknowledge notification of scientific research activity by issuing to the operator or master of that vessel, or to the sponsoring institution, a letter of acknowledgment. This letter of acknowledgment is separate and distinct from any permit required by any other applicable law. If the Regional Administrator, Director, or designee, after review of a research plan, determines that it does not constitute scientific research but rather fishing, the Regional Administrator, Director, or designee will inform the applicant as soon as practicable and in writing. The Regional Administrator, Director, or designee may also make recommendations to revise the research plan to make the cruise acceptable as scientific research activity or recommend the applicant request an EFP. In order to facilitate identification of activity as scientific research, persons conducting scientific research activities are advised to carry a copy of the scientific research plan and the letter of acknowledgment on board the scientific research vessel. Activities conducted in accordance with a scientific research plan acknowledged by such a letter are presumed to be scientific research activity. The presumption may be overcome by showing that an activity does not fit the definition of scientific research [[Page 83]] activity or is outside the scope of the scientific research plan.

(b) Exempted fishing.--(l) General. A NMFS Regional Administrator or Director may authorize, for limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited. Exempted fishing may not be conducted unless authorized by an EFP issued by a Regional Administrator or Director in accordance with the criteria and procedures specified in this section. The Regional Administrator or Director may charge a fee to recover the administrative expenses of issuing an EFP. The amount of the fee will be calculated, at least annually, in accordance with procedures of the NOAA Handbook for determining administrative costs of each special product or service; the fee may not exceed such costs. Persons may contact the appropriate Regional Administrator or Director to find out the applicable fee. (2) Application. An applicant for an EFP shall submit a completed application package to the appropriate Regional Administrator or Director, as soon as practicable and at least 60 days before the desired effective date of the EFP. Submission of an EFP application less than 60 days before the desired effective date of the EFP may result in a delayed effective date because of review requirements.

The application package must include payment of any required fee as specified by paragraph (b)(1) of this section, and a written application that includes, but is not limited to, the following information: (i) The date of the application. (ii) The applicant's name, mailing address, and telephone number. (iii) A statement of the purposes and goals of the exempted fishery for which an EFP is needed, including justification for issuance of the EFP. (iv) For each vessel to be covered by the EFP, as soon as the information is available and before operations begin under the EFP: (A) A copy of the USCG documentation, state license, or registration of each vessel, or the information contained on the appropriate document. (B) The current name, address, and telephone number of the owner and master, if not included on the document provided for the vessel. (v) The species (target and incidental) expected to be harvested under the EFP, the amount(s) of such harvest necessary to conduct the exempted fishing, the arrangements for disposition of all regulated species harvested under the EFP, and any anticipated impacts on marine mammals or endangered species. (vi) For each vessel covered by the EFP, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used. (vii) The signature of the applicant. (viii) The Regional Administrator or Director, as appropriate, may request from an applicant additional information necessary to make the determinations required under this section. An incomplete application or an application for which the appropriate fee has not been paid will not be considered until corrected in writing and the fee paid. An applicant for an EFP need not be the owner or operator of the vessel(s) for which the EFP is requested. (3) Issuance. (i) The Regional Administrator or Director, as appropriate, will review each application and will make a preliminary determination whether the application contains all of the required information and constitutes an activity appropriate for further consideration. If the Regional Administrator or Director finds that any application does not warrant further consideration, both the applicant and the affected Council(s) will be notified in writing of the reasons for the decision. If the Regional Administrator or Director determines that any application warrants further consideration, notification of receipt of the application will be published in the *Federal Register* with a brief description of the proposal, and the intent of NMFS to issue an EFP. Interested persons will be given a 15- to 45-day opportunity to comment and/or comments will be requested during public testimony at a Council meeting. The notification may establish a cut-off date for [[Page 84]] receipt of additional applications to participate in the same, or a similar, exempted fishing activity. The Regional Administrator or Director also will forward copies of the application to the Council(s), the USCG, and the appropriate fishery management agencies of affected states, accompanied by the following information: (A) The effect of the proposed EFP on the target and incidental species, including the effect on any TAC. (B) A citation of the regulation or regulations that, without the EFP, would prohibit the proposed activity. (C) Biological information relevant to the proposal, including appropriate statements of environmental impacts, including impacts on marine mammals and threatened or endangered species. (ii) If the application is complete and warrants additional consultation, the Regional Administrator or Director may consult with the appropriate Council(s) concerning the permit application during the period in which comments have been requested. The Council(s) or the Administrator or Regional Administrator shall notify the applicant in advance of any meeting at which the application will be considered, and offer the applicant the opportunity to appear in support of the application. (iii) As soon as practicable after receiving responses from the agencies identified in paragraph (b)(3)(i) of this section, and/or after the consultation, if any, described in paragraph (b)(3)(ii) of this section, the Regional Administrator or Director shall notify the applicant in writing of the decision to grant or deny the EFP, and, if denied, the reasons for the denial. Grounds for denial of an EFP include, but are not limited to, the following: (A) The applicant has failed to disclose material information required, or has made false statements as to any material fact, in connection with his or her application; or (B) According to the best scientific information available, the harvest to be conducted under the permit would detrimentally affect the well-being of the stock of any regulated species of fish, marine mammal, or threatened or endangered species in a significant way; or (C) Issuance of the EFP would have economic allocation as its sole purpose; or (D) Activities to be conducted under the EFP would be inconsistent with the intent of this section, the management objectives of the FMP, or other applicable law; or (E) The applicant has failed to demonstrate a valid justification for the permit; or (F) The activity proposed under the EFP could create a significant enforcement problem. (iv) The decision of a Regional Administrator or Director to grant or deny an EFP is the final action of NMFS. If the permit, as granted, is significantly different from the original application, or is denied, NMFS may publish notification in the *Federal Register* describing the exempted fishing to be conducted under the EFP or the reasons for denial. (v) The Regional Administrator or Director may attach terms and conditions to the EFP consistent with the purpose of the exempted fishing, including, but not limited to: (A) The maximum amount of each regulated species that can be harvested and landed during the teuii of the EFP, including trip limitations, where appropriate. (B) The number, size(s), name(s), and identification number(s) of the vessel(s) authorized to conduct fishing activities under the EFP. (C) The time(s) and place(s) where exempted fishing may be conducted. (D) The type, size, and amount of gear that may be used by each vessel operated under the EFP. (E) The condition that observers, a vessel monitoring system, or other electronic equipment be carried on board vessels operated under an EFP, and any necessary conditions, such as pre-deployment notification requirements. (F) Reasonable data reporting requirements. (G) Other conditions as may be necessary to assure compliance with the purposes of the EFP, consistent with the objectives of the FMP and other applicable law. (H) Provisions for public release of data obtained under the EFP that are [[Page 85]] consistent with NOAA confidentiality of statistics procedures at set out in subpart E. An applicant may be required to waive the right to confidentiality of information gathered while conducting exempted fishing as a condition of an EFP. (4) Duration. Unless otherwise specified in the EFP or a superseding notice or regulation, an EFP is effective for no longer than 1 year, unless revoked, suspended or modified. EFPs may be renewed following the application procedures in this section. (5) Alteration. Any permit that has been altered, erased, or mutilated is invalid. (6) Transfer. EFPs issued under this section are not transferable or assignable. An EFP is valid only for the vessel(s) for which it is issued. (7) Inspection. Any EFP issued under this section must be carried on board the vessel(s) for which it was issued. The EFP must be presented for inspection upon request of any authorized officer. (8) Sanctions. Failure of a permittee to comply with the terms and conditions of an EFP may be grounds for revocation, suspension, or modification of the EFP with respect to all persons and vessels conducting activities under the EFP. Any action taken to revoke, suspend, or modify an EFP for enforcement purposes will be governed by 15 CFR part 904, subpart D. (c) Reports. (1) Persons conducting scientific research activity are requested to submit a copy of any cruise report or other publication created as a result of the cruise, including the amount, composition, and disposition of their catch, to the appropriate Science and Research Director. (2) Persons fishing under an EFP are required to report their catches to the appropriate Regional Administrator or Director, as specified in the EFP. (d) Exempted educational activities--(l) General. A NMFS Regional Administrator or Director may authorize, for educational purposes, the target or incidental harvest of species managed under an FMP or fishery regulations that would otherwise be prohibited. The decision of a Regional Administrator or Director to grant or deny an exempted educational activity authorization is the final action of NMFS. Exempted educational activities may not be conducted unless authorized in writing by a Regional Administrator or Director in accordance with the criteria and procedures specified in this section. Such authorization will be issued without charge. (2) Application. An applicant for an exempted educational activity authorization shall submit to the appropriate Regional Administrator or Director, at least 15 days before the desired effective date of the authorization, a written application that includes, but is not limited to, the following information: (i) The date of the application. (ii) The applicant's name, mailing address, and telephone number. (iii) A brief statement of the purposes and goals of the exempted educational activity for which authorization is requested, including a general description of the arrangements for disposition of all species collected. (iv) Evidence that the sponsoring institution is a valid educational institution, such as accreditation by a recognized national or international accreditation body. (v) The scope and duration of the activity. (vi) For each vessel to be covered by the authorization: (A) A copy of the U.S. Coast Guard documentation, state license, or registration of the vessel, or the information contained on the appropriate document. (B) The current name, address, and telephone number of the owner and master, if not included on the document provided for the vessel. (vii) The species and amounts expected to be caught during the exempted educational activity. (viii) For each vessel covered by the authorization, the approximate time(s) and place(s) fishing will take place, and the type, size, and amount of gear to be used. (ix) The signature of the applicant. (x) The Regional Administrator or Director may request from an applicant additional information necessary to make the determinations required [[Page 86]] under this section. An incomplete application will not be considered until corrected in writing. (3) Issuance. (i) The Regional Administrator or Director, as appropriate, will review each application and will make a determination whether the application contains all of the required information, is consistent with the goals, objectives, and requirements of the FMP or regulations and other applicable law, and constitutes a valid exempted educational activity. The applicant will be notified in writing of the decision within 5 working days of receipt of the application. (ii) The Regional Administrator or Director may attach terms and conditions to the authorization, consistent with the purpose of the exempted educational activity, including, but not limited to: (A) The maximum amount of each regulated species that may be harvested. (B) The time(s) and place(s) where the exempted educational activity may be conducted. (C) The type, size, and amount of gear that may be used by each vessel operated under the authorization. (D) Reasonable data reporting requirements. (E) Such other conditions as may be necessary to assure compliance with the purposes of the authorization, consistent with the objectives of the FMP or regulations. (F) Provisions for public release of data obtained under the authorization, consistent with NOAA confidentiality of statistics procedures in subpart E. An applicant may be required to waive the right to confidentiality of information gathered while conducting exempted educational activities as a condition of the authorization. (iii) The authorization will specify the scope of the authorized activity and will include, at a minimum, the duration, vessel(s), species and gear involved in the activity, as well as any additional terms and conditions specified under paragraph (d)(3)(ii) of this section. (4) Duration. Unless otherwise specified, authorization for an exempted educational activity is effective for no longer than 1 year, unless revoked, suspended, or modified. Authorizations may be renewed following the application procedures in this section. (5) Alteration. Any authorization that has been altered, erased, or mutilated is invalid. (6) Transfer. Authorizations issued under this paragraph (d) are not transferable or assignable. (7) Inspection. Any authorization issued under this paragraph (d) must be carried on board the vessel(s) for which it was issued or be in possession of the applicant to which it was issued while the exempted educational activity is being conducted. The authorization must be presented for inspection upon request of any authorized officer. Activities that meet the definition of fishing, despite an educational purpose, are fishing. An authorization may allow covered fishing activities; however, fishing activities conducted outside the scope of an authorization for exempted educational activities are illegal. [61 FR 32540, June 24, 1996, as amended at 63 FR 7075, Feb. 12, 1998].

APPENDIX B – NATIONAL OFFSHORE AQUACULTURE ACT OF 2007 SUMMARY AND H.R. 2010 (INTRODUCED ON APRIL 24, 2007)

NOTE: The Congressional session ended before Congress acted on HR 2010; however, similar legislation could be re-introduced and enacted in the future.

The National Oceanic and Atmospheric Administration (NOAA), an agency within the U.S. Department of Commerce, is working to enhance/increase domestic seafood supply to meet the growing demand for all seafood products. Currently, over 80 percent of the seafood Americans consume is imported, and at least half of those imports are farmed seafood. Additional U.S. aquaculture can help the nation reduce its $8 billion seafood trade deficit, provide additional jobs and revenue for coastal communities, and meet the growing consumer demand for safe, healthy seafood.

Right now, most U.S. marine aquaculture products come from shellfish, which are grown onshore or in coastal areas. However, new technology and equipment, and the promising results of open ocean aquaculture demonstration projects in state waters, are leading to opportunities for seafood farming further from the coast, in federal waters three to 200 miles off shore. The federal waters of the U.S. Exclusive Economic Zone cover 3.4 million square miles of ocean and hold promise for this new type of aquaculture.

While there are many potential benefits to offshore aquaculture, there are also barriers blocking the expansion of aquaculture into federal waters. Currently, there is no clear authority for the permitting of offshore aquaculture in federal waters. To address this challenge, the Administration will propose the *National Offshore Aquaculture Act of 2007* early in the 110th Congress. If enacted, the Act will establish the legal framework regarding permits, enforcement, and monitoring of aquaculture in federal waters.
Specifically, the bill will:

- Authorize the Secretary of Commerce to issue offshore aquaculture permits.
- Require the Secretary of Commerce to establish environmental requirements.
- Require the Secretary of Commerce to work with other federal agencies to develop and implement a streamlined and coordinated permitting process for offshore aquaculture.
- Exempt permitted offshore aquaculture from fishing regulations that restrict size, season and harvest methods.
- Authorize the establishment of a research and development program for marine aquaculture.
- Authorize funding to carry out the Act and provide for enforcement of the Act.

The 2007 proposal includes requirements to ensure that offshore aquaculture proceeds in an environmentally responsible manner that is consistent with stated policy to protect wild stocks and the quality of marine ecosystems and is compatible with other uses of the marine environment. The intent of the Act is to complement rather than supersede existing resource management authorities, so it specifically provides for coordination and consultation with other federal agencies, Fishery Management Councils, and coastal states.

In addition, the research and development provision of the act would authorize NOAA to fund the scientific research and the technology development necessary to help all types of domestic marine aquaculture to expand.

On a broad scale, the proposal will provide the necessary regulatory certainty to facilitate expansion of aquaculture in federal waters, where there is significant potential for development of the U.S. aquaculture industry. New technologies have been developed to better withstand extreme conditions of the offshore ocean environment, allowing this expansion to occur. By adopting these technologies, the United States can boost production of valuable marine species while creating jobs that contribute to economic development and the revitalization of depressed coastal communities. Additional domestic supplies of nutritious seafood can reduce pressure on wild fisheries. By adopting rigorous environmental standards for aquaculture, the United States can establish its leadership in development of sustainable uses of marine ecosystems, as an example for our trade partners, while leveling the playing field for U.S. fishery products.
Because of competing uses, community interest, and ocean conditions, offshore aquaculture will be better suited to some areas of the country than others. However, the most immediate challenge is to establish clear rules to allow this type of aquaculture and, ultimately, allow the nation to take advantage of this new opportunity for seafood production in federal waters. At the same time, the federal government must ensure that human health, the marine environment, and wild stocks are protected.

Source: www.noaa.gov/aquaculture

HR 2010 IH

110th CONGRESS
1st Session
H. R. 2010

To provide the necessary authority to the Secretary of Commerce for the establishment and implementation of a regulatory system for offshore aquaculture in the United States Exclusive Economic Zone, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES
April 24, 2007

Mr. RAHALL (for himself and Ms. BORDALLO) (both by request): introduced the following bill; which was referred to the Committee on Natural Resources, and in addition to the Committees on Ways and Means and Foreign Affairs, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

A BILL

To provide the necessary authority to the Secretary of Commerce for the establishment and implementation of a regulatory system for offshore aquaculture in the United States Exclusive Economic Zone, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the `National Offshore Aquaculture Act of 2007'.

SEC. 2. FINDINGS.

(a) It is the policy of the United States to:

(1) Support an offshore aquaculture industry that will produce food and other valuable products, protect wild stocks and the quality of marine ecosystems, and be compatible with other uses of the Exclusive Economic Zone;

(2) Encourage the development of environmentally responsible offshore aquaculture by authorizing offshore aquaculture operations and research;

(3) Establish a permitting process for offshore aquaculture that encourages private investment in aquaculture operations and research, provides opportunity for public comment, and addresses the potential risks to and impacts (including cumulative impacts) on marine ecosystems, human health and safety, other ocean uses, and coastal communities from offshore aquaculture;

(4) Promote, through public-private partnerships, research and development in marine aquaculture science, technology, and related social, economic, legal, and environmental management disciplines that will enable marine aquaculture operations to achieve operational objectives while protecting marine ecosystem quality.

(b) Offshore aquaculture activities within the Exclusive Economic Zone of the United States constitute activities with respect to which the United States has proclaimed sovereign rights and jurisdiction under Presidential Proclamation 5030 of March 10, 1983.

SEC. 3. DEFINITIONS.

As used in this Act--

(a) The term `coastal State' means a state of the United States in, or bordering on, the Atlantic, Pacific, or Arctic Ocean, the Gulf of Mexico, or Long Island Sound. The term also includes Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands, the Trust Territories of the Pacific Islands, and American Samoa.

(b) The term `coastline' means the line of ordinary low water along that portion of the coast that is in direct contact with the open sea and the line marking the seaward limit of inland waters.

(c) The term `Exclusive Economic Zone' means, unless otherwise specified by the President in the public interest in a writing published in the *Federal Register*, a zone, the outer boundary of which is 200 nautical miles from the baseline from which the breadth of the territorial sea is measured, except as established by a maritime boundary treaty in force, or being provisionally applied by the United States or, in the absence of such a treaty where the distance between the United States and another nation is less than 400 nautical miles, a line equidistant between the United States and the other nation. Without affecting any Presidential Proclamation with regard to the establishment of the United States territorial sea or Exclusive Economic Zone, the inner boundary of that zone is--

(1) a line coterminous with the seaward boundary of each of the several coastal States, as defined in 43 U.S.C. 1312;

(2) a line three marine leagues from the coastline of the Commonwealth of Puerto Rico;

(3) a line three geographical miles from the coastlines of American Samoa, the United States Virgin Islands, and Guam;

(4) for the Commonwealth of the Northern Mariana Islands--

(A) its coastline, until such time as the Commonwealth of the Northern Mariana Islands is granted authority by the United States to regulate all fishing to a line seaward of its coastline, and

(B) upon the United States' grant of such authority, the line established by such grant of authority; and

(5) for any possession of the United States not referred to in subparagraph (2), (3), or (4), the coastline of such possession.

Nothing in this definition shall be construed as diminishing the authority of the Department of Defense, the Department of the Interior or any other Federal department or agency.
(d) The term `lessee' means any party to a lease, right-of-use and easement, or right-of-way, or an approved assignment thereof, issued pursuant to the Outer Continental Shelf Lands Act, 43 U.S.C. 1331 et seq.
(e) The term `marine species' means finfish, mollusks, crustaceans, marine algae, and all other forms of marine life, excluding marine mammals and birds.
(f) The term `offshore aquaculture' means all activities, including the operation of offshore aquaculture facilities, involved in the propagation and rearing, or attempted propagation and rearing, of marine species in the United States Exclusive Economic Zone.
(g) The term `offshore aquaculture facility' means: 1) an installation or structure used, in whole or in part, for offshore aquaculture; or 2) an area of the seabed or the subsoil used for offshore aquaculture of living organisms belonging to sedentary species.
(h) The term `offshore aquaculture permit' means an authorization issued under section 4(b) to raise specified marine species in a specific offshore aquaculture facility within a specified area of the Exclusive Economic Zone.
(i) The term `person' means any individual (whether or not a citizen or national of the United States), any corporation, partnership, association, or other non-governmental entity (whether or not organized or existing under the laws of any State), and State, local or tribal government or entity thereof, and, except as otherwise specified by the President in writing, the Federal Government or an entity thereof, and, to the extent specified by the President in writing, a foreign government or an entity thereof.
(j) The term `Secretary' means the Secretary of Commerce.

SEC. 4. OFFSHORE AQUACULTURE PERMITS.

(a) General-

(1) The Secretary shall establish, through rulemaking, in consultation as appropriate with other relevant Federal agencies, coastal States, and regional fishery management councils established under section 302 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1852), a process to make areas of the Exclusive Economic Zone available to eligible persons for the development and operation of offshore aquaculture facilities, which shall include:

(A) Procedures and criteria necessary to issue and modify permits under this Act;

(B) Procedures to coordinate the offshore aquaculture permitting process, and related siting, operations, environmental protection, monitoring, enforcement, research, and economic and social activities, with similar activities administered by other Federal agencies and coastal States;

(C) Consideration of the potential environmental, social, economic, and cultural impacts of offshore aquaculture and inclusion, where appropriate, of permit conditions to address negative impacts;
(D) Public notice and opportunity for public comment prior to issuance of offshore aquaculture permits;
(E) Procedures to monitor and evaluate compliance with the provisions of offshore aquaculture permits, including the collection of biological, chemical and physical oceanographic data, and social, production, and economic data; and
(F) Procedures for transferring permits from the original permit holder to a person meeting the eligibility criteria in section 4(b)(2)(A) and able to satisfy the requirements for bonds or other guarantees prescribed under section 4(c)(3).

(2) The Secretary shall prepare an analysis under the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.) with respect to the process for issuing permits.

(3) The Secretary shall periodically review the procedures and criteria for issuance of offshore aquaculture permits and modify them as appropriate, in consultation as appropriate with other Federal agencies, the coastal States, and regional fishery management councils, based on the best available science.

(4) The Secretary shall consult as appropriate with other Federal agencies and coastal States to identify the environmental requirements that apply to offshore aquaculture under existing laws and regulations. The Secretary shall establish through rulemaking, in consultation with appropriate Federal agencies, coastal States, and regional fishery management councils established under section 302 of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1852), additional environmental requirements to address environmental risks and impacts associated with offshore aquaculture, to the extent necessary. The environmental requirements shall address, but are not limited to:

(A) risks to and impacts on natural fish stocks and fisheries, including safeguards needed to conserve genetic resources, to prevent or minimize the transmission of disease or parasites to wild stocks, and to prevent the escape of marine species that may cause significant environmental harm;
(B) risks to and impacts on marine ecosystems; biological, chemical and physical features of water quality and habitat; marine species, marine mammals and birds;
(C) cumulative effects of the aquaculture operation and other aquaculture operations in the vicinity of the proposed site;
(D) environmental monitoring, data archiving, and reporting by the permit holder;
(E) requirements that marine species propagated and reared through offshore aquaculture be species native to the geographic region unless a scientific risk analysis shows that the risk of harm

to the marine environment from the offshore culture of non-indigenous or genetically modified marine species is negligible or can be effectively mitigated; and

(F) maintaining record systems to track inventory and movement of fish or other marine species in the offshore aquaculture facility or harvested from such facility, and, if necessary, tagging, marking, or otherwise identifying fish or other marine species in the offshore aquaculture facility or harvested from such facility.

(5) The Secretary, in cooperation with other Federal agencies, shall:

(A) Collect information needed to evaluate the suitability of sites for offshore aquaculture; and

(B) Monitor the effects of offshore aquaculture on marine ecosystems and implement such measures as may be necessary to protect the environment. Measures may include, but are not limited to, temporary or permanent relocation of offshore aquaculture sites, a moratorium on additional sites within a prescribed area, and other appropriate measures as determined by the Secretary.

(b) Permits- Subject to the provisions of subsection (e), the Secretary may issue offshore aquaculture permits under such terms and conditions as the Secretary shall prescribe. Permits issued under this Act authorize the permit holder to conduct offshore aquaculture consistent with the provisions of this Act, regulations issued under this Act, any specific terms, conditions and restrictions applied to the permit by the Secretary, and other applicable law.

(1) PROCEDURES FOR ISSUANCE OF PERMITS-

(A) The applicant for an offshore aquaculture permit shall submit an application to the Secretary specifying the proposed location and type of operation, the marine species to be propagated or reared, or both, at the offshore aquaculture facility, and other design, construction, and operational information, as specified by regulation.

(B) Within 120 days after determining that a permit application is complete and has satisfied all applicable statutory and regulatory requirements, as specified by regulation, the Secretary shall issue or deny the permit. If the Secretary is unable to issue or deny a permit within this time period, the Secretary shall provide written notice to the applicant indicating the reasons for the delay and establishing a reasonable timeline for issuing or denying the permit.

(2) PERMIT CONDITIONS-

(A) An offshore aquaculture permit holder must (i) be a resident of the United States, (ii) be a corporation, partnership or other entity organized and existing under the laws of a State or the United States, or (iii) if neither (i) or (ii) applies, to the extent required by the Secretary by regulation after coordination with the Secretary of State, waive any immunity, and consent to the jurisdiction of the United States and its courts, for matters arising in relation to such permit, and appoint and maintain agents within the United States who are authorized to receive and respond to any legal process issued in the United States with respect to such permit holder.

(B) Subject to the provisions of subsection (e), the Secretary shall establish the terms, conditions, and restrictions that apply to offshore aquaculture permits, and shall specify in the permits the duration, size, and location of the offshore aquaculture facility.

(C) Except for projects involving pilot-scale testing or farm-scale research on aquaculture science and technologies and offshore aquaculture permits requiring concurrence of the Secretary of the Interior under subsection 4(e)(1), the permit shall have a duration of 20 years, renewable thereafter at the discretion of the Secretary in up to 20-year increments. The duration of permits requiring concurrence of the Secretary of the Interior under subsection 4(e)(1) shall be developed in consultation as appropriate with the Secretary of the Interior, except that any such permit shall expire no later than the date that the lessee, or the lessee's operator, submits to the Secretary of the Interior a final application for the decommissioning and removal of an existing facility upon which an offshore aquaculture facility is located.

(D) At the expiration or termination of an offshore aquaculture permit for any reason, the permit holder shall remove all structures, gear, and other property from the site, and take other measures to restore the site as may be prescribed by the Secretary.

(E) Failure to begin offshore aquaculture operations within a reasonable period of time, or prolonged interruption of offshore aquaculture operations, may result in the revocation of the permit.

(3) If the Secretary determines that issuance of a permit is not in the national interest, the Secretary may decline to issue such a permit or may impose such conditions as necessary to address such concerns.

(c) Fees and Other Payments-

(1) The Secretary is authorized to establish, through regulations, application fees and annual permit fees. Such fees shall be deposited as offsetting collections in the Operations, Research, and Facilities (ORF) account. Fees may be collected and made available only to the extent provided in advance in appropriation Acts.

(2) The Secretary may reduce or waive applicable fees or other payments established under this section for facilities used primarily for research.

(3) The Secretary shall require the permit holder to post a bond or other form of financial guarantee, in an amount to be determined by the Secretary as sufficient to cover any unpaid fees, the cost of removing an offshore aquaculture facility at the expiration or termination of an offshore aquaculture permit, and other financial risks as identified by the Secretary.

(d) Compatibility With Other Uses-

(1) The Secretary shall consult as appropriate with other Federal agencies, coastal States, and regional fishery management councils to ensure that

offshore aquaculture for which a permit is issued under this section is compatible with the use of the Exclusive Economic Zone for navigation, fishing, resource protection, recreation, national defense (including military readiness), mineral exploration and development, and other activities.

(2) The Secretary shall not authorize permits for new offshore aquaculture facilities within 12 miles of the coastline of a coastal State if that coastal State has submitted a written notice to the Secretary that the coastal State opposes such activities. This provision will not apply to permit applications received by the Secretary prior to the date the notice is received from a coastal State. A coastal State that transmitted such notice to the Secretary under this paragraph may revoke that notice in writing at any time.

(3) Federal agencies implementing this Act, persons subject to this Act, and coastal States seeking to review permit applications under this Act shall comply with the applicable section of the Coastal Zone Management Act (i.e., 16 U.S.C. 1456(c)(1), (c)(3)(A), (c)(3)(B) or (d)) and its corresponding Federal regulations.

(4) Offshore aquaculture conducted in accordance with permits issued pursuant to this Act is excluded from the definition of `fishing' in the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1802(15)). The Secretary shall ensure, to the extent practicable, that offshore aquaculture does not interfere with conservation and management measures promulgated under the Magnuson-Stevens Fishery Conservation and Management Act.

(5) The Secretary may promulgate regulations that the Secretary finds to be reasonable and necessary to protect offshore aquaculture facilities, and, where appropriate, shall request that the Secretary of the department in which the Coast Guard is operating establish navigational safety zones around such facilities. In addition, in the case of any offshore aquaculture facility described in section 4(e)(1), the Secretary of the department in which the Coast Guard is operating shall consult with the Secretary of the Interior before designating such a zone.

(6) After consultation with the Secretary, the Secretary of State, and the Secretary of Defense, the Secretary of the department in which the Coast Guard is operating may designate a zone of appropriate size around and including any offshore aquaculture facility for the purpose of navigational safety. In such a zone, no installations, structures, or uses will be allowed that are incompatible with the operation of the offshore aquaculture facility. The Secretary of the department in which the Coast Guard is operating may define, by rulemaking, activities that are allowed within such a zone.

(7)(A) Subject to paragraph (B), if the Secretary, after consultation with Federal agencies as appropriate and after affording the permit holder notice and an opportunity to be heard, determines that suspension, modification, or revocation of a permit is in the national interest, the Secretary may suspend, modify, or revoke such permit.

(B) If the Secretary determines that an emergency exists that poses a risk to the safety of humans, to the marine environment or marine species, or to the security of the United States and that requires suspension, modification, or revocation of a permit, the Secretary may suspend, modify, or revoke the permit for such time as the Secretary may determine necessary to meet the emergency. The Secretary shall afford the permit holder a prompt post-suspension or post-modification opportunity to be heard regarding the suspension, modification, or revocation.

(8) Permits issued under this Act do not supersede or substitute for any other authorization required under applicable Federal or State law or regulation.

(e) Actions Affecting the Outer Continental Shelf-

(1) The Secretary shall obtain the concurrence of the Secretary of the Interior on permits for offshore aquaculture facilities located:

(A) on leases, right-of-use and easements, or rights of way authorized or permitted under the Outer Continental Shelf Lands Act, as amended (43 U.S.C. 1331, et seq.), or

(B) within 1 mile of any other facility permitted or for which a plan has been approved under the Outer Continental Shelf Lands Act.

(2) Offshore aquaculture may not be located on facilities subject to section 4(e)(1)(A) without the prior consent of the lessee, its designated operator, and owner of the facility.

(3) The Secretary of the Interior shall review and approve any agreement between a lessee, designated operator, and owner of a facility subject to this subsection and a prospective aquaculture operator to ensure that it is consistent with the Federal lease terms, Department of the Interior regulations, and the Secretary of the Interior's role in the protection of the marine environment, property, or human life or health. An agreement under this subsection shall be part of the information reviewed pursuant to the Coastal Zone Management Act review process described in subsection 4(e)(4) and shall not be subject to a separate Coastal Zone Management Act review.

(4) Coordinated Coastal Zone Management Act review

(A) If the applicant for an offshore aquaculture facility that will utilize a facility subject to this subsection is required to submit to a coastal State a consistency certification for its aquaculture application under section 307(c)(3)(A) of the Coastal Zone Management Act (16 U.S.C. 1456(c)(3)(A)), the coastal State's review under the Coastal Zone Management Act and corresponding Federal regulations shall also include any modification to a lessee's approved plan or other document for which a consistency certification would otherwise be required under applicable Federal regulations, including changes to its plan for decommissioning any facilities, resulting from or necessary for the issuance of the offshore aquaculture permit, provided that information related to such modifications or changes is received by the coastal State at the time the coastal State receives the offshore aquaculture permit applicant's consistency certification. In this case, lessees are not required to submit a separate consistency certification for any such modification or change under section 307(c)(3)(B) of the Coastal Zone Management Act (16 U.S.C. 1456(c)(3)(B)) and the coastal State's concurrence or objection, or presumed concurrence, under section 307(c)(3)(A) of the Coastal Zone Management Act (16 U.S.C. 1456(c)(3)(A)) in a consistency determination for the offshore aquaculture permit, shall apply to both the offshore aquaculture permit and to any related modifications or changes to a lessee's plan approved under the Outer Continental Shelf Lands Act.

(B) If a coastal State is not authorized by section 307(c)(3)(A) of the Coastal Zone Management Act (16 U.S.C. 1456(c)(3)(A)) and corresponding Federal regulations to review an offshore aquaculture application submitted under this Act, then any modifications or changes to a lessee's approved plan or other document requiring approval from the Department of the Interior, shall be subject to coastal State review pursuant to the requirements of section 307(c)(3)(B) of the Coastal Zone Management Act (16 U.S.C. 1456(c)(3)(B)), if a consistency certification for those modifications or changes is required under applicable Federal regulations.

(5) For offshore aquaculture located on facilities subject to this subsection, the aquaculture permit holder and all parties that are or were lessees of the lease on which the facilities are located during the term of the offshore aquaculture permit shall be jointly and severally liable for the removal of any construction or modifications related to aquaculture operations if the aquaculture permit holder fails to do so and bonds established under this Act for aquaculture operations prove insufficient to cover those obligations. This subsection does not affect obligations to decommission facilities under the Outer Continental Shelf Lands Act.

(6) For aquaculture projects or operations subject to this subsection, the Secretary of the Interior is authorized to:

(A) Promulgate such rules and regulations as are necessary and appropriate to carry out the provisions of this subsection;

(B) Require and enforce such additional terms or conditions as the Secretary of the Interior deems necessary to protect the marine environment, property, or human life or health to ensure the compatibility of aquaculture operations with all activities for which

permits have been issued under the Outer Continental Shelf Lands Act;
(C) Issue orders to the offshore aquaculture permit holder to take any action the Secretary of the Interior deems necessary to ensure safe operations on the facility to protect the marine environment, property, or human life or health. Failure to comply with the Secretary of the Interior's orders will be deemed to constitute a violation of the Outer Continental Shelf Lands Act; and
(D) Enforce all requirements contained in such regulations, lease terms and conditions and orders pursuant to the Outer Continental Shelf Lands Act.

SEC. 5. RESEARCH AND DEVELOPMENT.

(a) In consultation as appropriate with other Federal agencies, the Secretary may establish and conduct an integrated, multidisciplinary, scientific research and development program to further marine aquaculture technologies that are compatible with the protection of marine ecosystems.
(b) The Secretary is authorized to conduct research and development in partnership with offshore aquaculture permit holders.
(c) The Secretary, in collaboration with the Secretary of Agriculture, shall conduct research to reduce the use of wild fish in aquaculture feeds, including but not limited to the substitution of seafood processing wastes, cultured marine algae and microbial sources of nutrients important for human health and nutrition, agricultural crops, and other products.

SEC. 6. ADMINISTRATION.

(a) The Secretary shall promulgate such regulations as are necessary and appropriate to carry out the provisions of this Act. The Secretary may at any time amend such regulations, and such regulations shall, as of their effective date, apply to all operations conducted pursuant to permits issued under the provisions of this Act, regardless of the date of the issuance of such permit.
(b) The Secretary shall have the authority to enter into and perform such contracts, leases, grants, or cooperative agreements as may be necessary to carry out the purposes of this Act and on such terms as the Administrator of the National Oceanic and Atmospheric Administration deems appropriate.
(c) For purposes related to the enforcement of this Act, the Secretary is authorized to use, with their consent and with or without reimbursement, the land, services, equipment, personnel, and facilities of any department, agency or instrumentality of the United States, or of any state, local government, Indian tribal government, Territory or possession, or of any political subdivision thereof, or of any foreign government or international organization.
(d) Authority to Utilize Grant Funds
(1) Except as provided in paragraph (2), the Secretary is authorized to apply for, accept, and obligate research grant funding from any Federal source operating competitive grant programs where such funding furthers the purpose of this Act.

(2) The Secretary may not apply for, accept, or obligate any grant funding under paragraph (1) for which the granting agency lacks authority to grant funds to Federal agencies, or for any purpose or subject to conditions that are prohibited by law or regulation.

(3) Appropriated funds may be used to satisfy a requirement to match grant funds with recipient agency funds, except that no grant may be accepted that requires a commitment in advance of appropriations.

(4) Funds received from grants shall be deposited in the National Oceanic and Atmospheric Administration account that serves to accomplish the purpose for which the grant was awarded.

(e) Nothing in this Act shall be construed to displace, supersede, or limit the jurisdiction, responsibilities or rights of any Federal or State agency, or Indian Tribe or Alaska Native organization, under any Federal law or treaty.

(f) The Constitution, laws, and treaties of the United States shall apply to an offshore aquaculture facility located in the Exclusive Economic Zone for which a permit has been issued or is required under this Act and to activities in the Exclusive Economic Zone connected, associated, or potentially interfering with the use or operation of such facility, in the same manner as if such facility were an area of exclusive Federal jurisdiction located within a State. Nothing in this Act shall be construed to relieve, exempt, or immunize any person from any other requirement imposed by an applicable Federal law, regulation, or treaty. Nothing in this Act shall be construed to confer citizenship to a person by birth or through naturalization or to entitle a person to avail himself of any law pertaining to immigration, naturalization, or nationality.

(g) The law of the nearest adjacent coastal State, now in effect or hereafter adopted, amended, or repealed, is declared to be the law of the United States, and shall apply to any offshore aquaculture facility for which a permit has been issued pursuant to this Act, to the extent applicable and not inconsistent with any provision or regulation under this Act or other Federal laws and regulations now in effect or hereafter adopted, amended, or repealed. All such applicable laws shall be administered and enforced by the appropriate officers and courts of the United States. For purposes of this subsection, the nearest adjacent coastal State shall be that State whose seaward boundaries, if extended beyond 3 nautical miles, would encompass the site of the offshore aquaculture facility. State taxation laws shall not apply to offshore aquaculture facilities in the Exclusive Economic Zone.

SEC. 7. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated to the Secretary $4,052,000 in fiscal year 2008 and thereafter such sums as may be necessary for purposes of carrying out the provisions of this Act.

SEC. 8. UNLAWFUL ACTIVITIES.

It is unlawful for any person--

(a) to falsify any information required to be reported, communicated, or recorded pursuant to this Act or any regulation or permit issued under this Act, or to fail to submit in a timely fashion any required information, or to fail to report to the Secretary immediately any change in circumstances that has the effect of rendering any such information false, incomplete, or misleading;

(b) to engage in offshore aquaculture within the Exclusive Economic Zone of the United States or operate an offshore aquaculture facility within the Exclusive Economic Zone of the United States, except pursuant to a valid permit issued under this Act;

(c) to refuse to permit an authorized officer to conduct any lawful search or lawful inspection in connection with the enforcement of this Act or any regulation or permit issued under this Act;

(d) to forcibly assault, resist, oppose, impede, intimidate, or interfere with an authorized officer in the conduct of any search or inspection in connection with the enforcement of this Act or any regulation or permit issued under this Act;

(e) to resist a lawful arrest or detention for any act prohibited by this section;

(f) to interfere with, delay, or prevent, by any means, the apprehension, arrest, or detection of another person, knowing that such person has committed any act prohibited by this section;

(g) to import, export, sell, receive, acquire or purchase in interstate or foreign commerce any marine species in violation of this Act or any regulation or permit issued under this Act;

(h) upon the expiration or termination of any aquaculture permit for any reason, fail to remove all structures, gear, and other property from the site, or take other measures, as prescribed by the Secretary, to restore the site;

(i) to violate any provision of this Act, any regulation promulgated under this Act, or any term or condition of any permit issued under this Act; or

(j) to attempt to commit any act described in subsections (a), (b), (g), (h) or (i).

SEC. 9. ENFORCEMENT PROVISIONS.

(a) Duties of Secretaries- Subject to sections 4(e)(6)(B) and (D), this Act shall be enforced by the Secretary and the Secretary of the department in which the Coast Guard is operating.

(b) Powers of Enforcement-

(1) Any officer who is authorized pursuant to subsection (a) of this section by the Secretary or the Secretary of the department in which the Coast Guard is operating to enforce the provisions of this Act may--

(A) with or without a warrant or other process--

(i) arrest any person, if the officer has reasonable cause to believe that such person has committed or is committing an act prohibited by section 8 of this Act;

(ii) search or inspect any offshore aquaculture facility and any related land-based facility;

(iii) seize any offshore aquaculture facility (together with its equipment, records, furniture, appurtenances, stores, and cargo), and any vessel or vehicle, used or employed in aid of, or with respect to which it reasonably appears that such offshore aquaculture facility was used or employed in aid

of, the violation of any provision of this Act or any regulation or permit issued under this Act;
(iv) seize any marine species (wherever found) retained, in any manner, in connection with or as a result of the commission of any act prohibited by section 8 of this Act;
(v) seize any evidence related to any violation of any provision of this Act or any regulation or permit issued under this Act;

(B) execute any warrant or other process issued by any court of competent jurisdiction; and
(C) exercise any other lawful authority.

(2) Any officer who is authorized pursuant to subsection (a) of this section by the Secretary or the Secretary of the department in which the Coast Guard is operating to enforce the provisions of this Act may make an arrest without a warrant for (i) an offense against the United States committed in his presence, or (ii) for a felony cognizable under the laws of the United States, if he has reasonable grounds to believe that the person to be arrested has committed or is committing a felony. Any such authorized person may execute and serve a subpoena, arrest warrant or search warrant issued in accordance with Rule 41 of the Federal Rules of Criminal Procedure, or other warrant of civil or criminal process issued by any officer or court of competent jurisdiction for enforcement of the Act, or any regulation or permit issued under this Act.

(c) Issuance of Citations- If any authorized officer finds that a person is engaging in or has engaged in offshore aquaculture in violation of any provision of this Act, such officer may issue a citation to that person.

(d) Liability for Costs- Any person who violates this Act, or a regulation or permit issued under this Act, shall be liable for the cost incurred in storage, care, and maintenance of any marine species or other property seized in connection with the violation.

SEC. 10. CIVIL ENFORCEMENT AND PERMIT SANCTIONS.

(a) Civil Administrative Penalties-

(1) Any person who is found by the Secretary, after notice and opportunity for a hearing in accordance with section 554 of Title 5, United States Code, to have violated this Act, or a regulation or permit issued under this Act, shall be liable to the United States for a civil penalty. The amount of the civil penalty under this paragraph shall not exceed $200,000 for each violation. Each day of a continuing violation shall constitute a separate violation.

(2) COMPROMISE OR OTHER ACTION BY THE SECRETARY- The Secretary may compromise, modify, or remit, with or without conditions, any civil administrative penalty which is or may be imposed under this section and that has not been referred to the Attorney General for further enforcement action.

(b) Civil Judicial Penalties- Any person who violates any provision of this Act, or any regulation or permit issued there under, shall be subject to a civil penalty not to exceed $250,000 for each such violation. Each day of a continuing violation shall constitute a separate violation. The Attorney General, upon the request of the Secretary, may commence a civil action in an appropriate district court of the United States, and such court shall have jurisdiction to award civil penalties and such other relief as justice may require. In determining the amount of a civil penalty, the court shall take into account the nature, circumstances, extent, and gravity of the prohibited acts committed and, with respect to the violator, the degree of culpability, any history of prior violations and such other matters as justice may require. In imposing such penalty, the district court may also consider information related to the ability of the violator to pay.

(c) Permit Sanctions-

(1) In any case in which--

(A) an offshore aquaculture facility has been used in the commission of an act prohibited under section 8 of this Act;

(B) the owner or operator of an offshore aquaculture facility or any other person who has been issued or has applied for a permit under section 4 of this Act has acted in violation of section 8 of this Act; or

(C) any amount in settlement of a civil forfeiture imposed on an offshore aquaculture facility or other property, or any civil penalty or criminal fine imposed under this Act or imposed on any other person who has been issued or has applied for a permit under any fishery resource statute enforced by the Secretary, has not been paid and is overdue, the Secretary may--

(i) revoke any permit issued with respect to such offshore aquaculture facility or applied for by such a person under this Act, with or without prejudice to the issuance of subsequent permits;

(ii) suspend such permit for a period of time considered by the Secretary to be appropriate;

(iii) deny such permit; or

(iv) impose additional conditions and restrictions on such permit.

(2) In imposing a sanction under this subsection, the Secretary shall take into account--

(A) the nature, circumstances, extent, and gravity of the prohibited acts for which the sanction is imposed; and

(B) with respect to the violator, the degree of culpability, any history of prior violations, and such other matters as justice may require.

(3) Transfer of ownership of an offshore aquaculture facility, by sale or otherwise, shall not extinguish any permit sanction that is in effect or is pending at the time of transfer of ownership. Before executing the transfer of ownership of an offshore aquaculture facility, by sale or otherwise, the

owner shall disclose in writing to the prospective transferee the existence of any permit sanction that will be in effect or pending with respect to the offshore aquaculture facility at the time of the transfer. The Secretary may waive or compromise a sanction in the case of a transfer pursuant to court order.

(4) In the case of any permit that is suspended under this subsection for nonpayment of a civil penalty or criminal fine, the Secretary shall reinstate the permit upon payment of the penalty or fine and interest thereon at the prevailing rate.

(5) No sanctions shall be imposed under this subsection unless there has been prior opportunity for a hearing on the facts underlying the violation for which the sanction is imposed, either in conjunction with a civil penalty proceeding under this section or otherwise.

(d) Injunctive Relief- Upon the request of the Secretary, the Attorney General of the United States is authorized to commence a civil action for appropriate relief, including a permanent or temporary injunction, for any violation of any provision of this Act, or regulation or permit issued under this Act.

(e) Hearing- For the purposes of conducting any investigation or hearing under this section or any other statute administered by the National Oceanic and Atmospheric Administration which is determined on the record in accordance with the procedures provided for under section 554 of Title 5, the Secretary may issue subpoenas for the attendance and testimony of witnesses and the production of relevant papers, books, and documents, and may administer oaths. Witnesses summoned shall be paid the same fees and mileage that are paid to witnesses in the courts of the United States. In case of contempt or refusal to obey a subpoena served upon any person pursuant to this subsection, the district court of the United States for any district in which such person is found, resides, or transacts business, upon application by the United States and after notice to such person, shall have jurisdiction to issue an order requiring such person to appear and give testimony before the Secretary or to appear and produce documents before the Secretary, or both, and any failure to obey such order of the court may be punished by such court as a contempt thereof. Nothing in this Act shall be construed to grant jurisdiction to a district court to entertain an application for an order to enforce a subpoena issued by the Secretary of Commerce to the Federal Government or any entity thereof.

(f) Jurisdiction- The United States district courts shall have original jurisdiction of any action under this section arising out of or in connection with the construction or operation of aquaculture facilities, and proceedings with respect to any such action may be instituted in the judicial district in which any defendant resides or may be found, or in the judicial district of the adjacent coastal State nearest the place where the cause of action arose. For the purpose of this section, American Samoa shall be included within the judicial district of the District Court of the United States for the District of Hawaii. Each violation shall be a separate offense and the offense shall be deemed to have been committed not only in the district where the violation first occurred, but also in any other district as authorized by law.

(g) Collection- If any person fails to pay an assessment of a civil penalty after it has become a final and unappealable order, or after the appropriate court has entered final judgment in favor of the Secretary, the matter may be referred to the Attorney General, who may recover the amount (plus interest at currently prevailing rates from the date of the final order). In such action the validity, amount and appropriateness of the final order imposing the civil penalty shall not be subject to review. Any person who fails to pay, on a timely basis, the amount of an assessment of a civil penalty shall be required to pay, in addition to such amount and interest, attorney's fees and costs for collection proceedings and a quarterly nonpayment penalty for each quarter during which such failure to pay persists. Such nonpayment penalty shall be in an amount equal to 20 percent of the aggregate amount of such person's penalties and nonpayment penalties which are unpaid as of the beginning of such quarter.
(h) Nationwide Service of Process- In any action by the United States under this title, process may be served in any district where the defendant is found, resides, transacts business or has appointed an agent for the service of process, and for civil cases may also be served in a place not within the United States in accordance with Rule 4 of the Federal Rules of Civil Procedure.

SEC. 11. CRIMINAL OFFENSES.

(a) Any person (other than a foreign government or any entity of such government) who knowingly commits an act prohibited by subsections 8(c), (d), (e), or (f) of the Act, shall be imprisoned for not more than five years or shall be fined not more than $500,000 for individuals or $1,000,000 for an organization, or both; except that if in the commission of any such offense the individual uses a dangerous weapon, engages in conduct that causes bodily injury to any officer authorized to enforce the provisions of this title, or places any such officer in fear of imminent bodily injury, the maximum term of imprisonment is not more than ten years.
(b) Any person (other than a foreign government or any entity of such government) who knowingly violates any other provision of section 8, except subsections 8(c), (d), (e) or (f), of the Act, or any provision of any regulation promulgated pursuant to this title or any permit issued under this title, shall be imprisoned for not more than five years, or shall be fined not more than $500,000 for an individual or $1,000,000 for an organization, or both.
(c) The United States district courts shall have original jurisdiction of any action arising under this section out of or in connection with the construction or operation of aquaculture facilities, and proceedings with respect to any such action may be instituted in the judicial district in which any defendant resides or may be found. For the purpose of this section, American Samoa shall be included within the judicial district of the District Court of the United States for the District of Hawaii. Each violation shall be a separate offense and the offense shall be deemed to have been committed not only in the district where the violation first occurred, but also in any other district as authorized under law.

SEC. 12. FORFEITURES.

(a) Criminal Forfeiture- A person who is convicted of an offense in violation of section 11 of this Act shall forfeit to the United States--

(1) any property, real or personal, constituting or traceable to the gross proceeds obtained, or retained, as a result of the offense including, without limitation, any marine species (or the fair market value thereof) taken or retained in connection with or as a result of the offense; and

(2) any property, real or personal, used or intended to be used to commit or to facilitate the commission of the offense, including, without limitation, any offshore aquaculture facility or vessel, including its structure, equipment, furniture, appurtenances, stores, and cargo, and any vehicle or aircraft.

Pursuant to title 28, United States Code, section 2461(c), the provisions of section 413 of the Controlled Substances Act (21 U.S.C. 853) with the exception of subsection (d) of that section, shall apply to criminal forfeitures under this section.

(b) Civil Forfeiture- The following shall be subject to forfeiture to the United States and no property right shall exist in them:

(1) any property, real or personal, constituting or traceable to the gross proceeds obtained, or retained, as a result of a violation of any provision of section 8 or subsection 4(b)(2)(D) of this Act, including, without limitation, any marine species (or the fair market value thereof) taken or retained in connection with or as a result of the violation; and

(2) any property, real or personal, used or intended to be used to commit or to facilitate the commission of any such violation, including, without limitation, any offshore aquaculture facility or vessel, including its structure, equipment, furniture, appurtenances, stores, and cargo, and any vehicle or aircraft.

Civil forfeitures under this section shall be governed by the procedures set forth in title 18, United States Code, Chapter 46.

(c) Rebuttable Presumption- In any criminal or civil forfeiture proceeding under this section, there is a rebuttable presumption that all marine species found within an offshore aquaculture facility and seized in connection with a violation of section 8 of this Act were taken or retained in violation of this Act.

SEC. 13. SEVERABILITY AND JUDICIAL REVIEW.

(a) Severability- If any provision of this chapter or the application thereof to any person or circumstances is held invalid, the validity of the remainder of this chapter and of the application of such provision to other persons and circumstances shall not be affected thereby.

(b) Judicial Review-

(1) IN GENERAL- Judicial review of any action taken by the Secretary under this chapter shall be in accordance with sections 701 through 706 of Title 5, except that--

(A) review of any final agency action of the Secretary taken pursuant to section 11(a) or (c) of this title may be had only by the filing of a complaint by an interested person in the United States

District Court for the appropriate district; any such complaint must be filed within 30 days of the date such final agency action is taken; and

(B) review of all other final agency actions of the Secretary under this chapter may be had only by the filing of a petition for review by an interested person in the Circuit Court of Appeals of the United States for the Federal judicial district in which such person resides or transacts business which is directly affected by the action taken; such petition shall be filed within 120 days from the date such final action is taken.

(2) LIMITATION OF JUDICIAL REVIEW- Final agency action with respect to which review could have been obtained under paragraph (1)(B) of this subsection shall not be subject to judicial review in any civil or criminal proceeding for enforcement.

(3) AWARDS OF LITIGATION COSTS- In any judicial proceeding under paragraph (1) of this subsection, the court may award costs of litigation (including reasonable attorney and expert witness fees) to any prevailing party whenever it determines that such award is appropriate.

END

APPENDIX C - GULF COUNCIL'S MARINE AQUACULTURE POLICY

The Gulf of Mexico Fishery Management Council (Council) defines marine aquaculture as the cultivation of marine plants or animals for food or other purposes. Recognizing that marine aquaculture presents both potential benefits as well as potential negative impacts, it is the policy of the Council to encourage environmentally responsible marine aquaculture; the Council encourages consideration of the following guidelines:

a. <u>Cultured Species</u>:

The Council recommends that genetic stocks native to the Gulf of Mexico and the geographic area in which they would be cultured receive priority as candidate culture species. Non-native species should be used only after thorough investigation has demonstrated no detrimental impacts on native species. The Council opposes use of non-native species in marine aquaculture systems unless demonstrated there would be no detrimental impacts on native species. The Council particularly opposes use of non-native species in open water environments where escapement can occur. The Council opposes the collection of juvenile native species for grow out.

Collection of native wild brood stock should be regulated in order to prevent overfishing cultured species stocks, and provision should be made to aid enforceability of possession, landing, and marketing of fish that would be illegal if wild caught fish.

Strategies should be adopted to minimize the potential that the genetic fitness (including both genetic variation and genetic composition) of wild populations would be diminished by marine aquaculture activities and escapement from marine aquaculture activities.

An invoice should accompany all cultured species through each sales transaction, including transactions at the place of the final sale to the consumer to verify the origin of the cultured species.

b. <u>Habitat</u>:

To ensure that marine aquaculture activities are environmentally responsible, the following considerations should be made with respect to habitat in that:

(1) Existing inland and offshore habitats important to marine fisheries should be protected from physical alterations or degradation;

(2) A baseline assessment should be conducted as part of the permitting process; and

(3) Sensitive areas, including habitat areas of particular concern, should be avoided.

c. Research:

The Council recommends the marine aquaculture industry demonstrate, in part, its stewardship of Gulf waters by:

(1). Actively educating its member institutions about necessary regulations and permits;

(2). Actively participating in research and monitoring to improve the understanding of marine aquaculture's relationship to coastal and marine ecosystems; and

(3). Participating in cooperative research to enhance knowledge of cultured species.

d. Location, Design, and Operation:

Marine aquaculture operations should be located, designed, operated, and monitored to prevent adverse impacts to estuaries, marine habitats and native fishery stocks. Impacts that cannot be prevented must be fully mitigated in-kind.

Conditions should be maintained to sustain healthy, diverse, native biological communities without the production of nuisance, toxic, or oxygen-demanding conditions.

Standard operating procedures should contain methods to prevent escapement, accidental transport, or release of cultured organisms.

Marine aquaculture operations should be conducted in accordance with a management plan that incorporates a routine monitoring program. The plan should be approved prior to the beginning of operations as part of the permitting process and modified as needed in accordance with adaptive management principles and based on the results of the monitoring program.

Marine aquaculture operations should develop an "emergency plan" that covers natural disasters such as tropical stouiis, floods, and hurricanes.

Ingress and egress of native wild organisms in natural and public waters should not be impeded by physical or water quality barriers.

Marine aquaculture operations in the EEZ should minimize disruption of navigation in natural or public waters.

Marine aquaculture facility locations should avoid areas of high commercial and recreational fishing activities.

Marine aquaculture facilities should avoid or at least minimize conflicts with or restrictions on recreational, for-hire, or commercial fishing activities.

When designing land-based marine aquaculture facilities, settling ponds, man-made wetlands, or other appropriate technologies should be used to allow for suspended solids to settle out, allow the nutrient load to dissipate, and reduce overall discharge velocities prior to being discharged into the receiving water body.

As part of the permit process, measures should be established to deal with intentional or unintentional facility or property abandonment or other environmental liability to ensure that sites can be reclaimed without public expense and with minimal risk of long-term impact.

As part of the permitting process procedures should be established to deal with: removal of damaged equipment from the permitted site; recovery of equipment that may be unintentionally transported from the permitted site; and restoration of habitats that may be damaged by marine aquaculture activities, whether at the permitted site or elsewhere.

Mechanisms should be developed to ensure that marine aquaculture facilities and operations avoid harmful effects to both wild aquatic and terrestrial organisms.

- Water Quality:

Marine aquaculture facilities should be designed, maintained, and operated in such a manner that avoids impacts to the local environment by utilizing water conservation practices and discharging effluent that protects existing designated use of receiving water and meets applicable state and federal water quality guidelines.

Marine aquaculture facilities should develop, implement, and monitor best management practices to conserve water and improve effluent water quality.

Comprehensive marine aquaculture facility waste management practices should be required to minimize negative impacts of discharge from the facility.

f. Health Management and Disease Control:

Marine aquaculture activities should:

1. Minimize impacts of disease outbreaks if they occur;

2. Create and implement health evaluation programs and policies that prevent the importation or release of disease pathogens or parasites of regulatory concern. These policies should support development and utilization of technologies to identify and control disease organisms;

3. Develop effective disease control, quarantine, and inventory destruction procedures to prevent the spread of disease to public waterways, native species, and other marine aquaculture facilities;

4. Create and implement health management strategies for marine aquaculture organisms in cooperation with states, federal agencies, industry, veterinarians, and

scientists; and

5. Use only FDA approved therapeutic and chemical treatments as part of best management practices.

APPENDIX D – ALTERNATIVES CONSIDERED DURING THE SCOPING AND PUBLIC REVIEW PROCESS, BUT REJECTED FROM DETAILED STUDY IN THE FISHERY MANAGEMENT PLAN.

1. Require all permit applicants to indicate the actions they will take to comply with the provisions of the Council's Marine Aquaculture Policy that are applicable to offshore aquaculture.

Discussion: Actions and preferred alternatives considered in this FMP are consistent with the Council's Marine Aquaculture Policy. Permittees will be required to abide by numerous requirements outlined in the Council's Aquaculture Policy, including: using species native to the Gulf of Mexico, minimizing impacts of disease outbreaks, conducting routine monitoring, appropriately siting facilities, and protecting important habitat. In addition, Action 3 includes additional plans permittees must submit to NOAA Fisheries Service in order to ensure animal health is appropriately managed, genetic impacts on wild stocks are limited, environmental impacts are monitored, plans are in place for emergencies, and practices for collecting and spawning of broodstock.

2. Require permits for both persons (or firms) spawning brood stock and those raising fingerlings or juveniles in the EEZ.

Discussion: Action 1 discusses the types of permits that would be required for conducting aquaculture in the EEZ. The Council's preferred alternative (Alternative 2) would only require an operating permit, while Alternative 3 (Action 1) would require both an operating and a siting permit. The permit for operating a facility in the EEZ would authorize collection of broodstock. Additionally, numerous application and operational requirements in Action 2 would place the onus on the permit applicant/permittee to certify that hatchery broodstock are tagged, fin clips or other genetic material from broodstock are submitted to NOAA Fisheries Service, and juveniles used for growout are certified as native, non-genetically modified and non-transgenic species. The applicant or permittee would also be required to submit contact information pertaining to hatcheries.

3. Permits should be issued 3 years or 7 years.

Discussion: Action 2 discusses the various permit durations considered by the Council. These range from 1 year (EFP) to an indefinite time period. The Council also considered permit durations of 5, 10 and 20 years. Permit durations of 3 and 7 years are within the range of possible permit durations considered within this FMP.

4. All fish landed or harvested from the facility should be reported quarterly to NOAA Fisheries Service (by species and pounds) or the permit will not be renewed.

Discussion: Action 8 requires aquaculture permittees to maintain and make available to NOAA Fisheries Service during inspection or upon request harvest and sale records. There is no timeframe for providing this information, although such information would be a part of the annual report submitted to NOAA Fisheries Service. Additionally, Action 2, requires NOAA Fisheries Service be notified prior to harvest, transport, and landing of cultured fish. Requiring quarterly reports was deemed unnecessary since most fish species will require greater than three months to grow to marketable sizes.

5. Require a program approved by NOAA Fisheries Service and EPA to monitor the dissolved oxygen, carbon dioxide, ammonia and other water quality parameters around the marine aquaculture facility.

Discussion: Water quality standards and monitoring requirements are required by the EPA and NOAA Fisheries Service does not have the authority to require water quality monitoring for aquaculture facilities. Action 8 requires permittees to provide NOAA Fisheries Service with copies of monitoring reports from other federal agencies. Action 2 requires operations to conduct feed management and monitoring practices in compliance with EPA regulations at 40 CFR 451.21. Standards and monitoring requirements will be specified in the NPDES permit issued by the EPA, in consultation with NOAA Fisheries Service and other state and federal agencies.

6. Require each permittee to specify their operational plans for dealing with hurricanes, vessel collision, fire, and structure damage.

Discussion: Action 2 requires permittees to submit to NOAA Fisheries Service a copy of their emergency disaster plan. The plan shall include, but is not limited to: procedures for preparing allowable aquaculture systems, offshore aquaculture equipment, and cultured organisms in the event of a disaster.

7. Prohibit the use of species that are threatened, endangered, candidates for threatened species or species for which wild harvest is prohibited.

Discussion: No species currently managed by the Council and proposed for aquaculture are threatened or endangered or considered candidates for threatened or endangered status. Nassau grouper, speckled hind, and warsaw grouper are listed as a Species of Concern by NOAA Fisheries Service and the harvest of red drum, goliath grouper, and Nassau grouper in the Gulf of Mexico EEZ is prohibited. Red drum is abundant in state waters and marine stock enhancement of this species has been occurring in Texas and Florida for many years. Goliath grouper is no longer overfishing, but its overfished status is unknown. This species was removed from NOAA Fisheries Service' Species of Concern list in 2006. Nassau grouper is not undergoing overfishing and its overfished status is unknown. The Council did not want to prohibit species that are suitable for aquaculture, but that are currently prohibited from harvest (in particular red drum). To ensure wild stocks of these species are not illegally harvested, the Council developed numerous operational, reporting, and recordkeeping requirements (Actions 2 and 8) that permittees would have to abide by. Regardless of what species is or is not allowed for harvest, NOAA Fisheries Service will need to conduct consultations under the ESA to determine if aquaculture operations will adversely affect endangered or threatened species.

8. Quarterly reports will be filed with NOAA Fisheries Service on:

- **substrate and water quality monitoring;**
- **disease outbreak;**
- **any use of medicinal therapeutics;**
- **summaries of events related to escapement of fish, damage to cages or pens and marine mammal and endangered species interaction during that quarter.**

Discussion: Action 8 requires permittees to report all incidents of suspected disease episodes with 24 hours of diagnosis to NOAA Fisheries Service. Similarly, permittees must report major escapement and entanglements or interactions with endangered species and marine mammals within 24 hours of discovery. Major escapement is defined as the escape of 5 percent or more of the cultured organisms in a seven consecutive day period. For all other reporting requirements an annual standardized report will be required for each aquaculture facility. Requiring an annual, rather than quarterly report, was deemed more appropriate since the amount of time to raise most cultured species to marketable size is greater than three months and NOAA Fisheries Service will be notified immediately (within 24 hours) if major escapement, disease outbreaks, or entanglements and interactions occur. Additionally, facilities will be required to abide by FDA regulations when using medicinal therapeutics and EPA standards for pollution discharge and monitoring. These requirements fall outside the authority of NOAA Fisheries Service.

9. Describe plans for one or more of the following:

- **physical maintenance of the facility;**
- **preventing localized biological oxygen demand (BOD)**
- **localized hypoxic conditions.**

Discussion: The EPA establishes standards for water pollution discharge and monitoring. Requiring plans for preventing BOD and localized hypoxic conditions is outside the authority of NOAA Fisheries Service. However, Action 2 does require permittees to comply with EPA feed management and monitoring practices. Standards and monitoring requirements will be specified in the NPDES permit issued by the EPA, in consultation with NOAA Fisheries Service and other state and federal agencies.

Physical maintenance of facilities is considered a normal business practice. Proper maintenance will potentially increase productivity of a facility and minimize the risk of system failure and fish escapement. Requiring a plan for physically maintaining a facility was deemed unnecessary, since it will be to the benefit of the operator/permittee to properly maintain their facility.

10. Allow the aquaculture of all marine species native to the Gulf of Mexico, except highly migratory species.

Discussion: The Council believed it was important to include highly migratory species for use in aquaculture. Although the Council does not have the authority to regulate highly migratory species, Action 4, Alternative 4 states that the Council will send a letter to NOAA Fisheries Service requesting development of concurrent rulemaking to allow aquaculture of highly migratory species.

11. Allow the aquaculture of all marine species managed by the Council.

Discussion: The Council concluded that shrimp would not be cultured in the EEZ since they are normally raised in coastal ponds in jurisdiction of the states, e.g., about 1 million pounds are raised annually in Texas waters. The regional fishery management councils in the Southeast all prohibit harvest of corals except for scientific purposes. Allowance for aquaculture would increase the likelihood that coral will be illegally harvested for the aquarium trade.

12: Describe plans for the following:

- **i. Limit genetic impacts on wild Gulf stocks. Required components of the plan would include: 1) the source of brood fish for fingerling production by geographic area, 2) the frequency broodstock are replaced, and 3) whether any cultured fish will be raised to sexual maturity.**
- **ii. Aquatic animal health management. Required components of the aquatic health management plan would include: 1) identification of an animal health management expert and frequency of visits, 2) procedures for notifying NOAA of reportable disease, 3) procedures for pre-stocking health inspections of aquatic animals, and 4) freezing or refrigerating diseased animals so they are available for inspection. "Diseased" animals are those infested with parasites and/or infected by bacteria or virus.**
- **iii. Collecting and spawning brood stock and rearing fingerlings. Required components of the plan would include: 1) a description of the culture facility; 2) the number, species, and size of broodstock proposed to be captured and the methods/gears used for capturing, holding, and transporting broodstock; 3) anticipated size to which fingerlings will be raised; and 4) a list of names and addresses for spawning and rearing facilities used to obtain fingerlings and any relevant aquaculture permit numbers.**
- **iv. Environmental monitoring. Required components of the plan would include: 1) a plan for interactions with threatened or endangered species, 2) a description of how environmental impacts would be monitored, and 3) compliance with EPA standards.**

Discussion: The above plans have been replaced with specific regulatory requirements in Actions 2 and 8 in response to NOAA General Counsel and public comments. The above plans did not include any criteria for determining adequacy and there was concern that these plans would greatly vary in quality and content from one applicant/permittee to the next. Specific regulatory requirements now identified in the FMP will allow for greater standardization during review of permit applications.

13. Allow cages and net pens for finfish, spiny lobster, and stone crab culture and floating longlines and ropes for shellfish, algae, and sponge culture in the Gulf of Mexico EEZ.

Discussion: Allowable species proposed for aquaculture include finfish, spiny lobster, and stone crabs. None of these species could be grown on longlines or ropes; therefore, this alternative was rejected by the Council.

14. Prohibit marine aquaculture within X feet (X meters) of oil and gas platforms.

Discussion: The Council discussed this alternative at their April 2008 meeting. Comments during public hearings expressed concerns about mercury contamination resulting from aquaculture occurring at or near oil and gas platforms. Because oil and gas platforms will likely serve as an important infrastructure for many offshore aquaculture operations, the Council moved this alternative to considered, but rejected section. Although there is much debate and disagreement about the effects of oil and gas platforms on marine fish and mercury contamination, the results of research to date indicate oil and gas platforms do not generally elevate levels of mercury in fish and other seafood. The following is an excerpt from the MMS website at: http://www.gomr.mms.gov/homepg/regulate/environ/mercury.html.

Mercury is a naturally occurring element that exists in sediments, rocks, oil, and coal. Mercury also occurs naturally in very small quantities in barite, a major component of drilling fluids used by the offshore oil and gas industry. However, this mercury is locked in the barite grains and not easily transferred to the marine life, which live around the platforms. Methylmercury is primarily created from mercury by a chemical process controlled by bacteria and only occurs when the right conditions exist. There is no evidence that mercury from drilling muds changes into methylmercury. Disposal of drilling fluids only occurs during drilling operations. Oil companies cannot discharge drilling fluids without a discharge permit from EPA. In the barite used to make drilling fluids, the EPA requires that the concentration of mercury be no more than one part per million (estimate of annual discharge). This reduces the addition of mercury to the environment to values similar to the concentration of mercury found in marine sediments throughout the Gulf of Mexico.

The MMS study, Gulf of Mexico Offshore Operations Monitoring Experiment (GOOMEX), was completed in 1995. In 1996 the results of this study were published in a peer reviewed dedicated volume of the Canadian Journal of Fisheries and Aquatic Sciences. This study examined three OCS platforms and included the analyses of over 700 sediment samples and over 800 tissue samples from shrimp, crabs, marine worms, clams, fish livers, and fish stomach contents. Results of the analyses documented that total mercury is not concentrated to any greater extent in organisms living near the platforms (less than 100 meters away) when compared to those living far away from the *platforms (over 3000 meters). From these results the scientists concluded that platforms do not contribute to higher mercury levels in marine organisms.*

The Minerals Management Service, MMS, recognizes that mercury (and specifically methylmercury) in the environment is a global issue and a global problem. While the issue of mercury in seafood in the Gulf of Mexico is the subject of an increasing amount of research particularly because of global and regional inputs, the results of research to date generally supports the conclusion that oil and gas platforms do not play a significant role in elevating levels of mercury in fish and other seafood.

15. Establish general siting criteria to be applied on a case-by-case basis for siting marine aquaculture facilities. Siting criteria would include, but not be limited to the items in Table 6.7-1, and the requirements of ACOE, MMS, EPA, NOAA Fisheries Service, and other regulatory agencies with authority in the EEZ as applied to aquaculture.

Discussion: These alternatives were replaced with more specific siting requirements in the Council's preferred alternative in Action 6. In particular, aquaculture operations cannot be sited in marine reserves, marine protected areas, HAPCs, NOS marine sanctuaries, coral areas, SMZs, and permitted artificial reef zones. Additionally, aquaculture operations must be sited at least 1.6 nautical miles apart and the size of the aquaculture site must be twice as large as the area encompassed by all allowable aquaculture systems to allow fallowing and rotation of cages. Lastly, NOAA Fisheries Service would be provided authority to conduct case-by-case reviews of proposed marine aquaculture sites. These siting requirements are in addition to any requirements considered by the ACOE.

16. The proxy for MSY should be equal to: a) 4 million pounds, b) 8 million pounds

Discussion: These MSY proxies were considered too low to develop a viable aquaculture industry in the Gulf of Mexico. MSY will likely be set equal to OY. Proxies for OY range from 16-190 million pounds annually. It is estimated OY levels less than 64 million pounds would support 5-20 aquaculture operations over the next 10 years.

17. The proxy for MSY is equal to X million pounds. MSY will be estimated by first using GIS to determine the allowable areas for aquaculture in the Gulf of Mexico EEZ given the siting criteria specified in Action 6. Next, the maximum number of aquaculture operations that could be sited in this area will be determined. The resulting value will then be multiplied by the average expected production of each facility to determine MSY. GIS analyses are currently underway to estimate MSY.

Discussion: The Council discussed this alternative at the April 2008 meeting and did not consider this a reasonable approach for estimating MSY. The Council believed the estimate of MSY generated from this alternative would have been far greater than the level of production they would initially like to authorize in the Gulf of Mexico.

Therefore, the Council moved this alternative to considered, but rejected section in favor of more precautionary alternatives for setting MSY and OY.

18. Major escapement is defined as the escape of 5 percent or more of the cultured organisms in a seven consecutive day period. A permittee shall provide NOAA Fisheries Service with the following information if major escapement occurs or is suspected of having occurred: permit number, contact person and phone number, location of escapement, reason(s) for escapement and the number, type of species, size, and percent of cultured organisms that escaped, and actions being taken to address the escapement.

Discussion: During the June 2008 Council meeting, the Council revised the definition for major escapement. The above definition for major escapement was replaced by the definition now contained within Action 8, Preferred Alternative 2(c)(1). The new preferred escapement definition contained in this FMP pertains to both escapement from individual allowable aquaculture systems, as well as escapement from all allowable aquaculture systems at an aquaculture site. The above definition pertained only to the cumulative escapement of cultured organisms from all allowable aquaculture systems at a specific site. The timeframes for determining escapement was also longer (7 days vs. 24 hours) for the above definition when compared with the newly preferred definition.

19. A completed application and all required supporting documents for an aquaculture permit must be submitted by the applicant on a form available from the NOAA Fisheries Service RA at least 120 days prior to the date the applicant desired the permit to be effective.

Discussion: During the October 2008 Council meeting, the Council increased the number of days prior to the date the permit is desired to become effective, because the Council felt that 120 days would not be sufficient time to review all the required documents submitted by the applicant.

20. A description of endangered and threatened species, essential fish habitat, wild marine fishes, wild invertebrates, and migratory birds present at the proposed aquaculture site, including their abundance and distribution.

Discussion: During the October 2008 Council meeting this suboption in Action 2 was considered, but rejected because this information can be collected through literature searches and as part of the baseline assessment of the proposed aquaculture site required in Action 6.

21. A copy of contact information for all vessel and aircraft operators including names, addresses, and phone numbers.

Discussion: During the October 2008 Council meeting the contact information for vessel and aircraft operators in Action 2, was considered overly burdensome and unnecessary for purposes of law enforcement.

22. Submit a standardized annual report to NOAA Fisheries Service Southeast RA addressing the recordkeeping and reporting requirements.

Discussion: During the October 2008 Council meeting the requirement for reporting an annual standardized report, Action 8 was considered, but rejected because it was redundant with more timely, in-season reporting requirements.

23. Major escapement is defined as the escape of 20 percent of the cultured organisms from a single allowable aquaculture system (e.g., one cage or one net pen) within a 24 hour period or the cumulative escape within a 24 hour period from all allowable aquaculture systems (e.g., all cages or net pens) at an aquaculture facility representing 5 percent or more of the total cultured organisms.

Discussion: During the October 2008 Council meeting, the Council revised the definition for major escapement. The above definition for major escapement was replaced by the definition now contained within Action 8, Preferred Alternative 2(b)(1). The above definition pertained to 20 percent of the cultured organisms; however, the Council felt 10 percent of the cultured organisms escaping from a single allowable aquaculture system would better quantify major escapement. The Council also added a cumulative escape of 10 percent or more of the cultured organisms from all allowable aquaculture systems at an aquaculture facility in any 30-day consecutive period.

APPENDIX E - STOCKS MANAGED IN COUNCIL FMPs

Reef Fish FMP

Species in the Management Unit

Snappers - Lutjanidae Family

Queen Snapper	*Etelis oculatus*
Mutton Snapper	*Lutjanus analis*
Schoolmaster	*Lutjanus apodus*
Blackfin Snapper	*Lutjanus buccanella*
Red Snapper	*Lutjanus campechanus*
Cubera Snapper	*Lutjanus cyanopterus*
Gray (Mangrove) Snapper	*Lutjanus griseus*
Dog Snapper	*Lutjanus jocu*
Mahogany Snapper	*Lutjanus mahogoni*
Lane Snapper	*Lutjanus synagris*
Silk Snapper	*Lutjanus vivanus*
Yellowtail Snapper	*Ocyurus chrysurus*
Wenchman	*Pristipomoides aquilonaris*
Vermilion Snapper	*Rhomboplites aurorubens*

Groupers - Serranidae Family

Rock Hind	*Epinephelus adscensionis*
Speckled Hind	*Epinephelus drummondhayi*
Yellowedge Grouper	*Epinephelus flavolimbatus*
Red Hind	*Epinephelus guttatus*
Goliath Grouper	*Epinephelus itajara*
Red Grouper	*Epinephelus morio*
Misty Grouper	*Epinephelus mystacinus*
Warsaw Grouper	*Epinephelus nigritus*
Snowy Grouper	*Epinephelus niveatus*
Nassau Grouper	*Epinephelus striatus*
Black Grouper	*Mycteroperca bonaci*
Yellowmouth Grouper	*Mycteroperca interstitialis*
Gag	*Mycteroperca microlepis*
Scamp	*Mycteroperca phenax*
Yellowfin Grouper	*Mycteroperca venenosa*

Tilefishes - Malacanthidae (Branchiostegidae) Family

Goldface Tilefish	*Caulolatilus crysops*
Blackline Tilefish	*Caulolatilus cyanops*
Anchor Tilefish	*Caulolatilus intermedius*
Blueline Tilefish	*Caulolatilus microps*
Tilefish	*Lopholatilus chamaeleonticeps*

Jacks - Carangidae Family

Greater Amberjack	*Seriola dumerili*
Lesser Amberjack	*Seriola fasciata*
Almaco Jack	*Seriola rivoliana*
Banded Rudderfish	*Seriola zonata*

Triggerfishes - Balistidae Family

Gray Triggerfish	*Balistes capriscus*

Wrasses - Labridae Family

Hogfish	*Lachnolaimus maximus*

Species in the Management Unit for Data Collection Only

Sand Perches - Serranidae Family

Dwarf Sand Perch	*Diplectrum bivattatum*
Sand Perch	*Diplectrum formosum*

Red Drum FMP

Species in the Management Unit

Red Drum	*Sciaenops ocellatus*

Coastal Migratory Pelagics FMP

Species in the Management Unit

King Mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*Scomberomorus maculatus*
Cobia	*Rachycentron canadum*

Species in the Management Unit for Data Collection Only

Cero	*Scomberomorus regalis*
Little Tunny	*Euthynnus alletteratus*
Dolphin	*Coryphaena hippurus*
Bluefish	*Pomatomus saltatrix*

Species that may be added to the Management Unit

Wahoo	*Acanthocybium solandri*
Blackfin tuna	*Thunnus atlanticus*
Blue runner	*Caranx crysos*

Shrimp FMP

Species in the Management Unit

Brown Shrimp	*Farfontepenaeus aztecus*

White Shrimp	*Litopenaeus setiferus*
Pink Shrimp	*Farfontepenaeus duorarum*
Royal Red Shrimp	*Hymenopenaeus robustus*

<u>Spiny Lobster FMP</u>

<u>Species in the Management Unit</u>

Spiny Lobster	*Panulirus argus*
Slipper Lobster	*Scyllarides nodifer*

<u>Species in the Management Unit for Data Collection Only</u>

Spotted Spiny Lobster	*Panulirus argus*
Smooth Tail Lobster	*Panulirus laevicauda*
Spanish Slipper Lobster	*Scyllarides aequinoctialis*

<u>Stone Crab FMP</u>

<u>Species in the Management Unit</u>

Stone Crab	*Menippe mercenaria*
Stone Crab (Cedar Key north)	*Menippe adina*

<u>Coral FMP</u>

<u>Species in the Management Unit</u> (330)
Corals of the Class *Hydrozoa*
Corals of the Class *Anthozoa*

APPENDIX F - ILLUSTRATIONS OF CAGES AND PENS

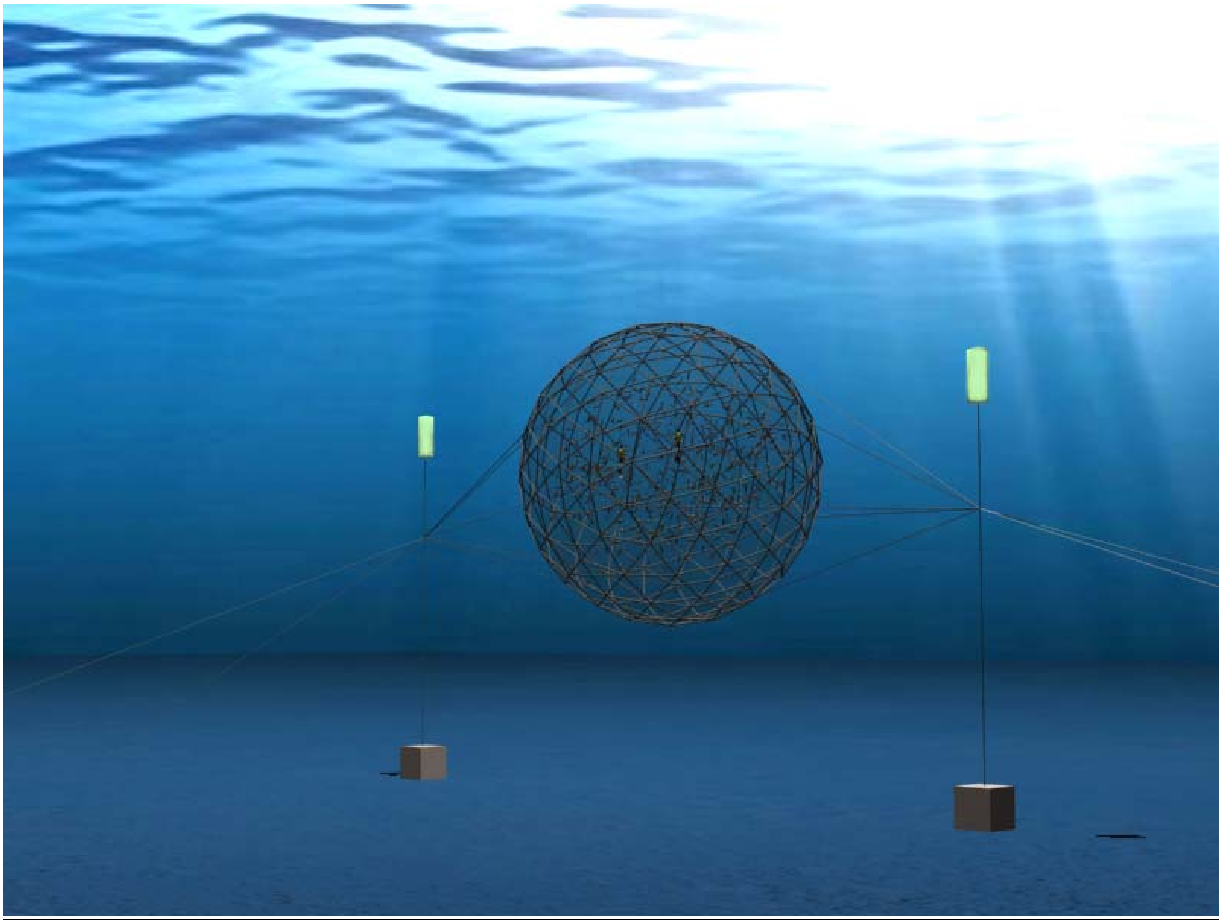

Figure 1. Illustration of an Aquapod designed by Ocean Farm Technologies, www.oceanfarmtech.com

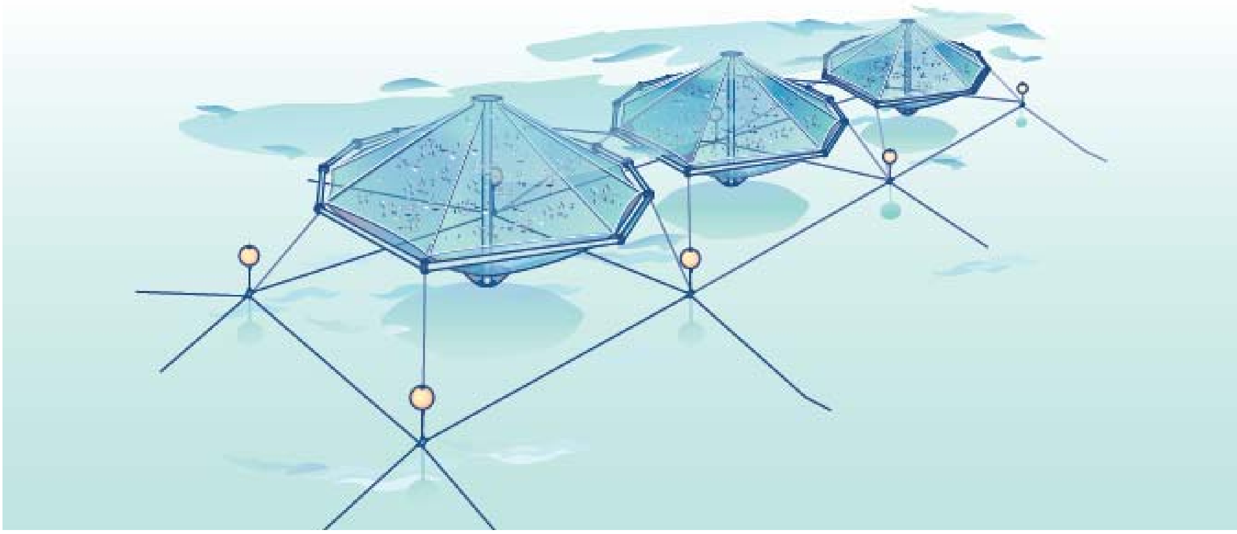

Figure 2. Illustration of Open Ocean Sea Station by Ocean Spar, www.oceanspar.com

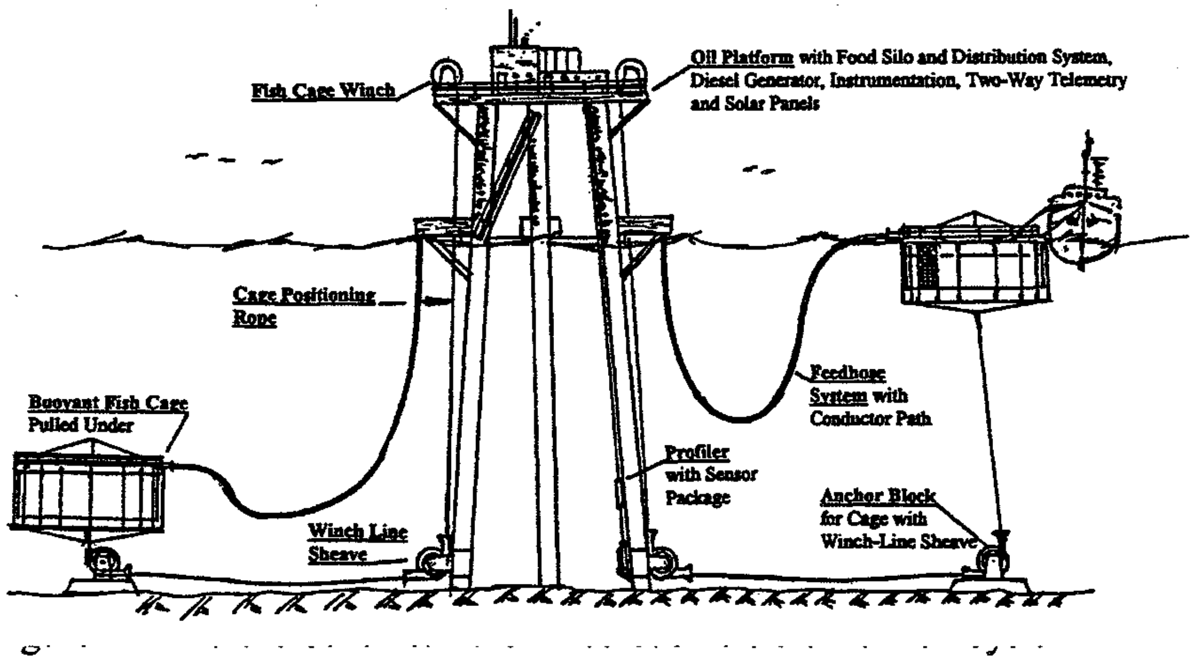

Figure 3: Oil platform with food silo and distribution system, diesel generator, instrumentation, two-way telemetry and solar panels. Source: Offshore Mariculture in the Gulf of Mexico: A Feasibility Report published by the Louisiana Sea Grant College Program, Sea Grant Building, Louisiana State University, Baton Rouge, Louisiana

APPENDIX G - EPA EFFLUENT LIMITATIONS GUIDELINES AND NEW SOURCE PERFORMANCE STANDARDS FOR THE CONCENTRATED AQUATIC ANIMAL PRODUCTION POINT SOURCE CATEGORY

For the reasons set forth in the preamble, chapter I of title 40 of the Code of Federal Regulations is amended by adding part 451 to read as follows:

PART 451--CONCENTRATED AQUATIC ANIMAL PRODUCTION POINT SOURCE CATEGORY

Sec.
451.1 General applicability.
451.2 General definitions.
451.3 General reporting requirements.

Subpart A--Flow-Through and Recirculating Systems Subcategory
451.10 Applicability.
451.11 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).
451.12 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).
451.13 Effluent limitations attainable by the application of the best conventional technology (BCT).
451.14 New source performance standards (NSPS).

Subpart B--Net Pen Subcategory
451.20 Applicability.
451.21 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).
451.22 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).
451.23 Effluent limitations attainable by the application of the best conventional technology (BCT).
451.24 New source performance standards (NSPS).

Authority: 7 U.S.C. 135 et seq., 136-136y; 15 U.S.C. 2001, 2003, 2005, 2006, 2601-2671, 21 U.S.C. 331j, 346a, 348; 31 U.S.C. 9701; 33 U.S.C. 1251 et seq., 1311, 1313d, 1314, 1318, 1321, 1326, 1330, 1342, 1344, 1345(d) and (e), 1361; 42 U.S.C. 241, 242b, 243, 246, 300f, 300g, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-2, 300j-3, 300j-4, 300j-9, 1857 et seq., 6901-6992k, 7401-7671q, 7542, 9601-9657, 11023, 11048; E.O. 11735, 38 FR 21243, 3 CFR, 1971-1975 Comp., 973.

Sec. 451.1 General applicability.

As defined more specifically in each subpart, this Part applies to discharges from concentrated aquatic animal production facilities as defined at 40 CFR 122.24 and

Appendix C of 40 CFR Part 122. This Part applies to the discharges of pollutants from facilities that produce 100,000 pounds or more of aquatic animals per year in a flow-through, recirculating, net pen or submerged cage system.

Sec. 451.2 General definitions.

As used in this part:

(a) The general definitions and abbreviations in 40 CFR part 401 apply.

(b) Approved dosage means the dose of a drug that has been found to be safe and effective under the conditions of a new animal drug application.

(c) Aquatic animal containment system means a culture or rearing unit such as a raceway, pond, tank, net or other structure used to contain, hold or produce aquatic animals. The containment system includes structures designed to hold sediments and other materials that are part of a wastewater treatment system.

(d) Concentrated aquatic animal production facility is defined at 40 CFR 122.24 and Appendix C of 40 CFR Part 122.

(e) Drug means any substance defined as a drug in section 201(g)(1) of the Federal Food, Drug and Cosmetic Act (21 U.S.C. 321).

(f) Extralabel drug use means a drug approved under the Federal Food, Drug and Cosmetic Act that is not used in accordance with the approved label directions (21 CFR part 530).

(g) Flow-through system means a system designed to provide a continuous water flow to waters of the United States through chambers used to produce aquatic animals. Flow-through systems typically use rearing units that are either raceways or tank systems. Rearing units referred to as raceways are typically long, rectangular chambers at or below grade, constructed of earth, concrete, plastic, or metal to which water is supplied by nearby rivers or springs. Rearing units comprised of tank systems use circular or rectangular tanks and are similarly supplied with water to raise aquatic animals. The term does not include net pens.

(h) Investigational new animal drug (INAD) means a drug for which there is a valid exemption in effect under section 512(j) of the Federal Food, Drug, and Cosmetic Act, 21 U.S.C. 360b(j), to conduct experiments.

(i) New animal drug application is defined in 512(b)(1) of the Federal Food, Drug, and Cosmetic Act (21 U.S.C 360b(b)(1)).

(j) Net pen system means a stationary, suspended or floating system of nets, screens, or cages in open waters of the United States. Net pen systems typically are located along a shore or pier or may be anchored and floating offshore. Net pens and submerged cages rely on tides and currents to provide a continual supply of high-quality water to the animals in production.

(k) Permitting authority means EPA or the State agency authorized to administer the National Pollutant Discharge Elimination System permitting program for the receiving waters into which a facility subject to this Part discharges.

(l) Pesticide means any substance defined as a ``pesticide'' in section 2(u) of the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136(u)).

(m) Real-time feed monitoring means a system designed to track the rate of feed consumption and to detect uneaten feed passing through the nets at a net pen facility.

These systems may rely on a combination of visual observation and hardware, including, but not limited to, devices such as video cameras, digital scanning sonar, or upweller systems that allow facilities to determine when to cease feeding the aquatic animals. Visual observation alone from above the pens does not constitute real-time monitoring.

(n) Recirculating system means a system that filters and reuses water in which the aquatic animals are produced prior to discharge. Recirculating systems typically use tanks, biological or mechanical filtration, and mechanical support equipment to maintain high quality water to produce aquatic animals.

Sec. 451.3 General reporting requirements.

(a) Drugs. Except as noted below, a permittee subject to this Part must notify the permitting authority of the use in a concentrated aquatic animal production facility subject to this Part of any investigational new animal drug (INAD) or any extralabel drug use where such a use may lead to a discharge of the drug to waters of the U.S. Reporting is not required for an INAD or extralabel drug use that has been previously approved by FDA for a different species or disease if the INAD or extralabel use is at or below the approved dosage and involves similar conditions of use.

(1) The permittee must provide a written report to the permitting authority of an INAD's impending use within 7 days of agreeing or signing up to participate in an INAD study. The written report must identify the INAD to be used, method of use, the dosage, and the disease or condition the INAD is intended to treat.

(2) For INADs and extralabel drug uses, the permittee must provide an oral report to the permitting authority as soon as possible, preferably in advance of use, but no later than 7 days after initiating use of that drug. The oral report must identify the drugs used, method of application, and the reason for using that drug.

(3) For INADs and extralabel drug uses, the permittee must provide a written report to the permitting authority within 30 days after initiating use of that drug. The written report must identify the drug used and include: the reason for treatment, date(s) and time(s) of the addition (including duration), method of application; and the amount added.

(b) Failure in, or damage to, the structure of an aquatic animal containment system resulting in an unanticipated material discharge of pollutants to waters of the U.S. In accordance with the following procedures, any permittee subject to this Part must notify the permitting authority when there is a reportable failure.

(1) The permitting authority may specify in the permit what constitutes reportable damage and/or a material discharge of pollutants, based on a consideration of production system type, sensitivity of the receiving waters and other relevant factors.

(2) The permittee must provide an oral report within 24 hours of discovery of any reportable failure or damage that results in a material discharge of pollutants, describing the cause of the failure or damage in the containment system and identifying materials that have been released to the environment as a result of this failure.

(3) The permittee must provide a written report within 7 days of discovery of the failure or damage documenting the cause, the estimated time elapsed until the failure or damage was repaired, an estimate of the material released as a result of the failure or damage, and steps being taken to prevent a recurrence.

(c) In the event a spill of drugs, pesticides or feed occurs that results in a discharge to waters of the U.S., the permittee must provide an oral report of the spill to the permitting authority within 24 hours of its occurrence and a written report within 7 days. The report shall include the identity and quantity of the material spilled.

(d) Best management practices (BMP) plan. The permittee subject to this Part must:

(1) Develop and maintain a plan on site describing how the permittee will achieve the requirements of Sec. 451.11(a) through (e) or Sec. 451.21(a) through (h), as applicable.

(2) Make the plan available to the permitting authority upon request.

(3) The permittee subject to this Part must certify in writing to the permitting authority that a BMP plan has been developed.

Subpart A--Flow-Through and Recirculating Systems Subcategory

Sec. 451.10 Applicability.

This subpart applies to the discharge of pollutants from a concentrated aquatic animal production facility that produces 100,000 pounds or more per year of aquatic animals in a flow-through or recirculating system.

Sec. 451.11 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must meet the following requirements, expressed as practices (or any modification to these requirements as determined by the permitting authority based on its exercise of its best professional judgment) representing the application of BPT:

(a) Solids control. The permittee must:

(1) Employ efficient feed management and feeding strategies that limit feed input to the minimum amount reasonably necessary to achieve production goals and sustain targeted rates of aquatic animal growth in order to minimize potential discharges of uneaten feed and waste products to waters of the U.S.

(2) In order to minimize the discharge of accumulated solids from settling ponds and basins and production systems, identify and implement procedures for routine cleaning of rearing units and off-line settling basins, and procedures to minimize any discharge of accumulated solids during the inventorying, grading and harvesting aquatic animals in the production system.

(3) Remove and dispose of aquatic animal mortalities properly on a regular basis to prevent discharge to waters of the U.S., except in cases where the permitting authority authorizes such discharge in order to benefit the aquatic environment.

(b) Materials storage. The permittee must:

(1) Ensure proper storage of drugs, pesticides, and feed in a manner designed to prevent spills that may result in the discharge of drugs, pesticides or feed to waters of the U.S.

(2) Implement procedures for properly containing, cleaning, and disposing of any spilled material.

(c) Structural maintenance. The permittee must:

(1) Inspect the production system and the wastewater treatment system on a routine basis in order to identify and promptly repair any damage.

(2) Conduct regular maintenance of the production system and the wastewater treatment system in order to ensure that they are properly functioning.

(d) Recordkeeping. The permittee must:

(1) In order to calculate representative feed conversion ratios, maintain records for aquatic animal rearing units documenting the feed amounts and estimates of the numbers and weight of aquatic animals.

(2) Keep records documenting the frequency of cleaning, inspections, maintenance and repairs.

(e) Training. The permittee must:

(1) In order to ensure the proper clean-up and disposal of spilled material adequately train all relevant facility personnel in spill prevention and how to respond in the event of a spill.

(2) Train staff on the proper operation and cleaning of production and wastewater treatment systems including training in feeding procedures and proper use of equipment.

Sec. 451.12 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must meet the following requirements representing the application of BAT: The limitations are the same as the corresponding limitations specified in Sec. 451.11.

Sec. 451.13 Effluent limitations attainable by the application of the best conventional technology (BCT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must meet the following requirements representing the application of BCT: The limitations are the same as the corresponding limitations specified in Sec. 451.11.

Sec. 451.14 New source performance standards (NSPS).

Any point source subject to this subpart that is a new source must meet the following requirements: The standards are the same as the corresponding limitations specified in Sec. 451.11.

Subpart B--Net Pen Subcategory

Sec. 451.20 Applicability.

This subpart applies to the discharge of pollutants from a concentrated aquatic animal production facility that produces 100,000 pounds or more per year of aquatic animals in net pen or submerged cage systems, except for net pen facilities rearing native species released after a growing period of no longer than 4 months to supplement commercial and sport fisheries.

Sec. 451.21 Effluent limitations attainable by the application of the best practicable control technology currently available (BPT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must meet the following requirements, expressed as practices (or any modification to these requirements as determined by the permitting authority based on its exercise of its best professional judgment) representing the application of BPT:

(a) Feed management. Employ efficient feed management and feeding strategies that limit feed input to the minimum amount reasonably necessary to achieve production goals and sustain targeted rates of aquatic animal growth. These strategies must minimize the accumulation of uneaten food beneath the pens through the use of active feed monitoring and management practices. These practices may include one or more of the following: Use of real-time feed monitoring, including devices such as video cameras, digital scanning sonar, and upweller systems; monitoring of sediment quality beneath the pens; monitoring of benthic community quality beneath the pens; capture of waste feed and feces; or other good husbandry practices approved by the permitting authority.

(b) Waste collection and disposal. Collect, return to shore, and properly dispose of all feed bags, packaging materials, waste rope and netting.

(c) Transport or harvest discharge. Minimize any discharge associated with the transport or harvesting of aquatic animals including blood, viscera, aquatic animal carcasses, or transport water containing blood.

(d) Carcass removal. Remove and dispose of aquatic animal mortalities properly on a regular basis to prevent discharge to waters of the U.S.

(e) Materials storage.

(1) Ensure proper storage of drugs, pesticides and feed in a manner designed to prevent spills that may result in the discharge of drugs, pesticides or feed to waters of the U.S.

(2) Implement procedures for properly containing, cleaning, and disposing of any spilled material.

(f) Maintenance.

(1) Inspect the production system on a routine basis in order to identify and promptly repair any damage.

(2) Conduct regular maintenance of the production system in order to ensure that it is properly functioning.

(g) Recordkeeping.

(1) In order to calculate representative feed conversion ratios, maintain records for aquatic animal net pens documenting the feed amounts and estimates of the numbers and weight of aquatic animals.

(2) Keep records of the net changes, inspections and repairs.

(h) Training. The permittee must:

(1) In order to ensure the proper clean-up and disposal of spilled material adequately train all relevant facility personnel in spill prevention and how to respond in the event of a spill.

(2) Train staff on the proper operation and cleaning of production systems including training in feeding procedures and proper use of equipment.

Sec. 451.22 Effluent limitations attainable by the application of the best available technology economically achievable (BAT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BAT: The limitations are the same as the limitations specified in Sec. 451.21.

Sec. 451.23 Effluent limitations attainable by the application of the best conventional technology (BCT).

Except as provided in 40 CFR 125.30 through 125.32, any existing point source subject to this subpart must achieve the following effluent limitations representing the application of BCT: The limitations are the same as the limitations specified in Sec. 451.21.

Sec. 451.24 New source performance standards (NSPS).

Any point source subject to this subpart that is a new source must meet the following requirements: The standard is the same as the limitations specified in Sec. 451.21.

APPENDIX H – AQUACULTURE SCOPING MEETING SUMMARIES

Adam's Mark Hotel
Mobile, Alabama
February 17, 2004

ATTENDEES: 7 persons:

Council:
Vernon Minton
Wayne Swingle
Kathy Conlon

W. J. Butts.. RNR Inc.
Ed Cake............... BioMarine Technologies, Inc. and Gulf Marine Institute of Technology
Jesse Chappell... Auburn University
John Ericcson... Gulf Marine Institute of Technology
Julian Stewart... Alma Bryant High School
David Underhill .... Sierra Club
Rick Wallace... Auburn University

Chairman Minton called the meeting to order at 6:00 p.m.

Mr. Swingle presented the Generic Amendment for Management of Offshore Marine Aquaculture.

Mr. Butts noted that he had been providing documentation since 1999 and wondered if the 200# license was going to be eliminated.

Mr. Swingle replied that red snapper fishery would not be affected. He further stated that if the referendum was approved, then Council could proceed with the development of an IFQ program for red snapper and that the Ad Hoc Red Snapper Advisory Panel had recommended that anyone with red snapper landings would be included in the IFQ program.

Mr. Minton noted that the Council historically had taken the advice of the AP panels. He further added that the chosen time frame could change and 1999 would not necessarily remain as the target year and would be identified in the IFQ.

Dr. Cake, representing BioMarine Technologies and GulfMarine Institute of Technology, which utilize oil and gas platforms, presented his comments regarding mariculture and the proposed regulation. He stated that uniformity was needed regarding the terminology of the process and that his preference was mariculture rather than aquaculture. **Dr. Cake** noted that Dr. Wenzel first coined the term mariculture. He added that mariculture referred to the development of marine species or estuarine species and that aquaculture generally refers to fresh water and land based species.

Dr. Cake presented the following handouts: Statement of Dr. Edwin C. Cake, Jr., Ph.D. to the Gulf of Mexico Fishery Management Council regarding The Regulation of Offshore Mariculture of Selected Finfish (**Attachment 1**); a letter to Mr. Larry Godwin, Corps of Engineers, from Gulf Environmental Associates (**Attachment 2**); and various articles (**Attachment 3**).

Dr. Cake stated that the issue of essential fish habitat needed to be addressed in the alternatives. He noted his concerns regarding mariculture versus commercial and recreational fishing and which group's interest had precedence with the Council.

Dr. Cake inquired if there was mariculture representation on the Gulf of Mexico Fishery Management Council and challenged the Council to end the adversity to mariculture. He stated that the Council should include persons interested in mariculture.

Mr. Minton replied that Mr. Joe Hendrix, an offshore and inshore shrimp farmer who maricultures in Harligen, Texas, was on the Gulf Council, and had contributed to the document.

Dr. Cake stated that a large portion of Alabama's EEZ was available for any one that wanted to create an artificial reef and that anything could be put down in the EEZ as long as it did not come ashore.

Mr. Minton responded that the statement was not factual and that there was a protocol documenting what types of artificial reefs could be placed exclusively in the permitted zones.

Dr. Cake stated his concern that disallowing mariculture due to the potential of or proximity to artificial reefs seemed to be favoring one fisher over another, with the fisher using an artificial reef having preference.

Dr. John Ericcson, Gulf Marine Institute of Technology, stated his concerns regarding permitting in the aquaculture industry. He noted that he, along with Dr. Cake, had been involved with the development of mariculture in the Gulf of Mexico, originally in Mississippi, for the past 14 years. He added that the state of Mississippi requested that he and his colleagues prepare the guidelines for establishing mariculture in Mississippi State waters. Subsequently, they could not obtain the permit for the guidelines that they prepared unless the state of Mississippi received 5% of the gross proceeds generated from the project.

Dr. Ericcson noted that his companies were the only companies in the United States that hold permits for mariculture in both federal and state waters and that they were presently working in Texas, Mississippi, Alabama, and Florida. He added that his companies have never been contacted by the Gulf of Mexico Fishery Management Council or National Marine Fisheries Service to assist with the development of the mariculture industry in the Gulf of Mexico. He further stated that many parts of the Amendment were ridiculous and many were right on target.

Mr. Minton reiterated that the purpose of the meeting was to obtain specific comments regarding the Amendment, both positive and negative, and that written comments were most beneficial and, when received, would be distributed to the Council.

Dr. Ericcson noted that he thought the most ridiculous part of the Amendment was that the permits were annually renewable and that he would prefer that the permits be granted for 5 years, given the amount of monies necessary for investment.

Dr. Ericcson noted that he had assisted in preparation of an Environmental Impact Statement (EIS), which was submitted to the Environmental Protection Agency (EPA). He added that the process of obtaining permits for mariculture was in existence and questioned the purpose of the Amendment. He added that he thought an Exempt Fishing Permit (EFP) was intended for scientific purposes and not for commercial fish farming purposes, yet an EFP was necessary to commence commercial mariculture as a research project. **Dr. Ericcson** further stated that when he requested a permit for an EPF from the National Marine Fisheries Services, he discovered that the permit did not exist and must be created by studying the Federal Register and comprehension of what must be requested.

Dr. Ericcson stated that his company was going to ask the State of Florida for a permit to fish farm in the state waters of Florida because he had not been able to obtain an Exempt Fishing Permit.

Mr. Minton responded that part of the process started when Florida Offshore Aquaculture requested an Exempt Fishing Permit. He added that NOAA General Counsel ruled that Aquaculture, or mariculture, was the harvesting and taking of fisheries that were managed under Fishery Management Plans (FMPs) in the Gulf and that holding the fish in numbers outside of the bag limits, trip limits, size limits and harvesting of the fish, constituted fishing. **Mr. Minton** added that without the proposed Amendment, which covered various plans, Council realized that it would be nearly impossible to obtain an Exempt Fishing Permit due to the fact that permits were issued only for science, under the current guidelines. He further added that the operations in the Texas waters never requested a permit and when a permit was requested, the General Counsel became involved and developed the current policy and need for the Amendment.

Dr. Ericcson noted that Mr. Tom Graham, a former member of NOAA legal counsel, informed him that the Magnuson Act was never intended as a guideline to regulate mariculture. He further added that NOAA General Counsel should be challenged to determine if the Magnuson Act was intended to regulate mariculture or sea farming.

Mr. Minton suggested that Dr. Ericcson contact Mike McLemore or Mr. Shepherd Grimes, NOAA General Counsel, and would provide their phone numbers if Dr. Ericcson desired.

Dr. Ericcson stated that his companies have 14 years and millions of dollars invested in the mariculture industry and planned to stay, unlike Mr. Joe Hendrix, who did not have long-term experience.

Mr. Minton reiterated that the Council appreciated Dr. Ericcson's comments and looked forward to receiving his written comments.

Dr. Jesse Chappel, a statewide aquaculture extension specialist with Auburn University, commented that the Amendment contains many excellent points and some that are ridiculous and prohibitive. He added that it was his understanding that now was the time to shape the document into a useful, practical, and enabling entity as a guideline in order for a young industry to grow. He added that he has sent over a billion fingerlings to overseas' markets from his own company because there was no market in the United States and that he would prefer to provide the fish to growers in his own country. He supported Dr. Ericcson's desires that Council include persons involved and experienced in mariculture.

Mr. Minton concluded the meeting by explaining the composition of the Council members in order to illustrate the wide variety of the members' backgrounds and experience. He encouraged the attendees to attend the March Council Meeting in Mobile during the week of March 8, 2004, and that the Reef Fish/Aquaculture Committee would meet on Tuesday. He also invited written comments to be received by March 5, 2004.

J. L. Scott Marine Education Center
Biloxi, Mississippi
February 18, 2004

ATTENDEES: 4 persons:

Council:
Kay Williams, Chairman
Wayne Swingle
Kathy Conlon
Phil Horn..Clark Seafood Co., Inc.
Jude LeDoux .... Mississippi DMR
Tom McIlwain ....Gulf Coast Research Laboratory
LaDon Swann............................Director, Mississippi/Alabama SeaGrant Consortium and
.... President Elect of the U. S. Aquaculture Society

Chairman Williams called the meeting to order at 6:00 p.m.

Chairman Williams inquired if there were any objections to forgo the presentation on Amendment for Limiting Access in the Commercial Reef Fish and King Mackerel Fisheries and moved to the presentation of Generic Amendment for Management of Offshore Marine Aquaculture.

Mr. Swingle presented the Generic Amendment for Management of Offshore Marine Aquaculture.

Dr. McIlwain stated that the Gulf Coast Research Laboratory wished to thank the Council for the continuation of the development of the Amendment for Offshore Aquaculture and encouraged the further development of the Amendment. He further stated that it was very important that a set of rules and regulations are developed to allow the Aquaculture industry to develop. He further added that it was inevitable that the Aquaculture industry was going to develop and that the Gulf Coast Research Laboratory would prefer the development fashioned in an orderly manner. He noted that the Amendment to the FMPs provided the necessary means for establishing a regulatory environment under which the industry can develop. **Dr. McIlwain** reported that his organization did not desire to comment on specific alternatives at the present time and would wait until the process proceeded to the development of the Amendment.

Mr. Swingle offered to e-mail a copy of the document and requested that any changes are returned to the Council by March 5, 2004, for presentation to the Council during the March Council Meeting.

Dr. Swann, Director of Mississippi/Alabama SeaGrant consortium, reported that he supported the Amendment and confirmed that there was great interest in growing fish in the EEZ and that several applications had been submitted. He further added that an application received through the Offshore Aquaculture Consortium, located at the University of Southern Mississippi, did receive the necessary permits. He noted that an

Amendment allowing the flexibility to grow fish in the EEZ was essential for the fishing industry to move forward and complimented the authors of the document as being very thorough and attainable. **Dr. Swann** reported that his original concerns were with monitoring and record keeping. He added that he did have a concern regarding the distance of the monitoring stations to the cage and suggested that the distance of the monitoring stations to the cage be extended. of the monitors to the cage and suggested that the distance of the monitor stages to the cage be extended.

Larose Regional Park
Larose, Louisiana
February 19, 2004

ATTENDEES: 25 persons:

Council:
Myron Fischer, Chairman
Wayne Swingle
Kathy Conlon

George Arneseh ....Commercial Fishery
Keith J. Barihe, Sr. ....Commercial Fishery
Leo Bickham ....Commercial Fishery
James B. Bruce...Commercial Fishery
David Camardelle ....Mayor of Grand Isle, LA, Commercial Fishery
Noel Camardelle ....Commercial Fishery
Al Cassagne ....Commercial Fishery
Harry J. Cheramie, Sr...Commercial Fishery
Josie Cheramie .... Grand Isle Tourist Commission, Commercial Fishery
Vincent F. Cottone ....Offshore Operators Committee
Sallie Davis ....Gulf Restoration Network
Connie DuBois..Commercial Fishery
Euris DuBois ....Commercial Fishery
Michael Frazier ....Commercial Fishery
Logan J. Galliano ....Commercial Fishery
Steve Kolian.. ECO Rigs
Ivy J. Lasseigne, Jr. ....Commercial Fishery
Robert J. Pitre, Jr...Commercial Fishery
Terry M. Pizani ....Commercial Fishery
Terrill Pizani ....Commercial Fishery
Mickey Readenour ....Commercial Fishery
Dr. Paul Sammarco .... Louisiana University Marine Consortium
James R. Scheer ....Commercial Fishery
Stu Scheer ....Commercial Fishery
Jerry Walker..Commercial Fishery

Mr. Swingle presented the Generic Amendment for Management of Offshore Marine Aquaculture. He stated that the reason for implementation was a current legal opinion indicated that commercial aquaculture constitutes fishing under the Magnuson-Stevens Act and cannot be done without an authorizing Amendment.

Mr. Kolian, a scientist, stated that Japan had found open-ocean aquaculture was the best Fishery Management Practice (FMP) for marine aquaculture. He noted that establishing aquaculture in the Gulf would be a very costly venture, given the necessary permitting requirements and that the Corp of Engineers may require a fishery management permit prior to issuing their respective permit. He also suggested that the FMP should cover more than net pen and that 100 – 250 platforms were being removed yearly from the water. **Mr. Kolian** noted that he was going to e-mail a copy of the Amendment to Mr. Swingle with his suggested amendments.

Mr. Swingle noted that the people fishing oil and gas platforms were allowed to maintain a recreational bag limit with the proviso that only 1 bag limit in possession was permitted.

Ms. Davis reported that her organization was extremely pleased with the development of the Amendment. She noted that Gulf Restoration Network agreed than annual issue of the permits was an excellent idea and would keep the companies within regulations. She also noted that her organization supports Alternative b in Section 6.5.6 and does not support Alternative d and that all Alternatives under Section 6.5.7 were important and that she would e-mail a copy of the Amendment with her comments to Mr. Swingle.

Dr. Sammarco noted that there were 4,000 offshore platforms in the Gulf and were more valuable in the water than out of the water as they add to the production of fish. **Dr. Sammarco** noted that his expertise was corals and invertebrates and not fish. He noted that coral was very valuable, which could possibly lead to a black market on coral. He also reported that there was a large demand for live rock. He added that there was a need in the pharmaceutical industry for certain algae that could be produced around the platforms. **Dr. Sammarco** emphasized that it was very important that the fish being grown were properly fed and that he supported culturing endangered corals. He concluded by noting that aquaculture was a future industry and that he was very impressed with the Scoping Document.

Moody Gardens Hotel
Galveston, Texas
February 24, 2004

ATTENDEES: 8 members of the public attended

Council:
Irby Basco
Rick Leard
Lorna Evans

Linda Butler .... Texas Parks & Wildlife Dept., Dickinson, Texas
Jan Culbertson .... Texas Parks & Wildlife Dept., Dickinson, Texas
Phillip Lee .... University of Texas Medical Branch, Galveston, Texas
Mark Muhich .... Sierra Club, Galveston, Texas
Ralph Rayburn .... Texas SeaGrant Program, College Station, Texas

Mr. Basco called the meeting to order at 6:30 p.m.

Dr. Leard presented the Generic Amendment for Management of Offshore Marine Aquaculture.

Dr. Lee stated that he has been an aquaculture scientist for 25 years. He entered two documents into the record: "Development of an Integrated Offshore Mariculture Project for Marine Finfish and Oysters in the Gulf of Mexico" **(Attachment 1)**. He believed the one-year time span for the permit was totally inadequate and did not allow the applicant enough time to get financially prepared. He disagreed with the requirement for excessive reports and duplication in permitting by NMFS and the EPA. He felt the Council should include brood stock management into the mariculture permit. He commented that there was a conundrum of genetic diversity and pointed out that the fingerprinting of stocks was expensive. He stated that one section of the document encouraged genetic diversity and in another section of the document genetic diversity was discouraged. He questioned ensuring disease-free hatcheries and disease-free fish when those fish were taken out of the environment as brood stock, grown in a hatchery then put back in the environment. The diseases that were in the environment would be in the cages when the fish were put back in the cages. He felt a more logical system would be to make the fish pathogen free, for specific diseases, during the hatchery and brood stock phases of growth. This would
initiated to fund this project. He was opp
or exotic species into the Gulf. He felt the brood stocks should consist of indigenous species to the area. He suggested that a research facility be set up to determine whether the best management practices were implemented and this should be funded by the federal government. He questioned how dolphins would be kept out of the pens and whether the individuals in charge of the pens would be allowed to kill any species that tried to penetrate the pens. He discouraged lowering the standards of water quality and asked that these standards be of the highest quality.

Madeira Beach City Hall
Madeira Beach, Florida
Thursday, February 26, 2004

ATTENDEES: 30 members of the public attended

Council:
Karen Bell
Rick Leard
Lorna Evans

Tommy Butler............................... Florida Offshore Aquaculture, South Pasadena, Florida
Marianne Cufone .... The Ocean Conservancy, St. Petersburg, Florida
Ryan Dean.. Commercial Fisherman, Pinellas Park, Florida
Scott Doggett ....Commercial Fisherman, St. Petersburg, Florida
Martin Fisher... SOFA, St. Petersburg, Florida
Kenneth Glenn .... SOFA, Largo, Florida
Jack Golden.. SOFA, Madeira Beach, Florida
Phillip Jozza ....St. Petersburg, Florida
Roger Koske.. SOFA, Madeira Beach, Florida
Ronald Laskey ....Commercial Fisherman, Indian Rocks Beach, Florida
Randy Laurel.. SOFA, Largo, Florida
Ed Maccini ....SOFA, Seminole, Florida
Dennis O'Hern ....Seminole, Florida
Tommy Powell.. Florida Offshore Aquaculture, Tampa, Florida
Paul Renner...Commercial Fisherman
Mike Rice...Commercial Fisherman
Sal Versaggi ....Versaggi Shrimp, Tampa, Florida
Scott Webber...Fishing Rights Alliance, St. Petersburg, Florida

Ms. Bell called the meeting to order at 7:30 p.m.

Dr. Leard presented the Generic Amendment for Management of Offshore Marine Aquaculture.

Mr. Powell stated that NOAA General Counsel had no jurisdiction to decide that aquaculture was under the Council's authority and felt that decision should be left to the U.S. Department of Agriculture. He entered a letter into the record **(Attachment 1)**.

Mr. Butler supported aquaculture. He was opposed to the one-year permits because the investors would not give money for such a short time period. He asked for at least 2 years or 5 years maximum. He felt this would give time to address any problems such as fouling, marine mammals, or pollution. He asked that the Council help him make the transition from commercial fisherman to aquaculturist. He pointed out that this would create rather than deplete a resource. He stated that there were over 20 jobs available now with a possibility of over 200 to 1,000 jobs in the future. He was opposed to the requirement that the COE grant a permit before NMFS gave a permit. He related that the goal of offshore aquaculture was to create a resource of fish. He suggested using the most threatened species to grow in the cage. He commented that the commercial fishermen had depleted the species to its current state. He questioned where was the 73 million dollars that the Department of Agriculture, Department of Interior, and the Department of Commerce had received from Congress. He commented that he has a family and he would like to start a business.

Ms. Cufone stated that her agency was not anti-aquaculture. She related that there were concerns with regard to open ocean aquaculture because there was no comprehensive national legislation that detailed proper process, proper management practices and penalties for non-compliance with any of those practices. She was opposed to the scoping document because she felt there was a better way to deal with open ocean aquaculture. She was also concerned about the lack of scientific information about open ocean aquaculture to base comprehensive legislation. She pointed out that a lot of the information in the scoping document barely touched on potential and actual problems that exist with open ocean aquaculture. She commented that there was a lot of outdated information in the document and she felt there were more recent studies that should be used. She stated that fish that had been cultured on an oil rig had the potential for concentrating larger amounts of mercury. She felt that escapement should be a concern because cultivated populations that escaped could overtake wild populations that are already depleted. She added that the issue of algal blooms had not been fully addressed. She discussed behavioral differences of cultivated fish such as foraging for food and reaction to predators. She added that the document did not discuss stress and its effects especially on fish in tight quarters. She commented that the impacts to coral reefs or other fragile habitat was not addressed. She suggested that enforcement and penalties be looked into more avidly. She was concerned with the possibility of placement of a pen in a protected area and felt there should be buffer zones around these areas. She asked if there were any alternatives for some type of fee system to give back to the general public whose resources were being used for a private entity as was being done with the gas companies. She agreed that genetically modified, foreign, or exotic species should not be used. She asked that an EIS be done to satisfy NEPA before proceeding with the amendment.

Mr. Versaggi was concerned about water quality. He suggested placing the pens far offshore so they would not impact the inshore fisheries. He supported status quo. He did not believe the Department of Agriculture would have any jurisdiction over aquaculture. He believed anyone that was petitioning to run an aquaculture pen should have a demonstrated level of expertise and knowledge before being allowed to obtain a permit.

Holiday Inn Beachside
Key West, Florida
March 1, 2004

ATTENDEES: 51 persons:

Council:
Roy Williams, Chairman
Wayne Swingle
Kathy Conlon

William Arnold .... Commercial Fishery
Peter Bacle. .... Stock Island Lobster Co.
Peter Gladding .... Commercial Fishery
Jorge Blanco........ Commercial Fishery
Joseph Gartenmayer........ Commercial Fishery
William Golden........ Commercial Fishery
Robert Grant........ Commercial Fishery
Jesus Hernandez........ Commercial Fishery
Ron Meyers........ Commercial Fishery
Lorenzo Naseiro, Jr. .... Commercial Fishery
George Niles .... Monroe County Commercial Fishery
William Niles........ Monroe County Commercial Fishery
Bobby Pillar .... Commercial Fishery
John F. Reed III........ Commercial Fishery
Damon Santelli........ Commercial Fishery
Lee Starling........ Commercial Fishery
Mel Strahosky. .... Commercial Fishery
Danny Trevor........ Commercial Fishery

Mr. Swingle presented the Generic Amendment for Management of Offshore Marine Aquaculture after the Joint Reef Fish/Mackerel Limited Access Amendment Public Hearing. He stated that the reason for implementation was a current legal opinion indicated that commercial aquaculture constitutes fishing under the Magnuson-Stevens Act and cannot be done without an authorizing Amendment.

Mr. Sweeney, a diver**,** inquired if spiny lobster would be farmed.

Mr. Swingle responded that spiny lobster and stone crabs would probably not be raised.

Mr. Strahosky, an ex-commercial fisherman who presently ran a private boat, stated that it was a mistake to exclude any species and that aquaculture was here to stay and that it should be done in the United States. He added that he was opposed to 6.5.3.f, as it appeared to be a loophole for gill netters. He also thought that permits should be issued for a longer period.

APPENDIX I – COMMENTS ON DPEIS FROM EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

October 24, 2008

Dr. Roy E. Crabtree
Regional Administrator
Southeast Regional Office
National Oceanic and Atmospheric Administration
263 13" Avenue South
St. Petersburg, Florida 33701

Subject: EPA NEPA Comments on NOAA PDEIS for the "Fishery Management Plan for Regulating Offshore Marine Aquaculture in the Gulf of Mexico"; Gulf of Mexico Fishery Management Council; Gulf of Mexico EEZ; CEQ No. 20080350; ERP No. NOA-E91026-00

Dear Dr. Crabtree:

Consistent with our responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the National Oceanic and Atmospheric Administration's (NOAA) Programmatic Draft Impact Statement (PDEIS) for the referenced Fishery Management Plan (FMP) for offshore marine aquaculture (aka: mariculture). The PDEIS was prepared for NOAA (NOAA Fisheries Service) by the Gulf of Mexico Fishery Management Council (Council). In the PDEIS, the Council has made several recommendations to NOAA on preferred alternatives and other issues for NOAA's finalization in their pending Programmatic Final EIS (PFEIS).

A FMP is required to regulate offshore marine aquaculture since aquaculture is considered a form of "fishing" under the Magnuson Stevens Fishery Conservation Management Act (MSA). As a major federal action, NEPA documentation is required for the FMP. The current PDEISIFMP provides regional regulations for promoting and managing prospective marine aquaculture that is environmentally sound and economically sustainable in the federal waters of the Gulf of Mexico Exclusive Economic Zone (Gulf EEZ), located 3-200 miles offshore. Approximately 13.7% of the Gulf EEZ is considered suitable for aquaculture (pg. 53). Existing regulations for marine offshore aquaculture only provide for a short-termed Exempted Fishing Permit (EFP) that is not intended for commercial fish production. Based on the PDEIS (pg. l), it is expected that 5-20 investors would request permits over the next 10 years for aquaculture operations in the Gulf EEZ.

NEPA Process

As a Programmatic EIS (PEIS), future additional NEPA documentation tiering from this PEIS may be inferred. However, it is unclear if additional documentation for site-specific impacts would be prepared for each individual operation sited in the Gulf EEZ. Page 1 of the PDEIS states that "[effects falling outside the scope of the actions proposed herein would be further analyzed through additional National Environmental Policy Act analyses conducted by the Council and NOAA Fisheries Service." The PFEIS should further discuss the prospects and "triggers" for developing additional NEPA documentation, including site-specific Environmental Assessments (EAs) or EISs for each individual aquaculture site and operation. The basis for such additional NEPA reviews would primarily be the issuance of NOAA's federal aquaculture permit for each site, although other federal agency permitting may also trigger NEPA document development. Topics for site-specific documentation should include site description (water chemistry, flora & fauna, bathymetry, etc.), local use conflicts competing for the area, size of the proposed aquaculture system with the dimensions and capacity of the aquaculture system, predicted water quality and other impacts attributable to the individual aquaculture operation, and the cumulative impacts of the project together with any neighboring aquaculture systems or other offshore land use.

Background & Issues

The commercial interest in marine aquaculture is to produce additional marine protein for profit. The need for such additional protein stems from the fact that many fishery stocks are experiencing overfishing and over 80% of the seafood consumed in the US is imported (pg. 17). Onshore and nearshore aquaculture systems have existed for some time (onshore ponds and lagoons, offshore cages, net pens) to supplement wild-capture fisheries, and are essentially aquatic/marine farming operations similar to agricultural Concentrated Animal Feeding Operations (CAFOs). Offshore mariculture in the Gulf EEZ, however, is presently not sufficiently regulated for sustained commercial use.

Overview of issues: Concerns with aquaculture operations include water quality (over-feeding, antibiotic medication, algal blooms, and pathogens); the potential use of Genetically Modified Organisms (GMOs) or transgenic organisms engineered to maximize their efficient culture (e.g., increased growth rate); the domestication of cultured species (loss of fitness compared to wild populations); escapement of genetically modified or unmodified-but-domesticated species and their subsequent interbreeding with wild populations; disease infestation and pathogen transmission to wild populations; use of wild fish as broodstock and a feed source (baitfish/meal); risk of storm damage and generation of derelict infrastructure that could act as "ghost" fishing gear; entanglement or predation by wild species attracted to the facility; effects on the restoration management of wildstock fisheries; privatization of a public resource (state or federal waters) for profit; and public opposition and socio-economic use conflicts with competing users such as commercial and recreational fishers, the shipping industry and conservationists.

Water & Sediment Quality: Consistent with the Clean Water Act (CWA), water quality issues associated with aquaculture are of primary concern to EPA. We note that some of these water quality issues have been minimized with improved vaccination and feeding techniques (pg. 10). Monitoring of cages offshore New Hampshire and Puerto Rico showed little or localized changes in water quality attributable to aquaculture, although some changes in benthic communities were observed (pg. 189). Moreover, given that the proposed FMP would be for aquaculture operations in federal waters further offshore, water quality may be less of a concern than in nearshore facilities since operations in federal waters can be located in deeper water with greater circulation. However, since the PDEIS only estimates (pg. 71) the size of expected aquaculture operations, water quality effects at individual sites and cumulatively with any neighboring sites is somewhat unclear. To further disperse water and sediment quality impacts due to organic loading from feeding and wastes, EPA agrees (Action 6 of the proposed FMP) that operations might be periodically moved (or allowed to fallow) within the designated site complex to allow benthic recovery from excess nutrients, and that any neighboring sites not be clustered. Viral and other diseases may also be considered a water-quality-related concern. Diseases stemming from the broodstock, food source (baitfish/meal), stock handling, predators (sea birds) and other sources of contamination should be controlled to help ensure aquaculture success and to prevent epidemics that could spread to the native environment and its marine inhabitants. The PFEIS further discuss potential impacts to water and sediment quality as it relates to offshore aquaculture sites in the Gulf EEZ. While the offsite location of aquaculture systems in the Gulf EEZ may have some water quality advantages, the construction and supply of these sites can be more expensive than current onshore or nearshore operations in state waters, since they are located in federal waters that are further offshore (3-200 mi). From a cost effectiveness standpoint, it is therefore somewhat unclear as to why investors would select federal waters over closer nearshore waters for their aquaculture operations. However, on-site location of broodstock hatcheries could minimize such transit costs (pg. 29) and most of the Gulf EEZ areas considered suitable are located closer to 3 miles rather than 200 miles offshore.

Native Species Attraction & Control: Another persistent concern with aquaculture sites is their attraction (pg. 60) of predators (e.g., sea birds, sharks) and non-predator visitors (e.g., various fishes). The natural attraction of marine life to aquaculture structures is related to their search for food (overfeeding of aquacultured stocks and a captive aggregation of prey) and cover (structure, habitat, flotsam/jetsam) in open water. This behavior can be further complicated if the attracted species are protected by the MSA (managed fisheries), Endangered Species Act (e.g., sea turtles and marine mammals) and the Migratory Bird Treaty Act (various migratory birds). Furthermore, certain attracted species such as sea birds may carry and spread disease vectors that could pose a threat to aquacultured stocks. Although the PDEIS discusses predator control through acoustics, barriers, chemicals and electricity (pg. 193), we recommend that protected species – if not all species - should only be repelled rather than killed using benign methods. The use of chemical repellants that will remain in the water column and may affect sessile marine life, should be avoided. The PFEIS should further discuss how any problematic sea birds, sea turtles and marine mammals will be controlled and how their potential entanglement would be resolved. It should also be clarified when aquaculture facilities might have to obtain additional permits such as a Migratory Bird Treaty Act permit.

Privatization of Public Resource: Although not within EPA's purview, privatization of a public resource for profit is another significant aquaculture issue. Issuance of a permit to establish an offshore marine aquaculture system affords private enterprise exclusive use of public property (open ocean) over competing uses through a fairly simple and essentially free permitting process (even though permits can be revoked for cause and must periodically be renewed). Accordingly, those members of the public presently using Gulf areas for fishing or recreation would be excluded from these benefits in the future if those areas become aquaculture sites.

Federal Regulatory Roles

EPA 's Role: EPA's role for marine aquaculture operations in the Gulf EEZ is clearly defined. For these federal waters, EPA has statutory authority to administer NPDES permits and has determined that net pens constitute "concentrated aquatic animal production" facilities under the CWA and are thus subject to permit requirements. EPA has also determined that the Ocean Disposal Criteria of CWA ***8*** 403(c) applies, thus mandating an environmental effects review of aquaculture projects. In addition, EPA has a role in registering and regulating pesticides that may be used at the facility and also designates (together with the COE) Ocean Dredged Material Disposal Sites (ODMDSs) in state or federal waters under the Marine Protection, Research and Sanctuaries Act (MPRSA) of 1972.

Other Federal Roles: The U.S. Army Corps of Engineers (COE) is the permitting agency for a Section 10 permit (River and Harbors Act of 1899) relative to the siting and mooring of the aquaculture facility. Beyond its role for the proposed FMP, NOAA (NOAA Fisheries Service) regulates Essential Fish Habitat (EFH) and federally-protected threatened and endangered marine species (Endangered Species Act of 1973). NOAA also administers the Coastal Zone Management Act of 1972, which requires a consistency determination with approved state coastal zone management programs for federally-permitted activities that affect land, water, or natural resources of the coastal zone. Other federal agencies, such as the U.S. Coast Guard (USCG), Minerals Management Service (MMS) and U.S. Food and Drug Administration (FDA) also have (or may have) roles in the siting, construction and/or operation of an offshore marine aquaculture facility in the Gulf EEZ.

NOAA 's Authority: EPA agrees that NOAA is the appropriate federal agency to administer the majority of the federal regulations for offshore marine aquaculture. However, NOAA's authority in some areas of offshore aquaculture for the proposed aquaculture FMP should be clarified in the PFEIS. Although EPA understands the rationale behind the proposed limitations, additional rulemaking or legislation may be needed to strengthen NOAA's authorities under MSA. However, EPA will defer to NOAA in this regard. For example, NOAA's authority to remove portions of the public domain from public use for private aquaculture enterprise (Action 6) as opposed to traditional conservation should be discussed. Similarly, NOAA's authority to limit aquaculture to native Gulf species (Action 4) as opposed to modified species engineered to maximize their efficient culture for profit, should also be addressed. In addition, NOAA's authority to limit free enterprise by capping production by a single operator to no more than 20% of the established aquaculture optimum yield (Action 10) should also be reviewed.

One potential new legislation on aquaculture is the Administration's bill for the National Offshore Aquaculture Act of 2007 (pg. 12 and App. B) currently before Congress. If this bill becomes law, it would afford NOAA more authority; however, we note that the present version of the bill does not always parallel the proposed aquaculture FMP (e.g., the permit term for NOAA's aquaculture permit in the bill is 20 years while the term for the preferred alternative of the FMP is 10 years). As such, portions of the prospective FMP may be preempted if the bill is passed, and may need to be adapted or replaced. The PFEIS should further discuss this bill and the regulatory consequences for the aquaculture FMP, should it become law.

Alternatives

Overall, EPA believes that alternatives for offshore marine aquaculture operations should not produce water quality problems associated with overfeeding, wastes and medications. Operations should also be limited to the culture of those native Gulf species managed by the Council (since those managed species cannot be further exploited in the wild) and not use endangered species for culture (pg. 43) or impact them (e.g., entanglement of marine mammals in net pens). The FMP should also ensure that the management objectives for the species being restored by the Council and NOAA in the Gulf are not compromised through the capture of broodstock for hatcheries or baitfish for feed or the culture of non-native or genetically modified species that could accidentally be introduced by escapement to the wild. Use conflicts should also be minimized through the proper siting of aquaculture operations.

A Systems Alternative to Aquaculture: At least one "systems" alternative to offshore marine aquaculture exists - the creation of a more globally competitive U.S. fishing fleet. That is, achieving greater US landings in competition with prominent global fishing nations could - like offshore marine aquaculture - result in less need for importation of seafood. However, it is likely that such greater US effort and landings would result in even greater exploitation of global fisheries as opposed to a more even distribution of landings by fishing nations. It would also only increase or redistribute wild-capture marine protein (which is a finite resource) as opposed to supplementing it with another source of seafood.

Actions & Alternatives Considered: We appreciate that 10 actions with 28 alternatives were considered in the PDEIS and that NOAA and that the Council identified their preferred alternative for each action. These actions considered permitting, accounting, site and species selection, types of aquaculture systems, and administrative frameworks for the FMP. Overall, we find the actions, alternatives and preferred alternatives presented in the PDEIS to be well-conceived. We have provided our suggestions and comments for each action in the enclosed *Detailed Comments* for consideration by NOAA and the Council in their development of the NOAA PFEIS. Of the 10 actions proposed, EPA finds siting requirements (Action 6) primary to the regulation of offshore marine aquaculture, as emphasized below:

Significance of Proper Siting: Proper siting of aquaculture systems would help protect water quality and minimize use conflicts. We suggest a combination of Alternatives 2 and 3 of Action 6 to provide a sequential order of siting criteria used to determine the most suitable sites. That is, NOAA's pre-defined aquaculture zones (Alt. 2), which were screened from the generally suitable areas of the Gulf EEZ, would be used by aquaculture investors to apply for a COE Section 10 siting permit. If the site was permitted by the COE, a final NOAA review using NOAA's environmental criteria (Alt. 3) would determine final site suitability. These final criteria should include proper flushing of the aquaculture system to ensure good site water quality.

Proper siting of facilities can also minimize use conflicts that can exist within the Gulf EEZ areas considered suitable for aquaculture. Competing public and federal users of EEZ waters include investors of aquaculture and other interests (oil & gas, minerals, offshore wind farms, Liquefied Natural Gas [LNG] terminals), U.S. Department of Defense (offshore Naval sites & sonar testing), commercial fishers, recreational fishers and other recreators, and conservationists. The PFEIS should further discuss the socioeconomic implications of siting private aquaculture operations within the public domain, thereby excluding existing or future use of those areas by the general public. In addition to socioeconomic conflicts, ecologic conflicts among native marine inhabitants can also result by establishing and operating aquaculture sites. Consistent with the ecosystem management approach to manage fisheries, the potential displacement of native species by aquaculture sites should be further addressed since aquaculture operations would only be located in ecologically suitable areas where other marine species are likely to live.

Summary

EPA agrees that a FMP is needed to help regulate offshore marine aquaculture. Water quality issues associated with aquaculture operations are of primary concern to EPA. These principally concern the potential for excess nutrients from overfeeding and animal wastes that can cause organic loading within the water column (affecting algal blooms) and on-site sediments (affecting benthic assemblages). For proper aquaculture siting, we recommend that sites be located using NOAA and COE siting criteria (Action 6) to provide adequate flushing of excess nutrients, and that sites be large enough to rotate operations onsite to promote the recovery of water quality and sediment quality as needed. The use of chemicals to repel predators and other marine visitors attracted to an aquaculture system's infrastructure should also be avoided from a water quality perspective. Similarly, diseases stemming from the broodstock, food source, stock handling, predators and other sources of contamination should be monitored for early detection and controlled to prevent epidemics that could spread to the native environment and its marine inhabitants.

Beyond water quality, proper siting should also minimize use conflicts competing for EEZ Gulf areas. We agree (Action 4) that aquacultured stocks should best be limited to native species being managed by NOAA and the Council through FMPs and not expanded to non-native, GMO or transgenic species due to the risk of their escapement and interbreeding with native populations. Parenthetically, to help ensure success, we also recommend that animal behavior be considered in the selection of potential aquaculture species such that pelagic, non-migratory species might best be used for near surface systems and demersal species for benthic systems. We also concur (Action 8) with the need for accountability/transparency through recordkeeping and NOAA inspections. Because the regulation of offshore marine aquaculture is a relatively new arena, we suggest (but defer to NOAA in this regard) that NOAA's authority in certain areas - such as privatization of a public resource - be further discussed and strengthened as needed with additional rulemaking or legislation. Also, the impacts of potential events associated with aquaculture should also be further addressed in the PFEIS (broodstock collection frequency, broodstock inbreeding, aquacultured stock escapement, interbreeding, hybridization with wild stocks of the same species, aquaculture disease infestations and transmittance to the wild, algal blooms due to organic loading, etc.).

Future, site-specific NEPA documentation should be provided for the *5-20* individual sites expected in the Gulf EEZ. Topics for such follow-up documentation should include site description, local socioeconomic impacts such as use conflicts and privatization of a public resource, size of the proposed site with the dimensions and capacity of the aquaculture system, predicted water quality and other impacts attributable to the individual aquaculture operation, socioeconomic impact sand the cumulative impacts with any neighboring aquaculture systems or other offshore land use. In general, topics such as aquaculture system size and stock capacity should be generally discussed in the PDEIS (e.g., expected ranges) and specifically discussed in the site-specific NEPA documentation.

EPA PDEIS Rating

EPA rates this PDEIS as "EC-1" (Environmental Concerns with some additional information requested in the PFEIS). Overall, EPA supports the concept of aquaculture to supplement wild-capture fisheries if water quality impacts are regulated and capacities of aquaculture sites are limited and sites are not clustered. However, we have a few water quality and other concerns/comments that should be at least generally addressed in the PFEIS and more specifically in the follow-up, site-specific NEPA documents.

We appreciate the opportunity to review the PDEIS. Should you have questions regarding these comments, feel free to contact Chris Hoberg of my staff at 404/562-9619 or hoberg.chris@epa.gov.

Sincerely,
Heinz J. Mueller, Chief
NEPA Program Office

cc: Dr. Rodney F. Weiher - NEPA Coordinator (NOAA): Silver Spring, MD

DETAILED COMMENTS

EPA offers the following comments and suggestions on the 10 actions and 28 alternatives presented in the PDEIS. Other comments are also subsequently provided.

Actions & Alternatives

* **Action 1 *(Aquaculture Permit Requirements, Eligibility, and Transferability)*** – EPA agrees that offshore aquaculture regulations should include a NOAA Fisheries Service aquaculture permit to regulate offshore marine aquaculture. Under Alternative 2 preferred by the Council, the aquaculture permit provides authorization for the operation of a facility, securing hatchery fish from broodstock, the transport and sale of cultured finfish or shellfish, and other actions. We agree that permits can be transferable, as proposed in Preferred Alternative 2a; however, this assumes that the operation is in compliance with the permit or will be by the new operator. More importantly, we note that the NOAA aquaculture permit would also undergo a public review for comments. Because of potential socio-economic impacts (use conflicts) associated with aquaculture operations in public waters (also see discussion below under Action 6), we strongly support the permit public review process.

The NOAA permit under Alternative 3 would also be for the operation of an aquaculture system; however, it would also be for siting the operation in addition to a COE siting permit. This separate permit would emphasize NOAA siting criteria in addition to the COE's criteria in their Section 10 permit. While there are environmental advantages to having a separate NOAA siting permit in addition to the COE's Section 10 siting permit because of their unique siting criteria, it would be an additional administrative exercise for both NOAA and the applicant that may not be necessary (also see discussion below under Action 6).

* **Action 2 *(Application Requirements, Operational Requirements. and Restrictions)*** - EPA generally agrees with the application and operational requirements associated with PDEIS-Preferred Alternative 3 of Action 2. We particularly concur with requirements to collect broodstock from the Gulf in the same general area as the aquaculture site; to generate a storm disaster plan; to conduct feed monitoring for water quality purposes; to provide health certificates of specimens prior to the stocking of cages, net pens or other grow-out systems; to host annual NOAA Fisheries Service inspections of facilities; to post an assurance bond for removal of infrastructure in the event of abandonment; and to disallow the culture of GMOs or transgenic organisms.

Portions of Alternative 3 pertain to the collection of broodstock (pg. 37). The PFEIS should discuss how often broodstock subjects need to be collected (are they collected for each hatchery spawn or are tagged adults retained in cages for additional spawns?) and what is the fate of the broodstock adults after spawning (are they released, or retained and eventually harvested with mature cultured fingerlings?). We recommend the collection of new broodstock for each spawn (broodstock may not spawn a second time in captivity anyway) to refresh the genetic pool for the hatchery and prevent in-breeding; however, this would require multiple collections adding fishing pressure on overfished (managed) stocks. Accordingly, the PFEIS should discuss the effects of harvesting broodstock from managed overfished stocks. Would the broodstock collections for the expected 5-20 offshore marine aquaculture operations notably impact the wild stocks of managed species and potentially compromise FMP objectives? Page 68 indicates that broodstock collections are expected to be "small and insignificant." However, should broodstock collections become more frequent for genetic diversity or expansion of the offshore industry, will the FMP account for such collections by reducing quotas for fishers of wild stocks of the same species?

With regard to the culture of non-native species or even GMOs or transgenic organisms, it is possible that certain investors would wish to use modified organisms to expedite growth or other aspects to maximize aquaculture landings and profitability. However, EPA supports the position of NOAA and the Council to preventing the use of modified organisms due to the risk of escapement and their interbreeding with wild native populations. Nevertheless, cultured specimens would become domesticated and "less fit" than wild specimens of the same species. The PFEIS should discuss the impacts of presumed escapement of some of the aquacultured stocks and their inbreeding with wild stocks of the same species.

* **Action 3 *(Duration of the Permit)*** - We concur with Alternative 2 preferred by the Council which specifies a I 0-year term that can be renewed every five years. We agree that an initial 10 years is needed for most investors to establish their operations and that permits should not be too long-termed for better control. It is unclear, however, why other alternatives do not offer a similar possibility for permit renewal as opposed to a 'requirement for filing for a new permit.

Although a 10-year term with a 5-year renewal is preferred in the PDEIS, we note that a bill for the National Offshore Aquaculture Act of 2007 (pg. 12) before Congress proposes a 20-year term and a 20-year renewal (App. B). While we are aware that this bill and not law, the PFEIS should discuss this substantive inconsistency in permit terms, assuming NOAA participated in the development of this bill.

It is also our understanding (pp. 4,72) that an aquaculture permit could be revoked for cause (Subpart D of 15 CFR Part 904). We concur with such a provision; however, the PFEIS should specify NOAA's terms and conditions for such an action. From a practical standpoint, when would an aquaculture permit likely be revoked and what entity would manage the unpermitted facility?

* **Action 4 *(Species Allowed for Aquaculture and Included in the Aquaculture Fishery Management Unit)*** - As suggested above, we agree that species selected for aquaculture should be native Gulf species found near the aquaculture site and should primarily be those species being managed for restoration via a FMP to supply a greater food source of those species without additional exploitation of the wild stocks. However, it is unclear from the PDEIS if aquaculture systems would only be set at or near the surface of the water column for pelagic species or if any would utilize bottom habitat for demersal species, i.e., would the Gulf EEZ waters generally be too deep for bottom aquaculture systems or would they still be manageable in the 13.7% of the EEZ considered suitable? We note that while Alternatives 2-4 would all restrict some species, Alternative 4 (preferred in the PDEIS) would essentially allow the culture of all managed native species, including demersal species other than shrimp and coral. The PFEIS should clarify if all sections of the water column could be used for culturing.

From a practical standpoint, not all species would be ideal or suitable for successful aquaculture. For example, the culture of highly migratory pelagic species (billfish, tunas, swordfish & sharks) allowed in Alternative 2 and 4 (pending) seems counter-intuitive from a fish behavior perspective given the migratory instincts of these species and the confined nature of mariculture cages, net pens and other enclosures. We therefore offer that the use of migratory species would intuitively not seem to be good investments and that animal behavior be considered in the selection of aquaculture species. Ideally, those species that have previously been successfully spawned in captivity and successfully raised in hatcheries and grow-out facilities would be selected to help ensure success.

* **Action 5 *(Allowable Marine Aquacultural Systems)*** - Historically, cages and net pens have been used in offshore aquaculture. However, new designs are possible and should be encouraged (especially for deeper waters such as the Gulf EEZ). We therefore agree with the PDEIS preference for Alternative 3, which would allow a case-by-case approval or denial of designs. We also concur with the inclusion of an environmental effects review. We strongly agree with those review criteria provided on page 49 that would promote systems to minimize the degradation of habitat and water quality from feeding mechanisms and waste dispersion. Although no specific system designs are required, we support Alternative 3's disallowance of systems that cause significant risk to EFH, endangered species, marine mammals, fish stocks, and public health and safety (pg. 51).

* **Action 6 *(Marine Aquaculture Siting Requirements and Conditions)*** - EPA finds siting requirements critical to the regulation of offshore marine aquaculture since proper siting would help avoid reduce water quality concerns and potential use conflicts with physical, socio-economic and ecologic conditions. We note that only about 13.7% of the Gulf is considered suitable for siting aquaculture systems (pg. 53).

Specific physical use conflicts in the Gulf that aquaculture site might include existing fisheries (fishing grounds), shipping lanes, naval facilities and testing, designated marine preservation areas, designated disposal sites (e.g., ODMDSs) and other uses. Many of these are referenced in Alternatives 2 and 3 (outstanding ones should be discussed in the PFEIS). Also, ecologic use conflicts may also exist, i.e., how will the existing marine ecosystem respond to the introduction of a concentration of specimens from a water quality, habitat and behavioral perspective? Will other marine life avoid the area as a disturbed area or will the system be an attractant as new food or cover area?

Socio-economic use conflicts may also occur since issuance of an aquaculture permit to establish an offshore marine aquaculture system allows private enterprise exclusive use of public property through a fairly simple permitting process. Accordingly, fishers that may presently be using Gulf areas would be excluded from these benefits in the future if those areas become aquaculture sites.

With regard to the presented alternatives for Action 6, we note that Alternative 3 is preferred by the Council. It establishes numerous marine siting criteria for suitable aquaculture sites: avoidance of designated marine areas such as marine reserves; separating facilities by at least 1.6 nautical miles (nmi); sizing the site to be twice the size of the aquaculture system, so that rotation and fallowing of systems within the site is possible; production of a video of the benthic habitat at the site; and characterization of the site by NOAA (currents, water chemistry, migratory routes, live bottoms, etc.).

Although we generally concur with these criteria, the PFEIS should clarify the basis for selecting a separation distance of 1.6 nmi (6,076 ft). Page 57 suggests that the separation is to minimize the spread of pathogens from one facility to a neighboring one. The cited literature (pg. 57) provides a range of 800 m (2,625 ft) to 8 km (26,248 ft) depending on the species being cultured. Although 1.6 nmi lies within this range, it remains unclear as to why 1.6 nmi was selected since the fishery species to be cultured (and presumably their pathogens) are unknown.

Beyond a buffer for pathogens, the adequacy of the 1.6 nmi distance is also uncertain in terms of water quality since the general size (or size range) of each operation is undefined in the PDEIS and perhaps unknown at this time. Page 71 estimates that operations would use 6-12 cages approximately 3,000-6,000 m3 in size and produce 22-44 pounds per m3. However, the PFEIS should provide any additional information (ranges) on the size and stock capacity that can be expected for EEZ operations and whether the 1.6 nmi separation distance would be adequate for dispersion from a water quality standpoint.

Although we support the specific siting criteria of Alternative 3, EPA prefers a combination of Alternatives 2 and 3. Alternative 2 screens suitable Gulf areas by establishing 13 aquaculture zones (encompassing 5% of Gulf EEZ and 36% of areas considered suitable) where applicants could locate their aquaculture grow-out systems. We assume these pre-defined zones (pg. 56) would avoid obvious physical use conflicts (discussed above) such as shipping lanes and active fishing grounds, while providing adequate marine conditions for aquaculture. Within these zones, investors would need to apply for a COE Section 1 0 permit for a specific site, which would be assessed pursuant to COE criteria. Beyond these COE criteria, NOAA could then use their siting criteria under Alternative 3 to further assess the suitability of the site. These final criteria should include proper flushing of the aquaculture system to ensure good site water quality.

* **Action 7** ***(Restricted Access Zones for Marine Aquaculture Facilities)*** - We agree with the use of a buffer area around the site of the actual marine aquaculture system to restrict access by unauthorized vessels. The use of the coordinates of the COE siting permit - as proposed by the PDEIS-Preferred Alternative 2 - seems appropriate. We agree with page 60 that restricting access around the aquaculture site may reduce ship strikes with marine mammals that may be attracted or entangled to the aquaculture system for food or cover. We assume the COE siting permit would need to allow for the site to be about twice as large as the actual aquaculture system to provide for a restricted buffer and to be consistent with subpart 'c' of Preferred Alternative 3 of Action 6 on siting requirements. EPA supports such a large site to create the restricted buffer area as well as to allow for aquaculture systems to be rotated onsite for water quality purposes.
The boundary of the site/buffer, as indicated in Alternative 2, would need to be marked with buoys and enforced by the USCG.

* **Action 8** ***(Recordkeeping and Reporting)*** - Alternative 2 was preferred in the PDEIS. This alternative establishes numerous recordkeeping requirements for transparency. These appear appropriate to EPA and include the recordkeeping or reporting of a significant escapement of the cultured stock, copies of federal permits, harvest and sales of the cultured stock, hatchery records, broodstock harvest times, pathogen episodes, etc. These records can be useful during audits to determine, for example, that no more than the original number of fingerlings are harvested and sold to ensure that wildstock specimens were not mixed in and sold as aquacultured stock. Conversely, we note that keeping such records - even if electronically in many cases -plus completing annual NOAA site inspections could be a significant workload for the applicant and NOAA, such that attempts to streamline recordkeeping should be a continuous process.

With regard to requirement 'n' of Preferred Alternative 2 involving the reporting of broodstock lengths and weights, we offer that such manipulation could be traumatic to many species. Perhaps the broodstock could be subsampled to obtain representative weights and lengths so that not all specimens are handled. Overall, impacts to the broodstock should be minimized to ensure a good spawn for hatchery eggs and larvae, and ultimately fingerlings.

* **Action 9** ***(Biological Reference Points and Status Determination Criteria)*** - Consistent with other more conventional FMPs for wild-capture fishery species, biological reference points such as Maximum Sustainable Yield (MSY) and Optimum Yield (OY) were also established for aquaculture harvests. We will defer to NOAA and the Council regarding the establishment of

these reference points. Although required under MSA, such reference points seem to have less meaning for aquaculture than for conventional fisheries management. We note that NOAA permitting will limit production to no more than 20% of the established OY (pg. 72).

* **Action 10 *(Framework Procedures)*** - This action relates to Action 9 by specifying framework procedures for modifying reference points. PDEIS-Preferred Alternative 3 proposes the Council's appointment of an Aquaculture Advisory Panel (Panel) to evaluate the aquaculture management program. The recommendations of the Panel would need approval by the Council as well as a regulatory amendment and ultimately approval by NOAA.

Overall, we will defer to NOAA and the Council regarding these administrative procedures. However, we note that a considerable amount of administrative effort (reporting, recordkeeping, inspections and audits, testing, approvals at several levels of management, rulemaking and NEPA documentation, etc.) is being proposed for this FMP for a relatively small number of operations (5-20) of offshore marine aquaculture of uncertain size that have been predicted for the next 10 years.

Other Comments

* EFP Definition (pp. x & 16) - The abstract (pg. x), list of acronyms (pg. *vii)* and text in general (e.g., pg. 19) defines "EFP" as an "exempted fishing permit". However, page 16 defines it as an "experimental fishing permit". We assume this is an inconsistency, or does NOAA issue two kinds of "EFP" permits?

* NOAA Oversight (pg. 13) - The proposed FMP regulations would require considerable transparency which translates into recordkeeping, reporting, possible testing, audits and inspections. Although some activities are electronic and remote, others such as annual inspections are not and could be labor/time intensive. In times of resource constraints, we look to NOAA to adequately fund this oversight, particularly given the apparent large volume of the records and the long offshore distance of the facilities.

* Foreign Aquaculture Competition (pg. 17) - We note that one-half of the seafood the US imports is produced from aquaculture. As such, how competitive are the prospective 5-20 offshore operations expected to be with established foreign aquaculture farms? Will there be any US government subsidies to help ensure their success?

* Successful Hatchery /Aquaculture Species (pg. 45) - The PFEIS should provide information as to how many native Gulf species have been successfully spawned, reared to fingerlings, and cultured to economic maturity. Offshore aquaculture would seem an expensive investment for marine species that may not have been successfully raised in captivity.

* Aquaculture Potential (pg. 71) - Page 71 states that ". . .aquaculture has the potential to result in much greater production than wild fisheries.. ." This statement should be further discussed in the FPEIS given the annual tonnage of wild-capture fishery landings, aquaculture competition with wild populations for food and space, use conflicts, aquaculture feed limitations, and aquaculture cumulative impacts potential.

* Oil & Gas Impacts (pp. 130 & D-5) - Although there is some information regarding potential contamination of aquaculture facilities by wastes from the oil and gas industry, there is no mention of monitoring to verify the water and sediment quality conditions (e.g., mercury). Although oil and gas facilities may have EPA discharge permits, the potential cumulative impacts

of oil and gas operations on nearby or collocated aquaculture facilities should be described in more detail -particularly if aquaculture systems are actually collocated with drilling platforms.

* Marine Turtles & Mammals Effects (pg. 190) - Will there be inspections or reporting requirements to monitor whether sea turtles and/or marine mammals are routinely caught in the aquaculture nets? What penalties, if any, will be enforced if entanglements are persistent and fatal?

* On-site Seafloor Video (pg. 229) - How will NOAA verify if an applicant's video survey of the on-site benthic habitat is of the proper location and not fraudulent (i.e., video of a different location). We suggest providing guidelines for the video surveys or providing a reference for existing guidance in the PFEIS.

* Catastrophic Storm Frequency (pg. 238) - As part of the cumulative effects analysis, how many catastrophic storms are predicted over a given timeframe and would this frequency be affected by climate change or other factors, such as the density of aquaculture facilities in a given region of the Gulf EEZ?

* Cumulative Effects Analysis (pg. 264) - The PDEIS estimates (pg. I) that 5-20 aquaculture applications will be submitted to NOAA for aquaculture operations over the next 10 years. This number of operations - or an update - should be used in the cumulative impacts analysis in the PFEIS (Sec. 6.1 5).

* Algal Blooms - Given the likelihood for organic loading at aquaculture sites, the PFEIS should discuss the potential for such excess nutrients triggering algal blooms.

* Marine Debris - We support the use of pingers on aquaculture systems so that cages and other infrastructure can be recovered after catastrophic storm events. Because derelict infrastructure could entrap various species like "ghost" fishing gear – including those species of managed fisheries - these pingers should be monitored (batteries, etc.) to ensure their function after such events.

* Potentially Controversial Issues - We raise to your attention three issues associated with the proposed action that may prove controversial:

1) The proposal to privatize a public resource without compensation is inconsistent with the U.S. Commission on Ocean Policy's recommendations made in its 2004 report, *An Ocean Blueprint for the 21St Century*. For example, the government collects grazing fees from ranchers, royalties from timber and mining companies, and bonuses and royalties from outer continental shelf oil and natural gas. The DPEIS does not address why ocean space should be treated differently.

2) The proposed action proposes to privatize "the wild," which raises the question of whether a permitted aquaculture facility is subject to regulations enacted to protect "the wild," e.g., 50 CFR Part 16.13(1) regarding the prohibition of fish releases into the wild except by or under the permission of the applicable state wildlife conservation agency. In a scenario where non-native species were released into "a fish pen" as opposed to the open ocean, would this still constitute a release into "the wild" pursuant to 50 CFR Part 16? If not, will NOAA Fisheries Services and the Council still have the requisite authority to exclude non-native species from aquaculture?

3) The DPEIS proposes a "use or lose" permit to be issued to those applicants most likely to ensure the most efficient and economical use of fishery resources to prevent speculation. A

collateral effect of a "use or loose" permit would be to bar acquisition by any entity interested in conservation. Conversationalists, including governmental agencies (e.g., the State of Florida), commonly acquire property interests to implement the public interest in conservation. It appears this provision would prevent these types of acquisitions (at aquaculture sites) for a legitimate public interest, which could generate controversy.

APPENDIX J – RESPONSE TO COMMENTS ON DPEIS

The Aquaculture DPEIS comment period extended from September 12 through October 27, 2008. During the comment period, 13 organizations or city governments submitted comments. Additionally, 19 form letters and one petition with 5,773 signatures were received. A comment was also submitted by the Chairman of the House of Representative's Committee on Natural Resources. Two additional comments were received from the general public. The EPA classified the DPEIS and proposed actions as "EC-1" (Environmental Concerns with some additional information requested in the PFEIS). The following are responses to EPA (denoted by an asterisk) and public comments received.

Comment 1: The Council should create buffer zones around areas designated as EFH or critical habitat.

Response: Under the Council's Preferred Alternative 3(a) for Action 6, aquaculture would be prohibited in marine protected areas and marine reserves, HAPCs, SMZs, permitted artificial reef areas, and coral reef areas. Permit applicants would be required to submit a baseline assessment of the proposed site (Preferred Alternative 3(d)), which would allow NOAA Fisheries Service to evaluate the proposed site to ensure siting would not adversely affect any EFH or permitted artificial reef areas. Under Preferred Alternative 3(e), NOAA Fisheries Service would also have the authority to conduct case-by-case reviews of potential sites that would include, but would not be limited to, depth of the site, current speeds, substrate type, the frequency of HAB or hypoxia at the proposed site, marine mammal migratory pathways, and the location of the site relative to commercial and recreational fishing grounds and important natural fishery habitats (e.g., seagrasses). The use of a proposed aquaculture site may be denied if it poses significant risks to EFH, endangered or threatened marine species, will result in user conflicts with commercial or recreational fishermen or other marine resource users, the depth of the site is not sufficient for the allowable aquaculture system(s), substrate and currents at the site will inhibit the dispersal of wastes and effluents, the site poses significant risks of mortality to the cultured species due to low dissolved oxygen or HAB, or other grounds inconsistent with the FMP objectives or applicable federal laws. These determinations will be made in consultation with other programs or offices with expertise in these areas.

Comment 2: The Council should not allow aquaculture operations to culture 'Species of Concern' or protected species.

Response: Endangered and threatened species under the Endangered Species Act (ESA) in the Southeast Region cannot be used for commercial aquaculture. Species of Concern (SOC) are not listed under or protected by the ESA. No specific protections would be afforded SOC with regard to commercial aquaculture. Rather, the purpose of the SOC list is to: 1) increase public awareness about these species, 2) identify those species potentially at risk and in need of protective measures before listing under the ESA becomes necessary, 3) identify data deficiencies and uncertainties associated with the status of the species, 4) work cooperatively with regional co-managers and interest groups to obtain the information necessary to evaluate species status and threats, 5) identify conservation opportunities, and 6) work proactively with federal and state agencies, Native American tribes, and the public to conserve the species. Currently, only Nassau grouper, speckled hind, and warsaw grouper are listed as SOC and managed by the Council. Harvest of Nassau grouper is prohibited in federal waters, while commercial and recreational harvest of speckled hind and warsaw grouper is allowed.

Comment 3: The plan should include a provision to compensate the public for the use of public resources by private developers.

Response: NOAA Fisheries Service must comply with fee provisions as specified in the MSFCMA. Under these provisions, the fees for a permit cannot exceed the administrative costs of issuing permits.

Comment 4: The plan should include standards for effluent monitoring and drug use for offshore aquaculture operations.

Response: The Environmental Protection Agency (EPA) has authority to set water quality standards for pollution discharge. The EPA has developed regulations for concentrated aquatic animal production in the United States (see Appendix G), and has set parameters for the marine aquaculture industry with regulations imposed through the issuance of National Pollutant Discharge Elimination System (NPDES) permits (Title 40 CFR Parts 122-124). Water quality and effluent standards and criteria for the NPDES are described in 40 CFR, Parts 125, 129, 133, 136, 400-471, and 503, and are intended to monitor water quality, including benthic and organic loading, for comparison with established EPA water quality standards. The EPA also published a final rule on August 23, 2004 (69 F.R. 162) establishing Clean Water Act effluent limitations, guidelines, and new point source pollution standards for concentrated aquatic animal production facilities, including facilities that produce 100,000 pounds or more per year of aquatic animals in net pens or submerged cage systems. The use of drugs, pesticides, and biologics are regulated by the EPA, Food and Drug Administration, and U.S. Department of Agriculture. The Council's Preferred Alternative 3 for Action 2 outlines key operational requirements for permittees of offshore marine aquaculture facilities regarding the use of drugs, biologics, and pesticides in compliance with regulations of these federal agencies. Action 6 also includes additional requirements for conducting a baseline assessment and environmental monitoring at aquaculture facility sites.

Comment 5: The plan should require that cultured fish be tagged in order to aid in identification of escaped individuals or to distinguish cultured individuals from wild fish.

Response: Under Preferred Alternatives 3(b)(2) in Action 2, permittees would be required to obtain documentation from the hatchery certifying that broodstock are marked or tagged. This requirement will allow for enforcement and monitoring in the event that genetic modification of cultured organisms is suspected. NOAA Fisheries Service personnel would be able to identify source broodstock using fin clips or other genetic material and compare it to the genetic makeup of offspring used for culture. The FMP also prohibits the use of genetically modified and transgenic species in Action 2. Cultured species that escape from a facility would be of similar genetic composition as the wild stock, making it unnecessary to tag these fish in order to distinguish them from wild fish. Action 2 also includes several operational requirements and restrictions intended to assist law enforcement in preventing illegal harvest of wild caught fish by aquaculture operations.

Comment 6: The FMP lacks an environmental liability or cost-recovery mechanism to address disease outbreaks and the spread of disease from farmed fish to wild fish as well as other unforeseen events.

Response: The FMP contains several regulatory requirements to prevent and manage disease episodes at aquaculture facilities. In the event that disease events occur due to certain pathogens, it is within the authorities of the U.S. Department of Agriculture and NOAA Fisheries Service to require that diseased fish are removed from pens and steps will be taken to eradicate the disease and clean and disinfect the farm site. The assurance bond required in Action 2, Preferred Alternative 3(a)(2)(x) would the cover costs of removing organisms with OIE-reportable pathogens if a permittee does not remove these organisms upon order by NOAA Fisheries Service.

Comment 7: The Council should allow shellfish culture to occur in MPAs and HAPCs, where user conflicts do not occur.

Response: Under the Council's Preferred Alternative 3 in Action 6, all aquaculture would be prohibited in Gulf EEZ marine protected areas and marine reserves, HAPCs, SMZs, and permitted artificial reef areas as specified in 50 CFR 622, and coral reef areas (as defined in 50 CFR 622.2) (see Section 4.6). Prohibiting aquaculture activities in these areas will afford protection to these sensitive habitats and prevent and minimize, to the extent practicable, any impacts from occurring (e.g., nutrient loading) that are associated with aquaculture operation.

Comment 8: The Council should allow shellfish aquaculture to occur under the FMP.

Response: Preferred Alternative 4 in Action 4 would allow the aquaculture of all species native to the Gulf of Mexico that are managed by the Council with the exception of those species in the Shrimp and Coral FMP management units. Shellfish currently managed by the Council, which could potentially be used for aquaculture purposes include several species of lobster and crab (see Appendix E). The Council did not consider allowing the aquaculture of any species that they do not currently manage. Additional species of finfish and shellfish could be included in the Aquaculture FMU in the future through an amendment to this FMP.

Comment 9: The use of wild-caught (or forage) fish for feed should be minimized. Wild-caught feed ingredients should be from sustainably managed fisheries, seafood processing byproducts, and vegetable-based feed ingredients.

Response: As discussed in Section 6.1.7, efforts are being made on a global scale to reduce the dependence on fishmeal and oil sourced from wild-caught forage fishes by replacing them with more sustainable protein and oil ingredients including soybeans, barley, rice, peas, canola, lupine, wheat gluten, corn gluten, algae, as well as seafood and farm animal processing co-products. The NOAA Aquaculture Program in partnership with the U.S. Department of

Agriculture directly supports these efforts via the NOAA-USDA Aquaculture Feeds Initiative which was initiated during 2007 to stimulate research into alternative feeds.

Comment 10: The FMP should prohibit selective breeding of cultured species.

Response: The FMP contains language acknowledging the fact that genetic drift may occur in hatchery populations, whether through natural selection pressures imposed by the hatchery environment, or by efforts to improve stock performance (e.g., growth rate, disease resistance) through selective breeding (see Section 6.1.1). However, Preferred Alternatives 3(a)(2)(xi-xiii) of Action 2 outline specific requirements which pertain to broodstock collection, genetic management, and aquatic animal health. These requirements are aimed at avoiding deleterious impacts on locally-adapted stocks by ensuring that cultured fish are genetically similar to the wild stock they originated from.

Preferred Alternatives 3(b)(2) and 3(b)(3) of Action 2 would require permittees to obtain documentation from the hatchery certifying that broodstock are marked or tagged and to submit broodstock fin clips, or other genetic material, to NOAA Fisheries Service. This requirement will allow for enforcement and monitoring in the event that genetic modification of cultured organisms is suspected.

Comment 11: The FMP should require the establishment of reference points based on the assimilative or carrying capacity of a particular site (e.g., certain level of oxygen within X feet of a site, etc.).

Response: The U.S. EPA has authority under Section 403 of the Clean Water Act to establish criteria for ocean discharge. Title 40 CFR 125 specifies criteria and standards the EPA uses for NPDES permits and Title 40 CFR 451 describes EPA effluent guidelines and performance standards for concentrated aquatic animal production sources. These guidelines and standards were finalized on August 23, 2004 (69 FR 51892; Appendix H), and apply to all aquatic animal production facilities that produce 100,000 pounds or more per year of aquatic animals in net pen or submerged cage systems. In developing these guidelines and standards, the EPA considered establishing numerical limits for total suspended solids (TSS), while controlling the discharge of other pollutants through narrative requirements (see 69 FR 51899). However, the EPA revaluated the technical basis for a TSS numerical limit and determined it would be more appropriate to establish qualitative TSS limits, in the form of solids control best management practices, given differences in regional and site specific conditions. The EPA established narrative effluent limitations in their final rule requiring implementation of operational measures to achieve reduced discharges of solids and other materials. Regulations at 40 CFR 125.123(d) allow the director of the EPA to determine if an operation is resulting in unreasonable degradation to the marine environment. Unreasonable degradation means significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities.

Comment 12: The scientific literature (particularly in reference to farmed salmon) indicates that pathogens shed from fish raised in farms into open marine waters can infect wild fish, resulting in significant mortality to wild fish populations.

Response: Infectious disease outbreaks occur naturally in wild fish populations, as well as in farmed fish. A combination of factors is necessary to cause a disease event (wild or farmed) including a sufficient number of infectious agents (pathogens), a susceptible host (fish), and an environment that favors the pathogen but compromises the host (extreme temperatures, crowding, and handling). The types of pathogens that cause infectious diseases are placed in three categories – viruses, bacteria, and parasites. Generally speaking, viruses and bacteria are rapidly diluted in open waters to levels insufficient to cause disease outbreaks in healthy marine animal populations and there is little evidence to support this mode of farm-to-wild transmission. Nevertheless, precautions will be taken to mitigate possible negative interactions due to pathogen shedding from farms in the Gulf (see Preferred Alternative 3 for Action 2). Section 6.1.2 discusses the potential impacts associated with pathogens and infectious diseases.

Comment 13: Aquaculture should only be conducted in closed systems and regular monitoring for disease and parasites should be conducted.

Response: NOAA Fisheries Service is supporting research and demonstration projects to investigate ways to efficiently and effectively rear aquatic animals in closed-system aquaculture. Marine aquaculture experience from throughout the world clearly demonstrates that open-system aquaculture can be conducted safely, sustainably, and in an economically-viable way. NOAA Fisheries Service agrees that regardless of where the aquaculture occurs, aquatic animals should be monitored on a regular basis by an expert to determine presence/absence of aquatic animal pathogens. Alternatives in Actions 2 and 8 require monitoring and reporting of pathogen outbreaks.

Comment 14: The use of chemicals should be banned until it is demonstrated that their use will not harm human health or the health of the marine ecosystem.

Response: The legal use of drugs in agriculture and aquaculture in the United States is regulated by the FDA. Usage of drugs in aquaculture in the Gulf of Mexico will be under the auspices of the FDA. In order for the FDA to approve a drug it must be demonstrated to be effective, safe for the animal it is being applied to, and safe for the environment. Chemicals and pesticides are regulated by the EPA, and the use of pesticides in offshore aquaculture farms in the Gulf of Mexico will be under the auspices of the EPA. The EPA requires that pesticides be demonstrated scientifically to be effective, safe to the target animal, and safe for the environment prior to use.

Comment 15*: The FEIS should further discuss prospects and triggers for developing additional NEPA documentation, including site-specific EAs and EISs for each individual aquaculture site. Future, site-specific NEPA documentation should be provided for the 5-20 individual sites expected in the Gulf EEZ. Additionally, a cumulative impacts analysis should be conducted as part of permit review.

Response: The Council initiated this action to provide a programmatic approach to evaluating the impacts of aquaculture proposals in the Gulf. This action was also initiated to provide a comprehensive framework for regulating such activities. The FMP and associated PEIS are intended to address the environmental and cumulative impacts associated with development of offshore aquaculture in the Gulf of Mexico. Any activities proposed by a Gulf Aquaculture Permit applicant that fall outside the scope of this FMP would be prohibited, or would require future amendment to this FMP.

Comment 16: An interagency review panel should be developed for reviewing permit applications.

Response: NOAA Fisheries Service plans to coordinate with other federal agencies in implementing the Gulf FMP. Coordination with other federal agencies may involve entering into memorandums of understanding or other appropriate institutional arrangements to facilitate permit review and issuance.

Comment 17: A citizen suit provision should be included to allow the public as well as the government to enforce permit conditions.

Response: Implementation of this FMP is proposed under the authority provided in the MSFCMA. Actions taken by NOAA Fisheries Service under the MSFCMA are subject to challenge in federal court to the extent authorized by the MSFCMA and other applicable statutes. Any changes to such provisions would have to come from Congress in the form of changes to the relevant statutory provisions.

Comment 18: The DPEIS does not ensure commercial and recreational interests will be protected and restrictions should be put in place to prevent cultured products from flooding the market place.

Response: The Council is sensitive to the issue of the impacts of cultured product on the market for wild harvests and two actions in this proposed FMP will provide the Council with the flexibility to respond to adverse market developments. Total aquaculture production would be capped by the OY and the preferred alternative for Action 10 contains procedures under which the Council can modify OY levels for total planned production. As discussed in Action 9, if planned production exceeds the preferred OY, then the Council would initiate a review of the OY proxy and aquaculture program and determine an appropriate response. To support this process, the preferred alternative for Action 10 would establish a framework procedure to enact changes to the FMP, including the OY, that would rely on bi-annual assessments of the industry by an Aquaculture Advisory Panel. In addition to physical, environmental, and administrative impacts, the Advisory Panel would review the social and economic impacts, which would include market conditions for wild harvests, of the aquaculture industry. Adverse determinations for any of these types of impacts could provide the justification to change the OY or other management requirements. In addition to the provisions of the proposed FMP, it should be noted that significant adverse market effects are not expected to occur for the following reasons. First, because the market for most species is already dominated by imports, which are not limited except through anti-dumping regulations, domestic cultured product is expected to compete more with imported product than wild harvest. Second, while, in general, finfish species are substitutes for each other, the species that are expected to be the primary candidates for aquaculture production are not species with substantial commercial fisheries or markets and, thus, would not directly compete with wild harvests. Finally, while large quantities of cultured product could eventually be produced, the development and build-up of the industry is likely to occur slowly, which should allow harvesters, and the industry in general, time to generate marketing and product differentiation strategies to secure and maintain their market niche. Thus, while adverse market conditions for wild harvests are possible, the pressure for such is not expected to be great, and the Council will have mechanisms in place to monitor conditions and take corrective action should such be justified.

Comment 19: The Council should develop environmental monitoring requirements for offshore aquaculture operations.

Response: Action 6 requires permit applicants to conduct a baseline environmental assessment at the proposed aquaculture site. If a Gulf Aquaculture Permit is approved, then the permittee would also be required to conduct environmental monitoring at the site. Baseline assessment and environment monitoring procedures and guidance would be developed by NOAA Fisheries Service in consultation with the EPA, ACOE, and other federal agencies with authority over aquaculture. In addition, the EPA regulates water quality standards and monitoring requirements via the NPDES permits system. Preferred Alternative 3 in Action 2 would require permittees to abide by existing EPA feed monitoring and management practices as well as monitoring and reporting requirements specified by the ACOE and EPA. Permittees would also be required to comply with the existing regulations of the FDA, EPA, and USDA as they pertain to the use of drugs, biologics, and pesticides.

Comment 20: NOAA Fisheries Service and the Council should conduct an environmental risk assessment to clarify the relative severity of potential impacts.

Response: At this time, the PEIS contained in this FMP provides an overall assessment of the environmental risk of implementing a regulatory program for marine aquaculture in the Gulf of Mexico. In addition, the FMP contains provisions for applicants to provide information and NOAA Fisheries Service to assess potential environmental risks when evaluating a permit application under Action 2, Action 5, and Action 6. Such requirements are designed to minimize environmental impacts and provide NOAA Fisheries Service with the information it needs to conduct the required evaluations of proposed and permitted aquaculture operations.

Comment 21*: The Council should reconsider their approach to zoning for marine aquaculture facilities and consider a combination of Alternative 2 and Preferred Alternative 3 in Action 6.

Response: Establishing broad zones, as proposed in Alternative 2 (Action 6) would not provide NOAA Fisheries Service with sufficient information on a proposed aquaculture site to prevent or minimize localized, small-scale impacts. Additionally, this alternative would require continuous updating of reference maps to determine acceptable locations for siting facilities. Preferred Alternative 3 would establish specific criteria for siting, but would not establish predefined zones. Under the preferred alternative, an estimated 28,719 nm^2 would be suitable for offshore aquaculture in the Gulf (see Figure 4.6.1). NOAA Fisheries Service would also be able to employ a case-by-case approach under the preferred alternative, which would provide for a more comprehensive review process for specific sites. Ultimately, the Council felt that

Preferred Alternative 3 would include the most thorough review of a proposed site, and therefore would provide the greatest net benefits to the physical and biological environments.

Comment 22: We recommend that NOAA Fisheries Service eliminate the assurance bond requirement and that the ACOE require an assurance bond.

Response: Preferred Alternative 3(a)(2)(x) in Action 2 requires documentation certifying that the applicant has posted an assurance bond. If an applicant provides certification that a bond has already been posted as a requirement of the ACOE or other authority and that the bond is sufficient to cover the costs of removal of all components of the aquaculture facility, including cultured organisms as required by NOAA Fisheries Service, a separate bond would not be necessary. The RA will provide guidance for complying with this requirement.

Comment 23: The Council should refrain from identifying specific aspects of the EPA NPDES and NPDES BMP requirements, or any other permit.

Response: All references to the EPA NPDES regulations or any other permit requirements are for reference only and not meant by NOAA Fisheries Service to proscribe or prescribe any requirements or criteria that the EPA shall or would undertake in granting a NPDES permit or establishing NPDES BMP requirements. All standards and monitoring requirements will be specified in the NPDES permit issued by the EPA, in consultation with NOAA Fisheries Service and other state and federal agencies.

Comment 24*: The Council should allow the culture of species native to the Gulf, especially estuarine and bait species.

Response: Preferred Alternative 4 in Action 4 would allow the aquaculture of all marine species managed by the Council, except shrimp and corals, and includes a request to the Highly Migratory Species Management Division (HMSMD) of NOAA Fisheries Service to allow the culture of species managed under their authority (tunas, billfish, sharks, and swordfish). Non-native or genetically modified species would not be allowed under this FMP. Allowing only species native to the Gulf that are managed by the Council will ensure that any species being cultured is under an FMP and managed according to the MSFCMA National Standards. The Council could amend this FMP at any time to add or remove species included in the aquaculture fishery management unit.

Comment 25: The Council should revise the charge of the Aquaculture Advisory Panel to include: 1) accommodation of new or revised production equipment or farm management technologies and methods, species and habitat science, or resource management practices or technologies, and 2) elimination or revision of FMP requirements that are redundant with other federal laws or regulations or those that have proven to be ineffective.

Response: Under Action 10, the preferred alternative charges the Advisory Panel with reviewing and addressing management measures for regulating aquaculture, including: permit application requirements and aquaculture operational requirements and restrictions (Action 2), allowable aquaculture system requirements (Action 5), and siting requirements (Action 6).

These charges would seem to cover the type of innovations the Advisory Panel would address in recommending changes to the regulatory program. It should also be recognized that under Action 5, the preferred alternative requires NOAA Fisheries Service to evaluate an applicant's proposed marine aquaculture system on a case-by-case basis rather than specify in advance what systems could be used. This will allow NOAA Fisheries Service to consider new or improved aquaculture equipment, technologies, and practices proposed by an applicant.

The Advisory Panel is charged with reviewing and making recommendations with respect to all management measures contained in the FMP, including addressing those measures that were ineffective. The intent of this FMP is to integrate MSFCMA requirements with those current Federal agency requirements (e.g., EPA and ACOE) and not duplicate them.

Comment 26: The Council should modify the Hatchery and Genetic Management Plan template developed by the Northwest Region of NOAA Fisheries Service and require it as part of the application process.

Response: During development of this FMP, the Council considered, but rejected, an alternative requiring a genetic management plan. The genetic management plan alternative was replaced with more specific regulatory requirements in Actions 2 and 8 because the plan contained no criteria for determining adequacy and there was concern that these plans would greatly vary in quality and content from one applicant/permittee to the next. Specific regulatory requirements now identified in the FMP will allow for greater standardization during review of permit applications.

Comment 27: The Council should consider allowing culture of non-native species that have already become established in the Gulf.

Response: Non-native and genetically modified species can pose a threat to both wild stocks and biodiversity by competing for food and habitat and changing community and genetic structure. Potential negative effects caused by the introduction of non-native species include: competition with wild stocks, changes to community structure and food web dynamics, and modification of genetic structure if mating occurred with wild stock. In the most extreme cases where non-native species have become established, fundamental changes in ecosystem function may result in habitat degradation, transmission of pathogens, and loss of other species. To address this risk, the Council is prohibiting the use of non-native, genetically modified, and transgenic species for aquaculture in the Gulf of Mexico (see Sections 4.2 and 4.4).

Comment 28: Other federal agencies were not adequately consulted.

Response: Throughout development of this FMP, NOAA Fisheries Service and the Council have coordinated with other state and federal agencies. The Council established an Aquaculture Advisory Panel that included representatives from academia, state and federal government, and non-governmental organizations. The Aquaculture Interdisciplinary Planning Team has also coordinated and spoken with regional EPA staff and district ACOE staff. Finally, the PDEIS was sent to numerous state and federal agencies for public comment (see Section 13.0)

Comment 29: The Council should prevent the use of oil and gas platforms for aquaculture operations.

Response: The Council considered, but rejected (see Appendix D) a provision which would have prohibited the use of oil and gas platforms for aquaculture. The MMS is currently developing regulations under the authority of the Energy Policy Act of 2005 that would apply to alternate uses of oil and gas platforms, including aquaculture.

Comment 30: NOAA Fisheries Service and the Council lack the authority to regulate aquaculture and the FMP is counter to the development of national legislation.

Response: As discussed in Section 2.1, the Council has authority to regulate fisheries in the U.S. Gulf EEZ. Based on a legal opinion by NOAA General Counsel (GC), landings or possession of fish in the EEZ from commercial marine aquaculture production of species managed under FMPs constitutes "fishing" as defined in the MSFCMA [See Sec. 3(16)]. Fishing includes activities and operations related to the taking, catching, or harvesting of fish.

The Council does not believe the FMP is counter to the development of national legislation. In developing this FMP, the Council considered national legislation that was proposed in 2007 (see Appendix B) and designed many of the provisions included in this FMP to be consistent with that legislation.

Comment 31: Permits should be renewed for a longer period of time (e.g., 10 years rather than 5 years).

Response: Five years was considered a reasonable amount of time for permit renewal, although longer renewal periods would reduce administrative costs. A five year renewal period provides the best balance between a permittee's ability to finance and invest in operations and NOAA Fisheries Service review and oversight of the permit.

Comment 32: The plan allows siting of facilities that would impact traditional fishing grounds, EFH, and other sensitive areas.

Response: Preferred Alternative 3(e) in Action 6 would provide NOAA Fisheries Service with authority to conduct case-by-case review of proposed aquaculture sites. Criteria to be considered by NOAA Fisheries Service during case-by-case review include the location of a site relative to commercial and recreational fishing grounds. NOAA Fisheries Service may deny use of a proposed aquaculture site if the site will result in user conflicts with commercial and recreational fishermen. Additionally, Action 1 requires NOAA Fisheries Service to publish a notice indicating their intent to issue a Gulf Aquaculture Permit. The public would then have an opportunity to comment on the proposed project, including where it may be located. Information received during public comment would then be used by NOAA Fisheries Service when making a final determination about whether or not to issue the permit.

Comment 33: Aquaculture will not reduce wild fishing pressure.

Response: The ability of domestic U.S. aquaculture to reduce pressure on wild stocks will depend on a variety of factors, including the species, species substitutions, market demand, and global imports. Demand for wild caught species may be reduced if a greater supply of domestically-cultured species is available.

Comment 34: Establish a database for monitoring interactions with marine mammals and revise the DPEIS to consider risks associated with marine mammal interactions.

Response: Monitoring and reporting requirements in Actions 2 and 8 will allow NOAA Fisheries Service to track marine mammal interactions and entanglements. Data will be maintained by the SERO Aquaculture Coordinator. Section 6.1.4 discusses the risks associated with marine mammal interactions. To minimize risks to marine mammals, numerous aquaculture system requirements are proposed in Action 5 and numerous siting criteria are proposed in Action 6.

Under section 118 of the MMPA, NOAA Fisheries Service must publish, at least annually, a List of Fisheries (LOF) that classifies U.S. commercial fisheries into one of three categories. Because aquaculture meets the definition of fishing under the MSFCMA, it will be included on the LOF and subject to the same requirements. NOAA Fisheries Service regulations implementing section 118 of the MMPA (50 CFR 229) specifically include aquaculture as a commercial fishing operation. Eight aquaculture fisheries (6 in the Pacific and 2 in the Atlantic) are listed on the MMPA LOF, all as Category III fisheries (73 FR 73032; December 1, 2008). Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

Comment 35: The Council needs to ensure that rules governing live rock do not conflict with offshore aquaculture regulations

Response: This FMP would not change existing regulations for live rock. Live rock would continue to be regulated by management measures approved in Amendments 2 and 3 to the Coral and Coral Reefs FMP.

Comment 36*: The PFEIS should specify how often broodstock would need to be collected and the fate of the broodstock after spawning

Response: The Council is not proposing any regulatory requirements for how often broodstock need to be collected and their fate after spawning. However, other requirements within the FMP require broodstock to be marked and for permittees to submit a request to NOAA Fisheries Service prior to broodstock collection. This latter requirement would provide NOAA Fisheries Service information on how often broodstock are being collected and replaced. Any specific requirements pertaining to frequency of broodstock collection and broodstock disposition after spawning would be based on relevant aquaculture regulations imposed by the various Gulf States.

Comment 37*: The FEIS should further discuss how any problematic sea birds, sea turtles, and marine mammals will be controlled and how their potential entanglement would be resolved. It should also be clarified when aquaculture facilities might have to obtain additional permits, such as a Migratory Bird Treaty Act (MBTA) permit.

Response: The Council's Preferred Alternative 3 for Action 2 outlines specific monitoring requirements that a permittee would have to abide by when operating an aquaculture facility, including requiring permittees to regularly inspect allowable aquaculture systems for entanglements and interactions with marine mammals, protected species, and migratory birds. The EPA has a similar regulatory requirement for inspecting net pens/cages for damage (see 40 CFR 451.21(f)). Regular inspection will help ensure allowable aquaculture systems are properly maintained and repaired. Regular inspections will also allow for rapid diagnose of entanglements or interactions, in the event that they occur. If an entanglement or interaction occurs, then permittees would be required to report this information to NOAA Fisheries Service (Action 8 Preferred Alternative 2(c)(2)).

As mentioned in the response to Comment #16, NOAA Fisheries Service will coordinate with other federal agencies in implementing the Gulf FMP in order to facilitate permit review and issuance. Requirements for obtaining additional permits would be reviewed at that time.

Comment 38*: The FEIS should discuss privatization of a public resource, including the socioeconomic implications of siting private aquaculture operations within the public domain.

Response: Sections 4.7 and 6.8 discuss the development of restricted access zones around marine aquaculture facilities and the impacts associated with privatizing a public resource.

Comment 39*: The FEIS should discuss NOAA's authority to remove portions of the public domain from public use for private aquaculture enterprise.

Response: The MSFCMA provides the Council with authority to create zones that exclude fishing or the operation of fishing vessels. Section 303(b)(1) of the MSFCMA states that any FMP prepared by the Council may "designate zones where, and periods when, fishing shall be limited, or shall not be permitted, or shall be permitted only by specified types of fishing vessels or with specified types and quantities of fishing gear". Examples are zones where fishing with certain gear is prohibited and marine reserves where fishing and possession of fish is prohibited.

Comment 40*: NOAA Fisheries Service's authority to limit free enterprise by capping production of a single entity to 20 percent of OY should be discussed.

Response: Regulations at 50 CFR 325(a)(3) provide NOAA Fisheries Service with authority to allocate a fishery in such a manner that no particular individual, corporation, or other entity acquires an excessive share.

Comment 41*: The FEIS should further discuss proposed national legislation and the regulatory consequences for the Aquaculture FMP.

Response: Sections 2.1 and 6.15 discuss proposed national legislation and the potential effect of this legislation on this FMP.

Comment 42*: Consistent with the ecosystem management approach to manage fisheries, the potential displacement of native species by aquaculture sites should be further addressed since aquaculture operations would only be located in ecologically suitable areas where other marine species are likely to live.

Response: Aquaculture would be prohibited in marine protected areas and marine reserves, HAPCs, special management zones (SMZs), permitted artificial reef areas, and coral reef areas (Action 6, Alternative 3(a)). Additionally, permit applicants would be required to conduct a baseline assessment (and subsequent environmental monitoring) at the proposed site in accordance with NOAA Fisheries Service guidance and procedures (Action 6, Alternative 3(d)), which would ensure that siting would not unacceptably affect EFH, important benthic habitat, and marine resources. Section 6.1 discusses numerous scientific research studies describing both the attraction and displacement of marine life at marine aquaculture facility sites.

Comment 43*: The PFEIS should clarify the basis for selecting a separation distance of 1.6 nm (3 km).

Response: Additional rationale discussing the selection of the 1.6 nm separation distance was added to the FMP in Section 4.6. Requiring facilities to be sited at least 1.6 nm (3 km) from one another will limit transmission of pathogens between facilities. Siting aquaculture facilities close to one another allows for transmission of diseases due to contaminated water from nearby facilities. British Columbia and Chile currently require salmon farms to be separated at least 3 km apart, while Scotland requires salmon farms to be separated 8 km apart (http://www.agf. gov.bc.ca/fisheries/ Finfish/cabinet/Summary_Table_BC- World_Aqua_Regs.pdf). Nova Scotia, Newfoundland, Maine, and New Brunswick require salmon farms to be separated by 1 km or less. There is no widely accepted standard for how far apart facilities should be sited, but estimates range from 300 m to 8 km depending on the species being cultured and the country or state responsible for management (Levings et al. 1995). The farther apart facilities are sited, the lower the likelihood of diseases and pathogens being transferred from one facility to another.

Comment 44*: Would broodstock collections for the expected 5-20 offshore marine aquaculture operations notably impact wild stocks of managed species and potentially compromise FMP objectives?

Response: The preferred alternative in Action 8 requires permittees to submit a request for the harvest and collection of broodstock. Broodstock harvest is expected to be relatively minor when compared to the total commercial and recreational harvest. Requiring approval of broodstock collection will allow NOAA Fisheries Service to monitor amounts being harvested and ensure that objectives for wild stocks are not compromised.

Comment 45*: Pingers should be monitored (batteries, etc.) to ensure their function after storm events.

Response: NOAA Fisheries Service agrees that pingers should be properly maintained in the event of a catastrophe. Additional discussion pertaining to this comment was added to Section 4.2.

Comment 46: The FPEIS should discuss why only the preferred sub-alternative in Action 3 (Permit Duration) offers the possibility for permit renewal. The FPEIS should also discuss this substantive inconsistency in permit duration between the national legislation and the FMP.

Response: Under Preferred Alternative 2 for Action 3, a range of permit renewal periods was considered (from 5 years to indefinitely). However, five years was considered a reasonable amount of time for permit renewal as it provides the best balance between a permittee's ability to finance and invest in operations and NOAA Fisheries Service review and oversight of the permit.

In terms of permit duration, the time period a permit is effective is primarily an economic consideration, although it could have ramifications to the physical and biological environments if a permit is not regularly reviewed for compliance with governing regulations. The Council believes ten years provides the best balance between providing adequate time to establish operations and funding, while not granting excessively long permit duration. While this timeframe differs from the national legislation that was proposed in 2007 (20 years, see Appendix B), the choice of ten years is believed to strike the best balance between providing adequate time to establish operations and funding, while not granting excessively long permit duration.

Comment 47: The PFEIS should specify NOAA Fisheries Service's terms and conditions for revoking/modifying permits.

Response: NOAA Fisheries Service's terms and conditions for revoking or modifying permits are described in Table 4.1.1 and in subpart D of 15 CFR 904.

Comment 48: Animal behavior should be considered in the selection of aquaculture species. Species previously spawned and raised successfully in captivity and at grow-out facilities should be selected to help ensure success.

Response: Most reef fish and coastal migratory pelagic species could be raised in aquaculture systems, but likely only those commanding the highest value or with the highest growth rates will be raised. Several species native to the Gulf have been successfully raised in aquaculture operations, including cobia, mutton snapper, and red drum. Additionally, NOAA has funded numerous research studies pertaining to cobia, mutton snapper, and greater amberjack and the Gulf of Mexico Marine Stock Enhancement Program has also conducted research for administering live food to larval red snapper. Research and development activities have also been conducted in Puerto Rico to refine culture technology for spiny lobster. (See Section 5.2.2 for further discussion.)

Comment 49: How competitive are the prospective 5-20 offshore operations expected to be with established foreign aquaculture? Will there be any U.S. government subsidies to help ensure their success?

Response: Currently, foreign imports represent a majority of seafood consumed in the U.S. Domestic aquaculture will increase the supply of fresh U.S. fish; however, the extent to which cultured fish will compete with domestic wild fisheries is unknown at this time.

There are no U.S. government subsidies proposed for offshore aquaculture operations under the Gulf FMP.

Comment 50*: Although oil and gas facilities may have EPA discharge permits, the potential cumulative impacts of oil and gas operations on nearby or co-located aquaculture facilities should be described in more detail, particularly if aquaculture systems are actually co-located with drilling platforms.

Response: The MMS published a final Programmatic Environmental Impact Statement in November 2007 which assesses the impacts of allowing the use of energy facilities for non-energy related purposes, including aquaculture. Further discussion of the potential cumulative impacts of oil and gas operations on aquaculture facilities can be found in Section 6.15.

The FMP also includes a requirement for a baseline assessment and monitoring (Action 4.6). The baseline assessment will provide information on water quality and other parameters that could be used to assess potential impacts on aquaculture facilities, including the potential cumulative impacts of oil and gas operations. Permitted facilities will be required to monitor water quality and other parameters according to protocols and procedures to be established by NOAA Fisheries Service in consultation with other federal agencies.

Comment 51: How will NOAA verify if an applicant's video survey of the on-site benthic habitat is of the proper location and not fraudulent (i.e., video of a different location). We suggest providing guidelines for the video surveys or providing a reference for existing guidance in the PFEIS.

Response: The preferred alternative in Action 6 requires permit applicants to conduct a baseline assessment at the proposed aquaculture site. Procedures and guidelines will be specified by NOAA Fisheries Service in consultation with the ACOE, EPA, and other federal agencies with authority to regulate aquaculture.

Comment 52: Aquaculture should be prohibited in marine sanctuaries.

Response: The Council considered prohibiting offshore marine aquaculture in NOS marine sanctuaries, but ultimately rejected this action (see Appendix D). Therefore, each marine sanctuary can evaluate whether marine offshore aquaculture is compatible with their management plan.

Comment 53: The Council should not prohibit fishing around net pens and cages.

Response: Allowing fishing vessels to fish close to and/or transit in or through permitted aquaculture sites could result in damage to allowable aquaculture systems, including escapement of cultured fish. To minimize the risks of allowable aquaculture systems being damaged, restricted access zones have been proposed for marine aquaculture facilities. These zones would correspond to the coordinates on the ACOE siting permit, which should be an area at least twice as large as the total area encompassed by the allowable aquaculture systems (e.g., cages and net pens) as required in the siting criteria of Action 6. The ACOE permit will determine the appropriateness of the siting permit based on "the extent and permanence of the beneficial and/or detrimental effects which the proposed structure or work is likely to have on the public and private uses to which the area is suited" (33 CFR 320.4(a)(2)(iii).

Comment 54: NOAA Fisheries Service should be provided the flexibility to select a methodology appropriate for any particular site to accommodate factors that make a video survey impractical.

Response: Permit applicants would be required to conduct a baseline assessment (and subsequent environmental monitoring) at the proposed site in accordance with NOAA Fisheries Service guidance and procedures. Baseline assessment and monitoring guidance and procedures will be developed in consultation with the ACOE, EPA, and other federal agencies having authority to regulate offshore aquaculture. Guidance will include, but will not be limited to, procedures and methods for: 1) conducting diver and video surveys, 2) measuring hydrographic conditions, 3) collecting and analyzing benthic sediments and infauna, and 4) measuring water quality. The guidance and procedures will be available from the RA and on the NOAA Fisheries Service aquaculture website.

Comment 55: We recommend that an aquatic animal health expert provide a signed certificate of veterinary inspection.

Response: Preferred Alternative 3(a)(2)(xiii) for Action 2 specifies that the applicant must provide certification that a contractual arrangement with an identified aquatic animal health expert to provide services to the aquaculture facility has been obtained. An aquatic animal health expert is defined as a licensed doctor of veterinary medicine or is certified by the American Fisheries Society, Fish Health Section, as a "Fish Pathologist" or "Fish Health Inspector". A copy of the license or certification must also be provided to NOAA Fisheries Service with the application form.

In addition, Preferred Alternative 3(b)(3) of Action 2 specifies that prior to stocking cultured animals in an allowable aquaculture system in the Gulf EEZ, the permittee must provide NOAA Fisheries Service a copy of a health certificate (suggested form is USDA/APHIS VS 17-141, OMB 0579-0278) signed by an aquatic animal health expert certifying that cultured animals were inspected and determined to be free of World Organization of Animal Health (OIE) reportable pathogens (or additional pathogens that are subsequently identified as reportable pathogens in the National Aquatic Animal Health Plan as implemented by the USDA, Commerce, and Interior).

Comment 56: The Ocean Conservancy provided the Council and NOAA Fisheries Service with a list of 500+ references related to the effects of aquaculture on the environment.

Response: The Council and NOAA Fisheries Service thoroughly reviewed and considered the information provided by the Ocean Conservancy. Many of the references (~30 percent) pertained to freshwater aquaculture and were not directly relevant to the Aquaculture FMP. The remaining references covered a wide range of topics relevant to marine aquaculture, including: environmental impacts, genetics, disease, escapement, drugs/antibiotics, feeds, protected resources, and socio-economic impacts. Where appropriate, additional references identified by the Ocean Conservancy and other sources were added to the FMP to describe the environmental effects of offshore marine aquaculture. Many additional references not identified by the Ocean Conservancy are also included in the FMP and describe the environmental effects associated with offshore marine aquaculture.

APPENDIX K - FDA/CVM APPROVED DRUGS FOR USE IN AQUACULTURE

http://www.fda.gov/cvm/drugsapprovedaqua.htm

Drugs Approved for Use in Aquaculture*

Drug (Immersion)	**Species**	**Indication**	**Dosage regimen**	**Limitations/ Comments**
Formalin (Parasite-S® by Western Chemical and Formalin-F ™ by Natchez Animal Supply Co.)	All finfish	Control external protozoa (*Chilodonella, Costia, Epistylis, Ichthyophthirius, Scyphidia, Trichodina* spp.) and monogenetic trematodes (*Cleidodiscus, Dactylogyrus, Gyrodactylus* spp.)	Tanks and raceways: Salmon & trout Above 50 °F: up to 170 µl/L for up to 1 hr Below 50 °F: up to 250 µl/L for up to 1 hr All other finfish up to 250 µl/L for up to 1 hr Earthen ponds: 15 to 25 µl/L indefinitely	-Drug must not be subjected to temperature below 40 °F -Do not apply to ponds when water is warmer than 80 °F, there is a heavy phytoplankton bloom, or dissolved oxygen is less than 5 mg/L -Ponds may be retreated in 5 to 10 days if needed -Do not treat ponds containing striped bass -Test on a small number from each lot to check for any unusual sensitivity to formalin before proceeding
	All finfish eggs	Control fungi of the family Saprolegniaceae	All finfish eggs: 1000-2000 ppm for 15 min.; Acipenseriformes up to 1500 ppm for 15 min.	-Preliminary bioassay should be conducted to determine species sensitivity

	Penaeid shrimp	Control protozoan parasites (*Bodo, Epistylis* and *Zoothamnium* spp.)	Tanks and raceways: 50 to 100 µl/L for up to and 4 hours daily; Earthen ponds: 25 µl/L as single treatment	-Drug must not be subjected to temperature below 40 °F -Do not apply to ponds when water is warmer than 80 °F, when there is a heavy phytoplankton bloom, or when dissolved oxygen is less than 5 mg/L -Ponds may be retreated in 5 to 10 days if needed
Formalin (Paracide-F® by Argent Laboratories)	Salmon, trout, catfish, largemouth bass, and bluegill	Control external protozoa (*Chilodonella, Costia, Epistylis, Ichthyophthirius, Scyphidia, Trichodina* spp.) and monogenetic trematodes (*Cleidodiscus,* D*actylogyrus, Gyrodactylus* spp.)	Tanks and raceways: Salmon & trout Above 50 °F: up to 170 µl/L for up to 1 hr Below 50 °F: up to 250 µl/L for up to 1 hr Catfish, largemouth bass and bluegill: up to 250 µl/L for up to 1 hr Earthen ponds: 15 to 25 µl/L indefinitely	-Drug must not be subjected to temperature below 40 ° F -Do not apply to ponds when water is warmer than 80 ° F, when there is a heavy phytoplankton bloom, or when dissolved oxygen is less than 5 mg/L -Ponds may be retreated in 5 to 10 days if needed -Do not treat ponds containing striped bass
	Salmon, trout, and esocid	Control fungi of the family	1000-2000 ppm for 15 min.	-Preliminary bioassay should

	eggs	Saprolegniaceae		be conducted to determine species sensitivity
Hydrogen Peroxide (35% PEROX-AID® by Eka Chemicals Inc.)	Freshwater-reared finfish eggs	Control mortality due to saprolegniasis	Coldwater and coolwater: 500 to 1000 mg/L for 15 minutes in a continuous flow system once per day on consecutive or alternate days until hatch Warmwater: 750 to 1000 mg/L for 15 minutes in a continuous flow system once per day on consecutive or alternate days until hatch	-Initial bioassay on a small number is recommended before treating the entire group
	Freshwater-reared salmonids	Control mortality due to bacterial gill disease (*Flavobacterium branchiophilum)*	100 mg/L (30 minutes) or 50 to 100 mg/L (60 minutes) once per day on alternate days for three treatments	-Initial bioassay on a small number is recommended before treating the entire group
	Freshwater-reared coolwater finfish and channel catfish	Control mortality due to external columnaris disease (*Flavobacterium columnare/ Flexibacter columnaris*)	Fingerling and adults (except northern pike and paddlefish): 50 to 75 mg/L (60 minutes) once per day on alternate days for three treatments Fry (except northern pike, pallid sturgeon,	-Use with caution on walleye -Initial bioassay on a small number is recommended before treating the entire group

			and paddlefish): 50 mg/L (60 minutes) once per day on alternate days for three treatments	
Oxytetracycline hydrochloride (OxyMarine by Alpharma Inc.; Oxytetracycline HCl Soluble Powder-343 by Phoenix Scientific, Inc.; and TERRAMYCIN-343 (oxytetracycline HCl) Soluble Powder by Pfizer, Inc.)	Finfish fry and fingerlings	Mark skeletal tissues	200 to 700 mg oxytetracycline hydrochloride (buffered) per liter of water for 2 to 6 hours	
Tricaine methanesulfonate (Finquel® by Argent Laboratories and Tricaine-S by Western Chemical, Inc.)	Fish (Ictaluridae, Salmonidae, Esocidae, Percidae), aquatic amphibians, and other aquatic poikilotherms	Temporary immobilization	15 to 330 mg/L (fish) 1:1,000 to 1:20,000 (other poikilotherms)	-Powder is added to water -Concentration depends upon desired degree of anesthesia, species, size, water temperature and softness, stage of development; preliminary tests of solution should be made with a few fish -21 day withdrawal time (fish); laboratory or hatchery use only in other

				poikilotherms -Water temperature over 50° F (10° C)

Drug (Injectable)	**Species**	**Indication**	**Dosage regimen**	**Limitations/ Comments**
Chorionic Gonadotropin, (Chorulon® by Intervet Inc.)	Male and female brood finfish	Aid in improving spawning function	50 to 510 IU/lb males 67 to 1816 IU/lb females	-Intramuscular injection -Up to three doses. Total dose not to exceed 25,000 IU in fish intended for human consumption -Prescription product restricted to use by or on the order of a licensed veterinarian
Medicated Article/Feed				
Florfenicol (Aquaflor® by Schering-Plough Animal Health Corporation)	Catfish	Control of mortality due to enteric septicemia of catfish associated with *Edwardsiella ictaluri*	10 mg/kg/day for 10 consecutive days	-Veterinary Feed Directive (VFD) drug -12 day withdrawal time
Oxytetracycline dihydrate (Terramycin® 200 for Fish by Phibro Animal Health)	Pacific salmon	Mark skeletal tissue	250 mg/kg/day for 4 days	-Salmon < 30 g -In feed as sole ration -7 day withdrawal time
	Salmonids	Control ulcer disease,	2.5 to 3.75 g/100 lb/day for 10	-In mixed ration -Water

		furunculosis, bacterial hemorrhagic septicemia, and pseudomonas disease (*Hemophilus piscium, Aeromonas salmonicida, A. liquefaciens, Pseudomonas*)	days	temperature not below 48.2° F -21 day withdrawal time
	Catfish	Control bacterial hemorrhagic septicemia and pseudomonas disease (*A. liquefaciens*, *Pseudomonas*)	2.5 to 3.75 g/100 lb/day for 10 days	-In mixed ration -Water temperature not below 62° F -21 day withdrawal time
	Lobster	Control gaffkemia (*Aerococcus viridans*)	1 g/lb medicated feed for 5 days	-In feed as sole ration -30 day withdrawal time
Sulfadimethoxine, ormetoprim (Romet®-30 by Pharmaq AS)	Salmonids	Control furunculosis (*Aeromonas salmonicida*)	50 mg/kg/days for 5 days	-In feed -42 day withdrawal time
	Catfish	Control enteric septicemia (*Edwardsiella ictaluri*)	50 mg/kg/days for 5 days	-In feed -3 day withdrawal time
Sulfamerazine (by Alpharma, Inc.)	Rainbow, brook, and brown trout	Control furunculosis	-10 g/100 lb/day for up to 14 days	-In feed -21 day withdrawal time -Not currently available

*This is an abbreviated summary. For complete labeling see the package insert. Approval applies only to the specific drug which is the subject of a new animal drug application (NADA); active ingredients from other sources (e.g. bulk drug from a chemical company or similar compounds made by companies other than those specified in the NADA) are <u>not</u> approved new animal drugs. Approval applies only to use of the drug for the indications and manner specified on the label.