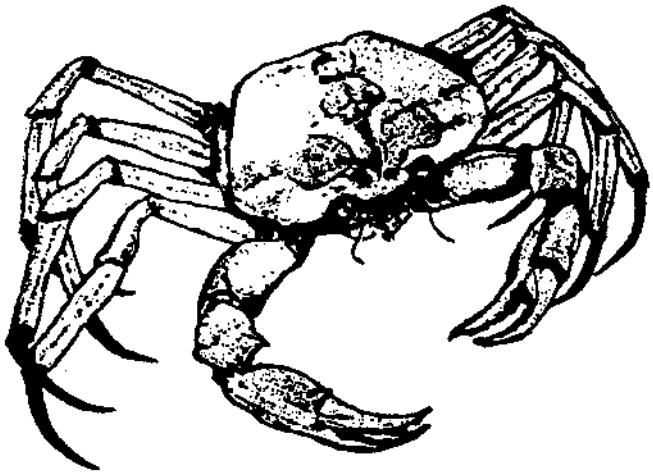
FINAL
FISHERY MANAGEMENT PLAN

(INCLUDING REGULATORY IMPACT REVIEW, ENVIRONMENTAL ASSESSMENT, AND SOCIAL IMPACT ASSESSMENT)

FOR THE GOLDEN CRAB FISHERY OF THE SOUTH ATLANTIC REGION



DECEMBER 1995

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prepared by the
South Atlantic Fishery Management Council

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TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

TABLE OF CONTENTS

INTRODUCTION

This integrated document contains all elements of the Fishery Management Plan, Environmental Assessment (EA), Regulatory Impact Review (RIR) and Social Impact Assessment (SIA). Separate "Tables of Contents" are provided to assist the NMFS/NOAA/DOC reviewers in referencing corresponding sections of the document. Introductory information and/or background for the EA, RIR and SIA are included with the separate "Table of Contents" for each of these sections. The general public information begins on page 1; information for agency reviewers continues below.

National Environmental Policy Act (NEPA) regulations require certain information be presented to define the issues and provide a clear basis for choice among options by the decision maker and the public. The Council's documents must also conform to Magnuson Act and "Other Applicable Law" requirements. National Environmental Policy Act regulations are one of the "Other Applicable Laws" referenced. The South Atlantic Council's policy is to consolidate Magnuson Act and "Other Applicable Law" (including NEPA) requirements into one non-duplicative and non-repetitive document. This results in a document that is more easily read by the general public and saves large quantities of paper, reduces copying requirements and saves money on postage costs. The Council concluded this is the most cost effective and efficient manner to meet the many requirements faced in preparing fishery management plans, amendments and framework seasonal adjustments.

Public comments were received during a scoping meeting held February 7, 1995 in St. Augustine, Florida. The Council received a briefing about the fishery from the National Marine Fisheries Service during the October 26, 1994 snapper grouper committee meeting. In addition, during the Golden Crab committee meeting on April 10, 1995 the Council received a briefing from staff and a South Carolina researcher, and took public comments from fishermen/processors present. Scoping comments are contained in the package with public hearing comments. Limited additional copies are available from the Council.

The first series of public hearings were originally scheduled for August 1-3 in Florida but had to be rescheduled for August 15-17 due to Hurricane Erin. Hearings were held at the following locations:

Cocoa Beach, FL	August 15	Holiday Inn 1300 N. Atlantic Avenue Cocoa Beach, FL 32931
Ft. Lauderdale, FL	August 16	Sheraton Design Center Hotel 1825 Griffin Road Dania, FL 33004
Marathon, FL	August 17	Hawks Cay Resort MM 61, Duck Key, FL 33050
Charleston, SC	August 7	Town & Country Inn 2008 Savannah Highway Charleston, SC 29407

A second series of public hearings were held as follows; all hearings began at 7 p.m.:

Cocoa Beach, FL	September 26	Holiday Inn 1300 N. Atlantic Avenue Cocoa Beach, FL 32931 407-783-2271[800-226-6587]
Dania, FL	September 27	Sheraton Design Center Hotel 1825 Griffin Road Dania, FL 33004 305-920-3500
Key West, FL	September 28	Holiday Inn Beachside 3841 N. Roosevelt Boulevard Key West, FL 33040 305-294-2571

Minutes from the public hearings and all written comments received are included in one package which is provided by the South Atlantic Fishery Management Council to facilitate the Magnuson and NEPA review process. Limited additional copies are available from the Council.

LIST OF ACTIONS

Section

4.2.1.1.1 ACTION 1. Management Unit.

The management unit is the population of golden crab occurring within the South Atlantic Council's area of jurisdiction along the U.S. Atlantic coast from the east coast of Florida, including the Atlantic side of the Keys, to the North Carolina/Virginia border. Red crab and Jonah crab are included in the fishery but not in the management unit because regulations in this plan only address golden crab at this time. Although all three species of crab are also harvested in the Gulf of Mexico and Mid-Atlantic/New England waters, the Council concluded the populations are sufficiently separated from one another to be managed separately.

4.2.1.1.2 ACTION 2. Optimum Yield.

Optimum yield (OY) is all golden crab that are harvested legally under the provisions of the golden crab fishery management plan which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels, minimize the cost of fishing, produce a stable level of landings that would maximize returns to fishermen, provide for a stable supply, and minimize management costs.

4.2.1.1.3 ACTION 3. Overfishing Definition.

Overfishing is defined as any rate of fishing mortality in excess of F_{msy} for golden crab in the South Atlantic Council's management area.

4.2.1.1.4 ACTION 4. Modify crustacean trap definition.

Modify the crustacean trap definition contained in regulations implementing the snapper grouper fishery management plan by adding golden crab. The revised wording is as follows: Crustacean trap means a type of trap historically used in the directed fishery for blue crab, stone crab, golden crab (including Jonah and red crab), or spiny lobster and that contains at any time not more than 25 percent, by number, of fish other than blue crab, stone crab, golden crab (including Jonah and red crab), and spiny lobster. Action 7 specifies traps as the only allowable gear in the directed golden crab fishery and includes a provision for non-conforming gear and experimental gear. Section 3.5.2 Commercial Fishery contains a description of traps used historically in the golden crab fishery.

4.2.1.2.1 ACTION 5. Escape gap.

Require at least two escape gaps in each golden crab trap, require they be located on opposite vertical sides of golden crab traps, and require the inside measurement of the escape gap be no smaller than 2 and 3/4 inches by 3 and 3/4 inches. If a ring is used, the inside diameter must not be less than 4 and 1/2 inches.

4.2.1.2.2 ACTION 6. No retention of females.

Require that all females be released immediately in a manner most likely to ensure survival; no retention of females will be allowed However, recognizing the need for a small tolerance for human error, the Council is specifying a limit on retention of females up to 0.5% by number but sale of female golden crabs is prohibited.

4.2.1.3.1 ACTION 7. Allowable gear, non-conforming gear, experimental gear, and requirement that crabs be landed whole.

Allowable Gear. Specify traps as the only gear allowable in the directed golden crab fishery. Rope is the only allowable gear for mainlines in the golden crab fishery, however, cable mainlines and buoy lines will be allowed in the golden crab fishery for 18 months after publication of the final rule to allow for an evaluation and transition period.

Non-Conforming Gear. Vessels using non-conforming gear will be allowed zero retention of golden crabs.

Experimental Gear. The NMFS Southeast Regional Director may issue permits for experimental gear on provided that a process is implemented to collect data on the use of the particular gear concurrently with issuance of the permit. It is the Council's intent to allow sale of the catch from experimental gear. The data collected would be reviewed by the assessment group as soon as possible after the gear has been in use for 12 months or some other specified period of time. The Council would review the data and the group's report and determine whether the gear should be allowed. Any changes would be made by plan amendment. (Note: this procedure tracks regulations implementing Snapper Grouper Amendment 7.)

Landed Whole. Require that all golden crabs be landed whole.

4.2.1.3.2 ACTION 8. Escape panel (degradable).

Require an escape panel or door on at least one of the vertical sides with an opening or area of at least 12" by 12". The hinges or fasteners of each panel or door must be made of one of the following degradable materials:

A. Ungalvanized or uncoated wire no larger than 19 gauge or 0.041 inches diameter.
B. Untreated cotton 3/16-inch diameter or smaller.
C. Traps made of webbing must have at least a 1-foot slit relaced with untreated cotton of 3/16-inch diameter or smaller.

4.2.1.3.3 ACTION 9. Tending traps.

A golden crab trap may be pulled or tended only by a person (other than an authorized officer) aboard the vessel permitted to fish such trap, or aboard another vessel if such vessel has on board written consent of the vessel permit holder and possesses a valid golden crab permit. Pulling traps at night is allowed because the potential of someone else pulling a fisherman's traps is low given the gear necessary.

4.2.1.3.4 ACTION 10. Gear identification.

Require that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. If buoys are used, the permit number or other assigned number must be marked on the buoy. It is the Council's intent that fishermen be allowed to identity traps and buoys in the manner they feel is most appropriate and cost effective and that the numbering system be as few digits as possible in order to minimize costs/impacts on fishermen.

4.2.1.3.5 ACTION 11. Maximum trap size.

Specify a maximum trap volume size of 64 cubic feet in the northern zone and 48 cubic feet in the middle and southern zones. (Note: See Action 19 for a description of the zones.)

4.2.1.4.1 ACTION 12. Depth limitations.

In the northern zone golden crab traps can only be deployed in waters deeper than 900 feet; in the middle and southern zones traps can only be deployed in waters deeper than 700 feet. (Note: See Action 19 for a description of the zones.)

4.2.1.4.2 ACTION 13. Possession of snapper grouper species.

Prohibit possession of whole or gutted fish or fillets of species in the snapper grouper management unit while fishing for, or possessing, golden crabs.

4.2.1.5.1 ACTION 14. Vessel permit.

For a person aboard a fishing vessel to fish for golden crab in the exclusive economic zone (EEZ), possess golden crab in or from the EEZ, off-load golden crab from the EEZ, or sell golden crab in or from the EEZ, a vessel permit for golden crab must be issued to the vessel and be on board.

A fee will be charged to cover the administrative costs of issuing federal vessel permits. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

4.2.1.5.2 ACTION 15. Dealer permit.

A dealer who receives golden crab must obtain an annual dealer permit for golden crab. To be eligible for such permit, an applicant must have a valid state wholesaler's license in the state where he or she operates and must have a physical facility for the receipt of fish/shellfish at a fixed location in that state.

A fee will be charged to cover the administrative costs of issuing federal dealer permits. To purchase golden crab harvested in the exclusive economic zone (EEZ) from a fisherman, a person or business (including a restaurant) must have a federal dealer permit. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers, and Federally permitted dealers may only purchase golden crab from Federally permitted fishermen. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

4.2.1.6.1 ACTION 16. Vessel/fishermen reporting.

The owner or operator of a vessel for which a permit for golden crab has been issued must maintain a daily logbook form for each fishing trip on a form available from the NMFS Science and Research Director. Among other things, the logbook forms provide a record of fishing locations, time fished, fishing gear used, and numbers of each bycatch species discarded. The forms should also provide for the recording of economic data such as variable costs and prices paid. Logbook forms must be submitted to the NMFS Science and Research Director postmarked not later than the 30th day after sale of the golden crabs off-loaded from a trip. If no fishing occurred during a month, a report so stating must be submitted in accordance with instructions provided with the forms.

If selected, the owner or operator of a vessel must provide data and must comply with any requirements regarding landing golden crab and any associated bycatch. The Council is specifying 100% logbook coverage given the severe lack of data and extreme importance of this data. Also, if selected, the owner or operator of a vessel must make their catch available for biological sampling and if required, must carry an observer.

4.2.1.6.2 ACTION 17. Dealer reporting.

A dealer who has been issued an annual dealer permit for golden crab must, if selected by the NMFS Science and Research Director, provide information on receipts of such crab and prices paid, to the NMFS Science and Research Director through existing state/federal cooperative agreements at monthly intervals, or more frequently if requested. Additional information must be provided as requested by the NMFS Science and Research Director. The NMFS Science and Research Director is not expected to select dealers in states where satisfactory data are being provided through existing cooperative agreements.

4.2.1.7.1 ACTION 18. Mechanism for Determination of Framework Adjustments.

Establish an assessment group and procedure for adjustments including in-season adjustments:

1. The Council will appoint an assessment panel (Panel) that will assess the condition of golden crab (including periodic economic and sociological assessments as needed) on an annually planned basis. The panel will present a report of its assessment and recommendations to the Council.

2. The Council may take action based on the assessment panel report or may take action based on issues/problems/information that surface separate from the assessment group. The steps are as follows:

A. Assessment panel report — The Council will consider the report and recommendations of the Panel and hold public hearings at a time and place of the Council's choosing to discuss the Panel's report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

B. Information separate from assessment panel report — The Council will consider information that surfaces separate from the assessment panel. Council staff will compile the information and analyze the impacts of likely alternatives to address the particular situation. The Council staff report will be presented to the Council. A public hearing will be held at the time and place where the Council considers the Council staff report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to review the staff report and provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

3. If changes are needed in the maximum sustainable yield (MSY), total allowable catch (TAC), quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year, the Council will advise the Regional Director in writing of their recommendations accompanied by the Panel's or Staff's report, relevant background material, draft regulations, regulatory impact review, social impact review, and public comments. This report will be submitted at least 60 days prior to the desired effective date of regulations.

4. The Regional Director will review the Council's recommendations, supporting rationale, public comments, and other relevant information. If the Regional Director concurs that the Council's recommendations are consistent with the goals and objectives of the fishery management plan, the national standards, and other applicable law, the Regional Director will recommend that the Secretary publish proposed and final rules in the Federal Register of any changes. The public comment period on the proposed rule will be not less than 15 days.

5. Should the Regional Director reject the recommendations, he will provide written reasons to the Council for the rejection, and existing regulations will remain in effect until the issue is resolved.

6. Appropriate adjustments that may be implemented by the Secretary by proposed and final rules in the Federal Register are:

A. Initial specification of MSY and subsequent adjustment of the best estimate of MSY when this information is available.

B. Initial specification of acceptable biological catch (ABC) and subsequent adjustment of the ABC range and/or best estimate when and where this information is available.

C. Setting TAC.

D. Modifying (or implementing) TAC, quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year.

E. The fishing year (calendar year) may not be adjusted by more than two months.

F. Authority is granted to the Regional Director to close the fishery once a quota has been established through the procedure described above and such quota has been reached or projected to be reached. Authority is also granted to reopen a fishery once a new fishing year begins. When such action is necessary, the Regional Director will recommend that the Secretary publish a notice in the Federal Register as soon as possible.

G. Requiring onboard observers.

4.2.1.8.1 ACTION 19. Controlled access program.

A. Zones. Because all catches occur in the exclusive economic zone (EEZ) (golden crabs are not harvested in state waters), the following zones are established from the seaward boundary of the EEZ to shore (Figure 2):

(1) Northern zone - north of the 28°N. latitude to the North Carolina/Virginia border;
(2) Middle zone - 28°N. latitude to 25°N. latitude; and
(3) Southern zone - south of 25°N. latitude to the border between the South Atlantic and Gulf of Mexico Fishery Management Councils.

B. Initial Eligibility. To be eligible for a permit, golden crabs must have been harvested within the South Atlantic Council's area of jurisdiction. For vessels which qualify, the applicant must indicate which zone the vessel will fish within, and fishing for golden crab will only be allowed within that zone. Initial eligibility is limited to owners of boats/vessels that meet the following two criteria:

(1) Catches equal to or greater than 600 pounds (whole live weight) by April 7, 1995 (control date); or
(2) Total catches (including pre-April 7, 1995 catches) equal to or greater than 2,500 pounds (whole live weight) by September 1, 1995.

C. Appeals. The Council will establish an ad hoc committee (comprised of Council members) to assist the NMFS Southeast Regional Director (by providing individual recommendations) in handling disputes over eligibility. Any appeal must be submitted within 30 days after the permit is rejected by NMFS. All appeals must be accompanied by written documentation and individuals will be allowed to testify before the appeals ad hoc committee. The appeals ad hoc committee will only meet once. The charge to the appeals ad hoc committee is to make sure the criteria pertaining to eligibility were applied to an individual's application in a correct manner.

D. Permits. Applications for permits must be made within 30 days after publication of the final rule in the Federal Register. Permits are to be implemented 90 days after implementation of the final rule. It is the Council's intent that the permit year be the 12 month period following issuance of the permits. Permits will be issued to the vessel. The possession of golden crab aboard a vessel within a zone for which you do not have a permit is prohibited except that vessels may transit zones provided they do not stop to fish and they notify the NMFS Office of Law Enforcement of the pending transit. It is the Council's intent that a message left on a NMFS Law Enforcement answering machine constitute notice.

The Council retains the right to issue additional permits depending on the status of the resource. Adding permits should dilute the value of existing permits. Any changes to the number of permits will be by plan amendment.

E. Transferability. Permits are transferable within a zone or to the northern zone. To permit a new vessel or enter the fishery, the owner of the new vessel must acquire a permit or permits for vessels currently in the fishery equal to at least 90% of the length of the new vessel (length to be determined from documentation or state registration information).

F. Renewals. Permits may be renewed if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that owner's vessel(s) during one out of the two previous years. It is anticipated that permits will be issued in April 1996. The first time permits may be renewed will be April 1997 and the two years under consideration will be retroactively to April'95-March'96 and the first permit year of April'96-March'97.

G. Assignment of Initial Permits. The initial assignment of permits will be to vessel owners.

H. Tracking/Monitoring Permit Transfers. Tracking transfers of permits will be done by requiring the buyer and seller to sign and date the appropriate lines on the reverse side of the permits that transfer. Fees to cover the administrative costs of processing transfers will be charged.

I. Increasing Enforceability. Because the benefits obtained from controlled access depend, in large measure, on regulatory compliance by fishermen, the Council maintains that gross violations (such as failure to report; fishing traps without escape gaps, identification numbers, or biodegradable panels; retaining female crabs in excess of the tolerance specified; and fishing in an unauthorized zone) warrant strict penalties such as permit sanctions. The Council's intent is that fishermen submit logbooks by the 30th day after sale. It is not the Council's intent that strict penalties such as permit sanctions be applied if the logbook reports are late once or twice. However, it is the Council's intent that repeated lateness warrant strict penalties. It is also the Council's intent that fishermen not be allowed to supply missing logbook reports at the time of permit renewal.

ENVIRONMENTAL ASSESSMENT

This integrated document contains all elements of the Fishery Management Plan (FMP), Environmental Assessment (EA), Regulatory Impact Review (RIR) and Social Impact Assessment (SIA). A "Table of Contents" for the EA is provided separately to aid reviewers in referencing corresponding sections of this document.

NAME OF ACTION

(X) Administrative ( ) Legislative

Responsible Agencies:

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Contact: Andrew J. Kemmerer
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9721 Executive Center Drive N.
St. Petersburg, Florida 33702
(813) 570-5301
(813) 570-5300 (FAX)

Summary

The proposed management options include:

1. Traditional Fishery Management Program Plus Controlled Access. Traditional fisheries management includes measures to provide biological protection to the resource (escape gap in traps and no retention of female crabs); regulate gear (define allowable gear, degradable panel, tending requirements, gear identification, and maximum trap size by zone); provide for law enforcement (depth limitations and prohibit possession of whole fish or fillets of snapper grouper species); determine the number of participants (vessel and dealer/processor permits); collect the necessary data (vessel/fishermen and dealer/processor reporting); and a framework procedure to adjust the management program (framework adjustments and adjustments to activities authorized by the Secretary of Commerce). Use of these traditional management techniques in other fishery management plans has not solved all fisheries management problems. At best, the fishery resource, in this case golden crab, is biologically protected. Ignored or even exacerbated are underlying social and economic problems resulting from open access fisheries. These include excess capacity, inefficiency which increases fishing costs, low conservation and compliance incentives, conflicts, high regulatory costs and low marketing incentives (see Section 1.0 A. Issues/Problems for more detail). To solve these social and economic problems, managers have increasingly turned to various forms of controlled access or effort limitation. The Council has chosen to limit the number of vessels and area fished for the golden crab fishery. Combining the more traditional fisheries management measures with controlled access best allows the Council to solve problems present in the golden crab fishery.

2. Traditional Fishery Management Program. Use of a traditional approach to management of this fishery (described above) would address the biological problems but would not sufficiently address the social and economic problems. The Council concluded that such an approach is not in the best, long-term interest of the fishermen, processors, consumers, and public and rejected such a limited approach.

3. No Action. Without protection, the golden crab resource would be overfished resulting in social and economic losses and displacement to participants in the fishery. Consumers would also lose long-term benefits which would result from a sustained fishery. The Council rejected taking no action because it would result in overfishing and large negative impacts on the fishermen, processors, consumers, and the public.

REGULATORY IMPACT REVIEW

This integrated document contains all elements of the Fishery Management Plan (FMP), Environmental Assessment (EA), Regulatory Impact Review (RIR) and Social Impact Assessment (SIA). A "Table of Contents" for the RIR is provided separately to aid reviewers in referencing corresponding sections of the document.

TABLE OF CONTENTS **PAGE**

TABLE OF CONTENTS PAGE

Introduction

The Regulatory Impact Review (RIR) is part of the process of developing and reviewing fishery management plans, amendments and seasonal adjustments, and is prepared by the Regional Fishery Management Council with assistance from the National Marine Fisheries Service, as necessary. The regulatory impact review provides a comprehensive review of the level and incidence of economic impact associated with the proposed regulatory actions. The purpose of the analysis is to ensure that the regulatory agency or Council systematically considers all available alternatives so that public welfare can be enhanced in the most efficient and cost effective way.

The National Marine Fisheries Service (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 proposed or final regulatory action, 2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that 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 and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA). The purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and record-keeping requirements, to the extent possible.

This RIR analyzes the probable impacts of the proposed management plan for the golden crab fishery.

Problems and Objectives

The general problems and objectives are found in the FMP (Section 1.0). This FMP proposes to establish a management program for the golden crab fishery. Further exposition of these issues are found in the discussions under each proposed action.

Methodology and Framework for Analysis

The basic approach adopted in this RIR is an assessment of management measures from the standpoint of determining the resulting changes in costs and benefits to society. The net effects should be stated in terms of producer and consumer surpluses for the harvesting, processing/dealer sectors, and for consumers. Ideally, the expected present values of net yield streams over time associated with the different alternatives should be compared in evaluating the impacts. However, estimates of the yield streams for golden crab are not available. The approach taken in analyzing alternative management approaches is to describe and/or quantify the changes in short-term net benefits. A qualitative discussion of long–term impacts is also attempted.

SOCIAL IMPACT ASSESSMENT

This integrated document contains all elements of the Fishery Management Plan (FMP), Environmental Assessment (EA), Regulatory Impact Review (RIR) and Social Impact Assessment (SIA). A "Table of Contents" for the Social Impact Assessment is provided separately to aid reviewers in referencing corresponding sections of the document.

TABLE OF CONTENTS **PAGE**

Introduction

Mandates to conduct Social Impact Assessments (SIA) come from both the National Environmental Policy Act (NEPA) and the Magnuson Fishery Conservation and Management Act (MFCMA). NEPA requires Federal agencies to consider the interactions of natural and human environments by using a "systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences...in planning and decision-making" [NEPA Section 102 (A)]. Under the Council on Environmental Quality's (U.S. CEQ, 1986) *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* a clarification of the terms "human environment" explained the interpretation to include the relationship of people with their natural and physical environment (40 CFR 1508.14). Moreover, agencies need to address the aesthetic, historic, cultural, economic, social, or health effects which may be direct, indirect or cumulative (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994).

Under the MFCMA, fishery management plans (FMPs) must "...achieve and maintain, on a continuing basis, the optimum yield from each fishery" [MFCMA Section 301(a)(1)]. When considering "a system for limiting access to the fishery in order to achieve optimum yield" the Secretary of Commerce and Regional Fishery Management Councils are to consider both the social and economic impacts of the system, and other factors [MFCMA Section 303(b)(6)]. More recent amendments to the MFCMA require 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 [MFCMA Section 303 (a) (9)]. 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 in order to mitigate the negative impacts experienced by the populations concerned.

Problems and Methods

Social impacts are generally the consequences to human populations that follow from some type of public or private action. Those consequences may include alterations to "the ways in which people live, work or play, relate to one another, organize to meet their needs and generally cope as members of a society...." (Interorganizational Committee on Guidelines and Principles for Social Impact Assessment, 1994:1). In addition, cultural impacts which may involve changes in values and beliefs which affect people's way of identifying themselves within their occupation, communities and society in general are included under this interpretation. Social impact analyses help determine the consequences of policy action in advance by comparing the status quo with the projected impacts. Therefore, it is extremely important that as much information as possible concerning a fishery and its participants be gathered for an assessment. Although public hearings and scoping meetings do provide input from those concerned with a particular action, they do not constitute a full overview of the fishery.

Without access to relevant information for conducting social impact analyses it is important to identify any foreseeable adverse effects on the human environment. With quantitative data often lacking, qualitative data can be used to provide a rough estimate of some impacts. In addition, when there is a body of empirical findings available from the social science literature, it needs to be summarized and referenced in the analysis.

1.0 PURPOSE AND NEED

The NMFS informed the Council in June 1994 that there was a "small scale trap fishery for *Geryon* crabs in the South Atlantic. The fishery is prosecuted primarily in depths of 200 to 300 meters. The crab traps are constructed similarly to fish traps. The similarity of crab and fish traps creates a potential law enforcement problem." NMFS specifically requested that the Council "provide NMFS with guidance concerning the use of traps for the *Geryon* fishery." At the June 1994 meeting, the Council approved a motion to allow use of traps for *Geryon* crabs with the provision that no possession of any species in the snapper grouper management unit would be allowed in this fishery. In August 1994, NMFS informed the Council that they need to "prepare and submit to NMFS a regulatory amendment to 'allow use of traps for *Geryon* crabs with the provision that no possession of any species in the snapper grouper management unit would be allowed in this fishery.' This is a gear restriction and can be done under the framework provision of the snapper grouper FMP." The Council discussed this at the August meeting and requested additional information from NMFS which was presented during the October 1994 Council meeting. At that meeting, the Council approved proceeding with a regulatory amendment to the snapper grouper fishery management plan and at the same time begin the scoping process for a possible golden crab fishery management plan. A scoping meeting was held February 7, 1995. Also, at the February 1995 Council meeting the Council approved a control date, effective upon publication in the federal register (Appendix A). The control date was published April 7, 1995. At the February 1995 meeting the Council requested staff prepare an options paper for development of a fishery management plan for the golden crab fishery.

Recent increases in the golden crab fishery are largely the result of a market developing for golden crab separate from serving as a substitute product for other crab species. Processing and marketing problems have been solved while, at the same time, supplies of other crab species have declined. Processing facilities have been constructed specifically for golden crab. These factors have resulted in an increase in effort in the golden crab fishery.

The fishery management plan for Golden Crab was developed to manage the previously unregulated and expanding golden crab fishery. The potential yield and stock status of golden crab are unknown due to severely limited data. The general life history characteristics of golden crab (long lived; slow growing; limited distribution in deep water, generally depths greater than 600 feet) result in this species being very susceptible to growth and recruitment overfishing. Information available for red crab, a closely related species, indicate a strong susceptibility to growth and recruitment overfishing. The maximum sustainable yield (MSY) for golden crabs in the South Atlantic Council's area of jurisdiction, cannot be estimated at this time due to the severe lack of information. The MSY will be specified through the framework procedure as soon as sufficient information becomes available.

In the South Atlantic Council's area of jurisdiction, there were two vessels fishing full-time on January 1, 1995, 7 vessels in the fishery as of February 1, 13 as of March 1, 17 as of April 1, and 27 as of April 7, 1995. The number of vessels continued to increase to 28 as of May 1, 33 as of June 1, 35 as of

July 1, and 37-38 as of August 1, 1995. The number of vessels in the fishery was thought to be considerably less than the 27 vessels for which information was provided during the public hearings indicating they would qualify by the April 7, 1995 control date. Since that time, data from the State of Florida and discussions with fishermen, indicate up to 80 individuals may qualify as of the April 7, 1995 control date and an additional 33 individuals may qualify if the additional criterion of September 1, 1995 considered by the Council were used. These large increases in number of vessels and the much higher than expected number of potential qualifiers, represent harvesting capacity greatly in excess of that necessary to harvest the maximum sustainable yield. Data from the State of Florida indicate 670,767 pounds of golden crab were landed through a portion of September 1995 (Martha Norris, FL DEP; personal communication). In addition, a large number of vessels will result in overcapitalization and other economic and social problems (e.g., gear and space conflict). Without the management measures specified, current and potential harvest rates are likely to exceed the expected MSY and result in overfishing and collapse of the fishery. This would also prevent obtaining the optimum yield from the golden crab resource because harvest and income levels would be significantly less than would be possible if the resource were not overfished.

Additional vessels are gearing up and/or converting. Due to large declines in Alaskan stocks of crabs and severe closures, as well as additional closures, in the New England area, several vessels have already moved into the fishery within the South Atlantic Council's area of jurisdiction and more are expected. The recent net ban in the State of Florida could also result in significant effort shifting into the unprotected golden crab fishery. The Council, NMFS, Sea Grant and fishermen continue to receive inquiries from fishermen around the country interested in entering the golden crab fishery.

Faced with an excessive number of vessels currently in the fishery and the potential for additional vessels entering the fishery, the Council has adopted a controlled access program which limits participation to vessels with documented landings equal to or greater than 600 pounds by April 7, 1995 (control date) and landings equal to or greater than 2,500 pounds by September 1, 1995 (golden crabs must have been harvested and landed within the South Atlantic Council's area of jurisdiction). Based on information from the State of Florida (provided by Martha Norris on October 20, 1995 and representing landings through most of July and part of August 1995), eleven vessels would qualify as of April 7, 1995; there were 6 additional individuals that may or may not qualify depending on whether they can document their catches were associated with a vessel not already qualified. Four additional vessels would qualify as of September 1, 1995; there were 3 additional individuals that may or may not qualify depending on whether they can document their catches were associated with a vessel not already qualified. Between two and four additional vessels are expected to qualify based on their providing information other than the Florida trip ticket information.

The South Atlantic Fishery Management Council is also concerned about the impact of the fish trap prohibition on the golden crab fishery. Currently golden crab traps fall under the definition of fish traps contained in the snapper grouper regulations, and as a result their use is technically illegal. The Council is

proposing to allow use of golden crab traps with no possession of species in the snapper grouper management unit except that provision will be established to allow use of fish heads/frames obtained from fish processing facilities to be used as bait.

The Council has evaluated all readily available information in designing the management measures contained in this fishery management plan. The framework procedure contained in the fishery management plan will be used to monitor and adjust management as necessary. The Council concluded the proposed measures are necessary to prevent overfishing and the economic/social problems listed below, based on: (1) the fact that yield and stock status of golden crab are unknown due to severely limited data; (2) the general life history characteristics of golden crab (long lived; slow growing; limited distribution in deep water, generally depths greater than 600 feet) result in this species being very susceptible to growth and recruitment overfishing; (3) the harvest capacity greatly exceeds the anticipated available yield; and (4) the number of individuals qualifying as of the April 7, 1995 control data may be as high as 80. The Council also concluded the proposed actions are necessary to comply with the NMFS Policy of Risk Aversion in the Face of Uncertainty" (see Appendix B).

1.1 Issues/Problems to be Considered

The following issues/problems exist in the golden crab fishery:

1. The status of the golden crab resources is unknown but given the life history characteristics (slow growing and long-lived), excessive fishing mortality will jeopardize the biological integrity of the golden crab resource of the south Atlantic.

2. Management is limited by lack of current and accurate biological, statistical, social, and economic information. Data necessary to document growth and/or recruitment overfishing, and to calculate spawning stock ratios (SSRs) are very limited. Since the universe of participants is unknown, scientists are unable to estimate catch, effort, and other important information with desired accuracy. The present system of fishery dependent and fishery independent data collection provides limited information for assessment purposes and practically no economic or social data.

3. Potential conflicts: Due to limited fishing grounds and competitive fishing conditions as a large number of vessels compete for the available golden crab resources, gear and area conflicts have occurred among commercial users of the golden crab resource, and between commercial users employing different gears (traps, trawls, longlines and entanglement nets) when traditional management measures are utilized.

4. Habitat degradation, which may be caused by some types of fishing gear, will adversely affect golden crab stocks and associated habitat/species.

5. Excess capacity: the size and capacity of the golden crab fleet will exceed that needed for prudent harvest levels the Council is likely to allow in the foreseeable future. Additional vessels in the future would exacerbate this situation since the derby nature of an open access fishery encourages fishermen to add harvest capacity even when gains in production are marginal or when economies of scale are not necessarily realized.

6. Inefficiency: measures to control harvest (total allowable catch, gear restrictions, trip limits) and other future measures that would likely be needed under continued open access, increase fishing costs and decrease potential consumer and producer benefits from the fishery.

7. Low conservation and compliance incentives: under open access, incentives to promote conservation and voluntary compliance with regulations are low because the benefits from doing so may be appropriated by other fishermen or new entrants.

8. High regulatory costs: management and enforcement costs will be unnecessarily high and would be expected to increase under open access as the number of vessels increases and stricter management measures are needed to control excess fishing effort.

9. Low marketing incentives: efforts by dealers to augment consumer acceptance of golden crab will be thwarted by short-run oversupply and lack of product continuity. The likelihood of additional harvest restrictions under open access increases uncertainty and instability and discourages long-run planning and investment by dealers.

1.2 Management Objectives

The following objectives address these issues/problems:

1. Prevent overfishing of golden crab by preventing the fishing mortality rate from exceeding the fishing mortality rate that would produce maximum sustainable yield (F_{msy}).

2. Collect necessary data to develop, monitor, and assess biological, economic, and social impacts of management measures designed to prevent overfishing, and address the other stated problems.

3. Promote orderly utilization of the resource.

4. Provide for a flexible management system that minimizes regulatory delays while retaining substantial Council and public involvement in management decisions, and rapidly adapts to changes in resource abundance, new scientific information, and changes in fishing patterns among user groups.

5. Minimize habitat damage due to direct and indirect effects of commercial fishing activities.

6. Promote public comprehension of, voluntary compliance with, and enforcement of the management measures.

7. Develop a mechanism to vest fishermen in the golden crab fishery, and create incentives for conservation and regulatory compliance whereby fishermen can realize potential long-run benefits from efforts to conserve and manage the golden crab resource.

8. Provide a management regime which promotes stability and facilitates long-range planning and investment by harvesters and dealers while avoiding, where possible, the necessity for more stringent management measures and increasing management costs over time.

9. Develop a mechanism that allows the marketplace to drive harvest strategies and product forms in order to maintain product continuity and increase total producer and consumer benefits from the fishery.

10. Promote management regimes that minimize gear and area conflicts among fishermen.

11. Minimize the tendency for over-capitalization in the harvesting and processing/distribution sectors.

12. Provide a reasonable opportunity for fishermen to make adequate returns from commercial fishing by controlling entry so that returns are not regularly dissipated by open access, while also providing avenues for fishermen not initially included in the controlled access program to enter the program.

1.3 History of Management

The golden crab resource and fishery in the South Atlantic Region are currently unprotected. The Council approved a control date which was published in the Federal Register on April 7, 1995. The notice of control date and comments are included in Appendix A.

The Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region was prepared by the South Atlantic Fishery Management Council (SAFMC, 1983) to address overfishing in 13 species and to establish a procedure for preventing overfishing in other species. A comprehensive expansion of the snapper grouper management program was accomplished in Amendment 4 (SAFMC, 1991) including a prohibition on fish traps and a definition of fish traps, sea bass pots and crustacean traps. These definitions and the prohibition on use of fish traps results in fishermen technically not being able to fish legally for golden crabs using traps. Fish trap means a trap used for or capable of taking fish, except a sea bass pot or a crustacean trap. Crustacean trap means a type of trap historically used in the directed fishery for blue crab, stone crab, or spiny lobster and that contains at any time not more than 25 percent, by number, of fish other than blue crab, stone crab, and spiny lobster. Sea bass pot means a trap that (1) Has six rectangular sides; (2) Does not exceed 25 inches (63.5 cm) in height, width, or depth; and (3) Has mesh sizes as follows (based on centerline measurements between opposite, parallel wires or netting strands): (i) Hexagonal mesh (chicken wire)--at least 1.5 inches (3.8 cm) between the wrapped sides; (ii) Square mesh--at least 1 inch (3.8 cm) between sides; or (iii) Rectangular mesh--at least 1 inch (2.5 cm) between the longer sides and 2 inches (5.1 cm) between the shorter sides.

The Council, at the October 1994 meeting, approved a regulatory amendment to the snapper grouper fishery management plan that would have allowed use of golden crab traps with no possession of species in the snapper grouper management unit. Subsequently, at the April 1995 meeting, the Council approved a draft fishery management plan for golden crab in the South Atlantic Region for public hearings and informal NMFS refiew. The draft FMP dated July 1995, which was used during the first round of public hearings, contained the Council's preferred option to limit access to those fishermen able to document landings as of the April 7, 1995 control date. Four public hearings were held (see Introduction, page vi for a listing of dates and sites). The Council met with the Golden Crab Advisory Panel, and reviewed the public and NMFS/agency comments at the August 21-25, 1995 meeting in Charleston, SC. The Council was advised by NMFS and NOAA General Counsel the controlled access portions of the plan would likely be

disapproved if the Council did not obtain additional public input. The Council took public input at the Charleston meeting on August 24, 1995 and heard from four members of the public. The Council, based on advice from NMFS and NOAA GC, refined their preferred option and approved the revised plan for a second round of public hearings. The revised plan dated September 1995 contained the Council's preferred option using April 7, 1995 (control date) to limit access in the southern and mid-zones and applying September 1, 1995 for access in the northern zone. The Council held three additional public hearings (see Intorduction page vii for a listing of dates and sites).

At the October 23-27, 1995 Council meeting in Wilmington, NC the Council reviewed public and NMFS/agency comments, met with the Golden Crab Advisory Panel and Scientific and Statistical Committee, and provided an additional opportunity for public comment during the Council meeting. The Council's preference was to limit the number of vessels by area directly but were advised by NOAA GC and NMFS that this was not an option available to the Council. The Council is very concerned about overexploitation in the golden crab fishery given they are long-lived, slow growing, and late maturing (spawning). The Council's objective is to be conservative by protecting the biological integrity of the golden crab resource while allowing the fishery to develop in a manner that protects the resource and the participants in the fishery. Since it had been determined by NOAA GC the Council could not meet this objective by limiting the number of vessels by area directly, the Council selected a combination of landing requirements and dates which limits the number of vessels expected to qualify to around 30 which the Council considers prudent at this stage of fishery development. The Council approved a final controlled access program which limits access to boats/vessels that have catches equal to or greater than 600 pounds by April 7, 1995 and/or total catches equal to or greater than 2,500 pounds by September 1, 1995.

The final golden crab fishery management plan also defines golden crab traps and prohibits possession of whole or gutted fish or fillets of species in the snapper grouper management unit while fishing for, or possessing, golden crabs. The Council has requested NMFS resolve the wording of the fish trap definition in the snapper grouper regulations in light of the golden crab trap defined in regulations implementing the golden crab fishery management plan. Accomplishing the action contemplated under the regulatory amendment via the golden crab fishery management plan will also reduce the federal work load and number of regulatory actions as called for in the President's recent directives.

1.4 Proposed Measures

The Council is proposing to: define the management unit as the population of golden crab occurring within the South Atlantic Council's area of jurisdiction along the U.S. Atlantic coast from the east coast of Florida, including the Atlantic side of the Keys, to the North Carolina/Virginia border; define optimum yield as all golden crab that are harvested legally under the provisions of the golden crab fishery management plan which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels,

minimize the cost of fishing, produce a stable level of landings that would maximize returns to fishermen, provide for a stable supply, and minimize management costs; define overfishing as any rate of fishing mortality in excess of F_{msy}; and modify the definition of crustacean trap under the snapper grouper regulations to include golden crab traps/pots. Biological measures include requiring at least two escape gaps on opposite vertical sides of the trap, no smaller than 2 and 3/4 inches by 3 and 3/4 inches or if a ring with an inside diameter not less than 4 and 1/2 inches; and no retention of females with a very limited incidental allowance. Measures for regulating gear are defining traps/pots as the only allowable gear; allowing cable main-line for 18 months; requiring crabs be landed whole; requiring the appropriate escape panel so that material degrades rendering the trap unfishable in 14 to 30 days; limiting persons allowed to pull traps/pots; and a maximum trap/pot volume of 64 cubic feet in the northern zone and 48 cubic feet in the southern and mid-zones. Measures designed to aid enforcement and minimize conflicts with existing fisheries include limiting traps/pots to waters deeper than 900 feet in the northern zone and 700 feet in the southern and mid-zones; and no possession of whole or gutted fish or fillets of species in the snapper grouper management unit. Permits for fishermen and dealers and reporting by both groups (fishermen logbooks and dealer trip tickets or monthly reports) are being proposed to address the severe lack of information and provide performance history for use in evaluating individual transferable quotas in the future. A framework procedure to modify management measures is included. In addition, the Council is establishing a controlled access program which limits participation to vessels with documented landings equal to or greater than 600 pounds by April 7, 1995 (control date) and landings equal to or greater than 2,500 pounds by September 1, 1995 (golden crabs must have been harvested within the South Atlantic Council's area of jurisdiction).

A complete listing of the proposed measures currently being considered by the Council is included in Section 2.0.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

National Environmental Policy Act (NEPA) regulations indicate that Section 2.0 should present the environmental impacts of the proposal and the alternatives in comparative form, thus sharply defining the issues and providing a clear basis for choice among options by the decision maker and the public. The Council's documents must also conform to Magnuson Act and "Other Applicable Law" requirements. National Environmental Policy Act regulations are one of the "Other Applicable Laws" referenced. The South Atlantic Council decided to blend Magnuson Act and "Other Applicable Law" (including NEPA) requirements in one consolidated, non-duplicative and non-repetitive document. The Council's approach is to present the detailed evaluation of alternatives and discussion about the effects on the environment in Section 4.0 Environmental Consequences of Fisheries Activities. Section 2 Alternatives is presented as a summary of Section 4.0. The Council concluded this meets the NEPA regulatory requirements.

Management measures (proposed actions) are intended to address the management objectives and issues discussed in Section 1.0. Each management measure has a number of alternatives that have been considered by the Council. The table on page 14 summarizes the alternatives and how they address the problems/issues identified by the Council. Management alternatives are presented in the rows and issues/problems in the columns.

Proposed management options are presented below. A complete listing of the proposed measures currently being considered by the Council begins on the next page.

Option 1. Traditional Fishery Management Program Plus Controlled Access. Traditional fisheries management includes measures to provide biological protection to the resource (escape gap in traps and no retention of female crabs); regulate gear (define allowable gear, degradable panel, tending requirements, gear identification, and maximum trap size by zone); provide for law enforcement (depth limitations and prohibit possession of whole or fillets of snapper grouper species); determine the number of participants (vessel and dealer/processor permits); collect the necessary data (vessel/fishermen and dealer/processor reporting); and a framework procedure to adjust the management program (framework adjustments and adjustments to activities authorized by the Secretary of Commerce). Use of these traditional management techniques in other fishery management plans has not solved all fisheries management problems. At best, the fishery resource, in this case golden crab, would be biologically protected. Ignored or even exacerbated are underlying social and economic problems resulting from open access fisheries. These include excess capacity, inefficiency which increases fishing costs, low conservation and compliance incentives, conflicts, high regulatory costs and low marketing incentives (see Section 1.1. Issues/Problems for more detail). To solve these social and economic problems, managers have increasingly turned to various forms of controlled access or effort limitation. Limiting the number of vessels and area fished is proposed for the golden crab fishery. Combining the more traditional fisheries management measures with controlled access best allows the Council to solve problems present in the golden crab fishery.

Specifically, Option 1 includes the actions shown below:

ACTION 1. Management Unit.

The management unit is the population of golden crab occurring within the South Atlantic Council's area of jurisdiction along the U.S. Atlantic coast from the east coast of Florida, including the Atlantic side of the Keys, to the North Carolina/Virginia border. Red crab and Jonah crab are included in the fishery but not in the management unit because regulations in this plan only address golden crab at this time. Although all three species of crab are also harvested in the Gulf of Mexico and Mid-Atlantic/New England waters, the Council concluded the populations are sufficiently separated from one another to be managed separately.

ACTION 2. Optimum Yield.

Optimum yield (OY) is all golden crab that are harvested legally under the provisions of the golden crab fishery management plan which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels, minimize the cost of fishing, produce a stable level of landings that would maximize returns to fishermen, provide for a stable supply, and minimize management costs.

ACTION 3. Overfishing Definition.

Overfishing is defined as any rate of fishing mortality in excess of F_{msy} for golden crab in the South Atlantic Council's management area.

ACTION 4. Modify crustacean trap definition.

Modify the crustacean trap definition contained in regulations implementing the snapper grouper fishery management plan by adding golden crab. The revised wording is as follows: Crustacean trap means a type of trap historically used in the directed fishery for blue crab, stone crab, golden crab (including Jonah and red crab), or spiny lobster and that contains at any time not more than 25 percent, by number, of fish other than blue crab, stone crab, golden crab (including Jonah and red crab), and spiny lobster. Action 7 specifies traps as the only allowable gear in the directed golden crab fishery and includes a provision for non-conforming gear and experimental gear. Section 3.5.2 Commercial Fishery contains a description of traps used historically in the golden crab fishery.

ACTION 5. Escape gap.

Require at least two escape gaps in each golden crab trap, require they be located on opposite vertical sides of golden crab traps, and require the inside measurement of the escape gap be no smaller than 2 and 3/4 inches by 3 and 3/4 inches. If a ring is used, the inside diameter must not be less than 4 and 1/2 inches.

ACTION 6. No retention of females.

Require that all females be released immediately in a manner most likely to ensure survival; no retention of females will be allowed However, recognizing the need for a small tolerance for human error, the Council is specifying a limit on retention of females up to 0.5% by number but sale of female golden crabs is prohibited.

ACTION 7. Allowable gear, non-conforming gear, experimental gear, and requirement that crabs be landed whole.

Allowable Gear. Specify traps as the only gear allowable in the directed golden crab fishery. Rope is the only allowable gear for mainlines in the golden crab fishery, however, cable mainlines and buoy lines will be allowed in the golden crab fishery for 18 months after publication of the final rule to allow for an evaluation and transition period.

Non-Conforming Gear. Vessels using non-conforming gear will be allowed zero retention of golden crabs.

Experimental Gear. The NMFS Southeast Regional Director may issue permits for experimental gear on provided that a process is implemented to collect data on the use of the particular gear concurrently with issuance of the permit. It is the Council's intent to allow sale of the catch from experimental gear. The data collected would be reviewed by the assessment group as soon as possible after the gear has been in use for 12 months or some other specified period of time. The Council would review the data and the group's report and determine whether the gear should be allowed. Any changes would be made by plan amendment. (Note: this procedure tracks regulations implementing Snapper Grouper Amendment 7.)

Landed Whole. Require that all golden crabs be landed whole.

ACTION 8. Escape panel (degradable).

Require an escape panel or door on at least one of the vertical sides with an opening or area of at least 12" by 12". The hinges or fasteners of each panel or door must be made of one of the following degradable materials:

A. Ungalvanized or uncoated wire no larger than 19 gauge or 0.041 inches diameter.
B. Untreated cotton 3/16-inch diameter or smaller.
C. Traps made of webbing must have at least a 1-foot slit relaced with untreated cotton of 3/16-inch diameter or smaller.

ACTION 9. Tending traps.

Require that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. If buoys are used, the permit number or other assigned number must be marked on the buoy. It is the Council's intent that fishermen be allowed to identity traps and buoys in the manner they feel is most appropriate and cost effective and that the numbering system be as few digits as possible in order to minimize costs/impacts on fishermen.

ACTION 10. Gear identification.

Require that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. If buoys are used, the permit number should be marked on the buoy. It is the Council's intent that fishermen be allowed to identity traps and buoys in the manner they feel is most appropriate and cost effective.

ACTION 11. Maximum trap size.

Specify a maximum trap volume size of 64 cubic feet in the northern zone and 48 cubic feet in the middle and southern zones. (Note: See Action 19 for a description of the zones.)

ACTION 12. Depth limitations.

In the northern zone golden crab traps can only be deployed in waters deeper than 900 feet; in the middle and southern zones traps can only be deployed in waters deeper than 700 feet. (Note: See Action 19 for a description of the zones.)

ACTION 13. Possession of snapper grouper species.

Prohibit possession of whole or gutted fish or fillets of species in the snapper grouper management unit while fishing for, or possessing, golden crabs.

ACTION 14. Vessel permit.

For a person aboard a fishing vessel to fish for golden crab in the exclusive economic zone (EEZ), possess golden crab in or from the EEZ, off-load golden crab from the EEZ, or sell golden crab in or from the EEZ, a vessel permit for golden crab must be issued to the vessel and be on board.

A fee will be charged to cover the administrative costs of issuing federal vessel permits. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

ACTION 15. Dealer permit.

A dealer who receives golden crab must obtain an annual dealer permit for golden crab. To be eligible for such permit, an applicant must have a valid state wholesaler's license in the state where he or she operates and must have a physical facility for the receipt of fish/shellfish at a fixed location in that state.

A fee will be charged to cover the administrative costs of issuing federal dealer permits. To purchase golden crab harvested in the exclusive economic zone (EEZ) from a fisherman, a person or business (including a restaurant) must have a federal dealer permit. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers, and Federally permitted dealers may only purchase golden crab from

Federally permitted fishermen. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

ACTION 16. Vessel/fishermen reporting.

The owner or operator of a vessel for which a permit for golden crab has been issued must maintain a daily logbook form for each fishing trip on a form available from the NMFS Science and Research Director. Among other things, the logbook forms provide a record of fishing locations, time fished, fishing gear used, and numbers of each bycatch species discarded. The forms should also provide for the recording of economic data such as variable costs and prices paid. Logbook forms must be submitted to the NMFS Science and Research Director postmarked not later than the 30th day after sale of the golden crabs off-loaded from a trip. If no fishing occurred during a month, a report so stating must be submitted in accordance with instructions provided with the forms.

If selected, the owner or operator of a vessel must provide data and must comply with any requirements regarding landing golden crab and any associated bycatch. The Council is specifying 100% logbook coverage given the severe lack of data and extreme importance of this data. Also, if selected, the owner or operator of a vessel must make their catch available for biological sampling and if required, must carry an observer.

ACTION 17. Dealer reporting.

A dealer who has been issued an annual dealer permit for golden crab must, if selected by the NMFS Science and Research Director, provide information on receipts of such crab and prices paid, to the NMFS Science and Research Director through existing state/federal cooperative agreements at monthly intervals, or more frequently if requested. Additional information must be provided as requested by the NMFS Science and Research Director. The NMFS Science and Research Director is not expected to select dealers in states where satisfactory data are being provided through existing cooperative agreements.

ACTION 18. Mechanism for Determination of Framework Adjustments.

Establish an assessment group and procedure for adjustments including in-season adjustments:

1. The Council will appoint an assessment panel (Panel) that will assess the condition of golden crab (including periodic economic and sociological assessments as needed) on an annually planned basis. The panel will present a report of its assessment and recommendations to the Council.
2. The Council may take action based on the assessment panel report or may take action based on issues/problems/information that surface separate from the assessment group. The steps are as follows:

A. Assessment panel report — The Council will consider the report and recommendations of the Panel and hold public hearings at a time and place of the Council's choosing to discuss the Panel's report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

B. Information separate from assessment panel report — The Council will consider information that surfaces separate from the assessment panel. Council staff will compile the information and analyze the impacts of likely alternatives to address the particular situation. The Council staff report will be presented to the Council. A public hearing will be held at the time and place where the Council considers the Council staff report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to review the staff report and provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

3. If changes are needed in the maximum sustainable yield (MSY), total allowable catch (TAC), quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year, the Council will advise the Regional Director in writing of their recommendations accompanied by the Panel's or Staff's report, relevant background material, draft regulations, regulatory impact review, social impact review, and public comments. This report will be submitted at least 60 days prior to the desired effective date of regulations.

4. The Regional Director will review the Council's recommendations, supporting rationale, public comments, and other relevant information. If the Regional Director concurs that the Council's recommendations are consistent with the goals and objectives of the fishery management plan, the national standards, and other applicable law, the Regional Director will recommend that the Secretary publish proposed and final rules in the Federal Register of any changes. The public comment period on the proposed rule will be not less than 15 days.
5. Should the Regional Director reject the recommendations, he will provide written reasons to the Council for the rejection, and existing regulations will remain in effect until the issue is resolved.
6. Appropriate adjustments that may be implemented by the Secretary by proposed and final rules in the Federal Register are:

A. Initial specification of MSY and subsequent adjustment of the best estimate of MSY when this information is available.
B. Initial specification of acceptable biological catch (ABC) and subsequent adjustment of the ABC range and/or best estimate when and where this information is available.
C. Setting TAC.
D. Modifying (or implementing) TAC, quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year.
E. The fishing year (calendar year) may not be adjusted by more than two months.
F. Authority is granted to the Regional Director to close the fishery once a quota has been established through the procedure described above and such quota has been reached or projected to be reached. Authority is also granted to reopen a fishery once a new fishing year begins. When such action is necessary, the Regional Director will recommend that the Secretary publish a notice in the Federal Register as soon as possible.
G. Requiring onboard observers.

ACTION 19. Controlled access program.

A. Zones. Because all catches occur in the exclusive economic zone (EEZ) (golden crabs are not harvested in state waters), the following zones are established from the seaward boundary of the EEZ to shore (Figure 2):

(1) Northern zone - north of the 28°N. latitude to the North Carolina/Virginia border;
(2) Middle zone - 28°N. latitude to 25°N. latitude; and
(3) Southern zone - south of 25°N. latitude to the border between the South Atlantic and Gulf of Mexico Fishery Management Councils.

B. Initial Eligibility. To be eligible for a permit, golden crabs must have been harvested within the South Atlantic Council's area of jurisdiction. For vessels which qualify, the applicant must indicate which zone the vessel will fish within, and fishing for golden crab will only be allowed within that zone. Initial eligibility is limited to owners of boats/vessels that meet the following two criteria:

(1) Catches equal to or greater than 600 pounds (whole live weight) by April 7, 1995 (control date); or
(2) Total catches (including pre-April 7, 1995 catches) equal to or greater than 2,500 pounds (whole live weight) by September 1, 1995.

C. Appeals. The Council will establish an ad hoc committee (comprised of Council members) to assist the NMFS Southeast Regional Director (by providing individual recommendations) in handling disputes over eligibility. Any appeal must be submitted within 30 days after the permit is rejected by NMFS. All appeals must be accompanied by written documentation and individuals will be allowed to testify before the appeals ad hoc committee. The appeals ad hoc committee will only meet once. The charge to the appeals ad hoc committee is to make sure the criteria pertaining to eligibility were applied to an individual's application in a correct manner.

D. Permits. Applications for permits must be made within 30 days after publication of the final rule in the Federal Register. Permits are to be implemented 90 days after implementation of the final rule. It is the Council's intent that the permit year be the 12 month period following issuance of the permits. Permits will

be issued to the vessel. The possession of golden crab aboard a vessel within a zone for which you do not have a permit is prohibited except that vessels may transit zones provided they do not stop to fish and they notify the NMFS Office of Law Enforcement of the pending transit. It is the Council's intent that a message left on a NMFS Law Enforcement answering machine constitute notice.

The Council retains the right to issue additional permits depending on the status of the resource. Adding permits should dilute the value of existing permits. Any changes to the number of permits will be by plan amendment.

E. Transferability. Permits are transferable within a zone or to the northern zone. To permit a new vessel or enter the fishery, the owner of the new vessel must acquire a permit or permits for vessels currently in the fishery equal to at least 90% of the length of the new vessel (length to be determined from documentation or state registration information).

F. Renewals. Permits may be renewed if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that owner's vessel(s) during one out of the two previous years. It is anticipated that permits will be issued in April 1996. The first time permits may be renewed will be April 1997 and the two years under consideration will be retroactively to April'95-March'96 and the first permit year of April'96-March'97.

G. Assignment of Initial Permits. The initial assignment of permits will be to vessel owners.

H. Tracking/Monitoring Permit Transfers. Tracking transfers of permits will be done by requiring the buyer and seller to sign and date the appropriate lines on the reverse side of the permits that transfer. Fees to cover the administrative costs of processing transfers will be charged.

I. Increasing Enforceability. Because the benefits obtained from controlled access depend, in large measure, on regulatory compliance by fishermen, the Council maintains that gross violations (such as failure to report; fishing traps without escape gaps, identification numbers, or biodegradable panels; retaining female crabs in excess of the tolerance specified; and fishing in an unauthorized zone) warrant strict penalties such as permit sanctions. The Council's intent is that fishermen submit logbooks by the 30th day after sale. It is not the Council's intent that strict penalties such as permit sanctions be applied if the logbook reports are late once or twice. However, it is the Council's intent that repeated lateness warrant strict penalties. It is also the Council's intent that fishermen not be allowed to supply missing logbook reports at the time of permit renewal.

Option 2. Traditional Fishery Management Program. Use of a traditional approach to management of this fishery (described above in Action 1-18) would address the biological problems but would not address the social and economic problems.

Option 2 would include Actions 1 through 18 as listed above. Controlled access (Action 19) would not be included and is the measure that would address the social and economic problems. Without such a measure, these problems would continue and would probably become worse. The Council concluded that such an approach is not in the best, long-term interest of the fishermen, processors, consumers, and the public and rejected such an approach. This approach would not achieve optimum yield due to the continued social and economic problems.

Option 3. No Action. Without protection, the golden crab resource would be overfished resulting in social and economic losses and displacement to participants in the fishery. Consumers would also lose long-term benefits which would result from a sustained fishery. The Council rejected taking no action because it would result in overfishing and large negative impacts on the fishermen, processors, consumers, and the public. This approach would not achieve optimum yield due to the resource being overfished and landings/revenue being below levels available if the resource were not overfished.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES
(Effects of Alternatives on the Issues/Problems)

ALTERNATIVE MANAGEMENT PROGRAMS: ISSUES/PROBLEMS

Alternatives	Biological Problems	Socioeconomic Problems	Enforcement & Compliance Problems
Proposed Action: Traditional Fishery Management Plus Controlled Access	Provides basic biological protection. Prevents overfishing.	Addresses social and economic problems. Promotes stability and facilitates long-range planning.	Promotes voluntary compliance. Creates incentives for conservation and regulatory compliance.
Traditional Fishery Management	Provides basic biological protection. Prevents overfishing.	Would not address social and economic problems. Would not promote stability.	Does not create incentives for conservation and regulatory compliance. Requires higher level of enforcement.
No Action	Results in biological overfishing	Results in social and economic disruption and long-term losses. Overcapitalization and market inefficiencies would result.	No regulations to be enforced.

3.0 AFFECTED ENVIRONMENT

The following information contains a description of the existing environment for the golden crab fishery and resource in the South Atlantic Region.

3.1 Description of the Stock Comprising the Management Unit and the Fishery

3.1.1 Description of the Species and Distribution

The following text is from Erdman (1990):

"The golden crab, *Chaceon fenneri*, is a large gold or buff colored species inhabiting the continental slope of Bermuda (Luckhurst, 1986; Manning and Holthuis, 1986) and the southeastern United States from off Chesapeake Bay (Schroeder, 1959), south through the Straits of Florida and into the eastern Gulf of Mexico (Manning and Holthuis, 1984, 1986; Otwell et al., 1984; Wenner et al., 1987).

Prior to its description, previous records referred to this species as either the red crab *C. quinquedens* or the similar gold colored *C. affinis*, which is endemic to the northeast Atlantic Ocean (National Marine Fisheries Service, 1986; Manning and Holthuis, 1984). Its recognition as a new species was a direct result of exploratory fishing in the eastern Gulf of Mexico in hopes of establishing a new deep-sea crab fishery in this area (Otwell et al., 1984).

Reported depth distributions of *C. fenneri* range from 205 m off the Dry Tortugas (Manning and Holthuis, 1984) to 1007 m off Bermuda (Manning and Holthuis, 1986). Size of males examined range from 34 to 139 mm carapace length (CL) and females range from 39 to 118 mm CL. Ovigerous females have been reported during September, October and November, and range in size from 91 to 118 mm CL (Manning and Holthuis, 1984, 1986)."

3.1.2 Growth

3.1.2.1 Size and Weight Relationships

The following text, Table 3 and Figures 4-6 are from Erdman (1990):

"Throughout the sampling period, the catch of male crabs greatly outnumbered that of females. Cumulative size frequency distributions of 508 males and 347 female *C. fenneri* examined (Figure 4) indicate a unimodal distribution for each sex with no suggestion of distinct year classes. Males are considerably larger than females, with overlap between the largest females and smallest males. Carapace widths of male crabs ranged from 111 to 190 mm with a mean CW of 158 mm, while females ranged from 89 to 156 mm CW with a mean CW of 123 mm. Animals smaller than 89 mm CW were not collected, possibly due to bias associated with trap design and the presence of escape rings. Fishing depths also precluded analysis of segregation by size with sex and depth as has been reported for other *Chaceon* species (see Beyers and Wilke, 1980; Gerrior, 1981; Intes and Le Loueff, 1976; Haefner, 1978 and Wenner et al., 1987). Monthly size frequency distributions of male *C. fenneri* are shown in Figure 5. Monthly mean carapace widths ranged between 152 and 162 mm; however, the incidence of smaller males decreased beginning in July 1986, coincidental with the fitting of escape rings in all traps. Although the present data

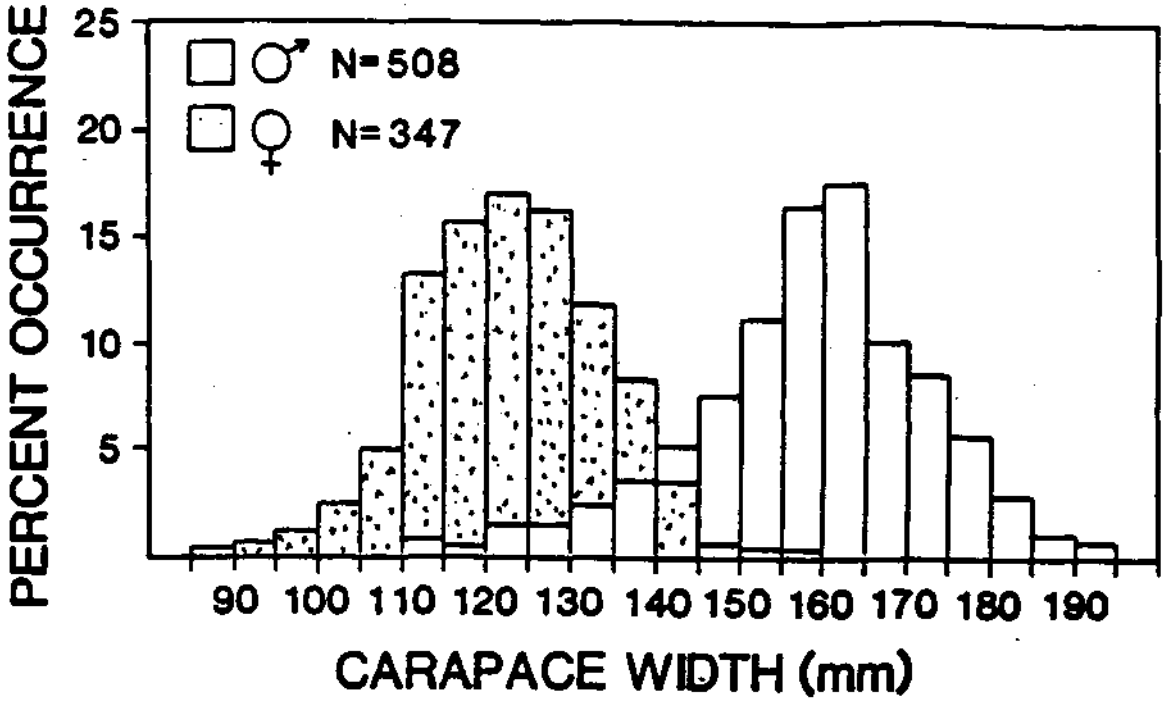

Figure 4. Cumulative size frequency distribution of male and female Chaceon fenneri collected during the period of February, 1986 through January, 1987 from southeast Florida. N represents the number of individuals examined.

Table 3. Linear and geometric mean (GM) functional regression equations of carapace length (CL) and weight (WT) on carapace width (CW) for male and female Chaceon fenneri. Size units are in mm and weight units are in gm. All linear regression equations are significant at $p<0.05$.

Linear equation	N	R^2	GM equation
Males			
CL = -5.99 + 0.81CW	262	0.89	CL = -14.30 + 0.92CW
WT = -2132.45 + 20.64CW	262	0.87	WT = -2369.34 + 22.15CW
Females			
CL = -4.28 + 0.86CW	193	0.88	CL = -13.19 - 0.93CW
WT = -790.63 + 9.92CW	136	0.87	WT = -877.09 - 10.62CW
Combined sexes			
CL = -5.19 + 0.86CW	455	0.95	CL = -8.61 + 0.88CW

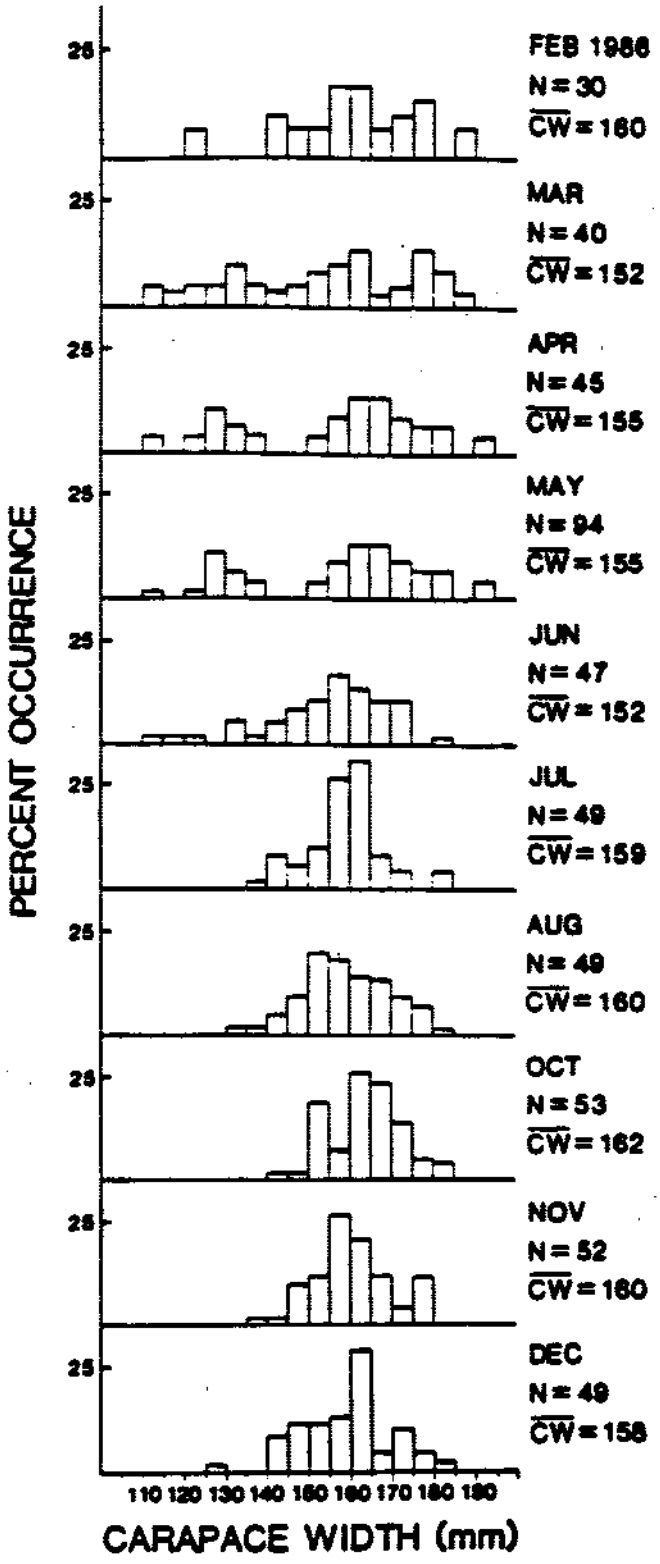

Figure 5. Monthly size frequency distributions of male Chaceon fenneri from southeast Florida.

set precludes statistical analysis of the effect of escape rings, the absence of smaller males and females in the overall catch was apparent following installation of escape rings in all traps. This suggests that smaller individuals may exit the trap once all bait is consumed.

Morphometric relationships for CL vs. CW were based on 262 males and 193 females. Linear and GM functional regression equations for each sex are shown in Table 3. ANCOVA indicated no significant differences between male and female CL vs. CW equations ($p<0.05$), therefore linear and GM functional regression equations of CL vs. CW were calculated for both sexes combined (Table 3).

The weight frequency distribution of 262 males and 136 non-ovigerous females is shown in Figure 6. Weight of male crabs greatly exceeded that of females, ranging from 280 to 1930 g, with a mean weight of 1116 g. Mean weight of females was 449 g, ranging from 207 to 800 g. Although weights of both sexes show a unimodal distribution, the greater incidence of females in a narrower range of weight classes is due to the variation in body weight associated with the various phases of oogenesis. Because of obvious size differences between sexes, WT vs. CW relationships were calculated separately for each sex and are shown in Table 3."

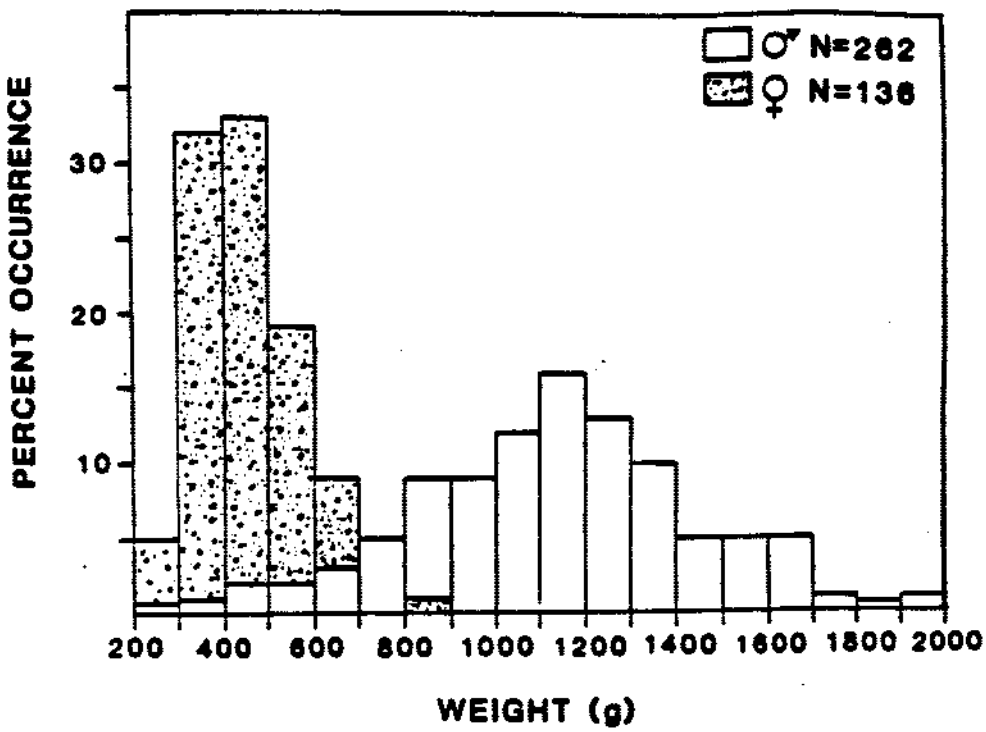

Figure 6. Cumulative weight frequency distribution of male and female Chaceon fenneri collected during the period of February, 1986 through January, 1987 from southeast Florida. N represents the number of individuals examined.

Information from the South Atlantic Bight (text, Figure 2 and Table 4 from: Wenner et al., 1987) indicated that:

"The 3,217 golden crabs which were measured ranged from 85 to 193 mm in carapace width and weighted from 100 to 2,109 g. Average weight of male golden crab collected during the study was 927 g (s = 373.448, n = 1,640) while average weight of females was 443 g (s = 289.385, n = 86). Carapace width-frequency distribution for *G. fenneri* gave modes at 155 mm for males and 100 mm for females (Fig. 2). The largest crab collected measured 193 mm and weighed 2,091 g.

Linear least-squares and functional regression equations (Ricker 1973; Sokal and Rohlf 1983) relating carapace length and live wet body weight with width are in Table 4. Width-weight relationships were calculated from data on individuals that were not missing appendages.

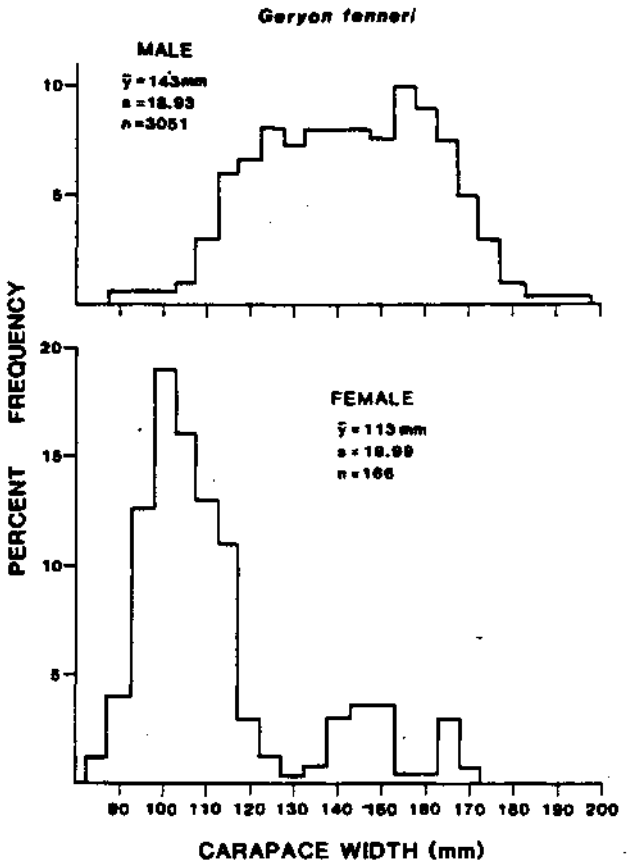

FIGURE 2.—Width-frequency distributions of male and female *Geryon fenneri* caught in traps. ȳ = mean; s = standard deviation; n = number of individuals.

TABLE 4.—Least-square linear and geometric mean functional regression equations of carapace length (CL) and live body weight (WT) on carapace width (CW) for each sex of *Geryon fenneri*. Length and width units are millimeters while weight units are kilograms. All least square regressions were significant at $\alpha = 0.05$.

Sex	Least squares equation	*n*	r^2	GM functional equation
Male	CL = −9.5 + 0.9 CW	3,042	0.95	CL = −11.9 + 0.9 CW
	$\log_{10}$ WT = −4.74 + 3.54 ($\log_{10}$ CW)	1,453	0.94	$\log_{10}$ WT = −4.99 + 3.66 ($\log_{10}$ CW)
Female	CL = 4.0 + 0.8 CW	141	0.92	CL = 0.7 + 0.8 CW
	$\log_{10}$ WT = −3.97 + 3.14 ($\log_{10}$ CW)	74	0.91	$\log_{10}$ WT = −4.27 + 3.29 ($\log_{10}$ CW)

3.1.2.2 Molting

The following text and Figure 7 are from Erdman (1990):

"No discernible molting pattern was observed for male *C. fenneri*. Fewer than 3% of the 508 crabs examined were observed in the immediate premolt stage (SO), while less than 10% showed the clean bright gold carapace indicative of recent molting. Although asynchronous molting is possible, meat of butchered males shows a watery texture during March and April that suggests physiological changes occurring prior to the onset of molting (R. Nielsen, commercial fishermen, pers. comm.). No changes in external carapace condition were noted during this period.

Conversely, female crabs showed two period of molting activity. During August and October, 1986, 33% of females examined were in the immediate premolt stage (SO) (Figure 7). Premolt females ranged in size from 89 to 118 mm CW. Females in the immediate post-molt stage (SN) and early intermolt stage (HN) were collected during October through December. Size ranges of recently molted females was between 110 and 139 mm.

Additional molting activity was also observed during January 1987, when 17% of females observed were in the premolt stage. Carapace widths of premolt females was between 103 and 123 mm CW. This molt period was not as pronounced as that observed during late summer and early fall. However, recently molted females (stage HN) were present in the catch during the period of March through May 1986, suggesting that these animals may have molted during the pervious late winter or early spring."

Information from the South Atlantic Bight (Wenner et al., 1987) indicated that:

"Most (80%) of the 3,183 male and female *G. fenneri* were in the intermolt stage. Less than 1% of the 3,041 male golden crab showed evidence of having recently molted. The incidence of imminent or recently molted female golden crab was higher that that observed for males, with four individuals classified as premolt (soft-old) and two in the newly molted (soft-new) condition.

Most (95%) of the 3,183 *G. fenneri* examined for molt condition had blackened abraded areas on the exoskeleton, indicative of damage by chitinolytic bacteria. Exoskeleton damage was most prevalent on individuals in the intermolt (75%) and premolt (19%) condition."

3.1.2.3 Growth

The following text is from Erdman (1990):

"Although the data collected during this study was insufficient for the analysis of growth patterns of *C. fenneri*, a discussion of growth in deep-sea crustaceans is warranted due to the important biological and fishery implications. Growth is generally expressed as an increase with time in length, volume or weight (von Bertalanffy, 1938). In crustaceans, growth is discontinuous and involves a series of molts (ecdyses) during which the rigid exoskeleton is shed and replaced by a new and larger one. However, this loss of integument results in the loss of all calcified structures thereby preventing the analysis of annual rings in persistent structures such as the shells of mollusks and the otoliths of fish. A second complication is that

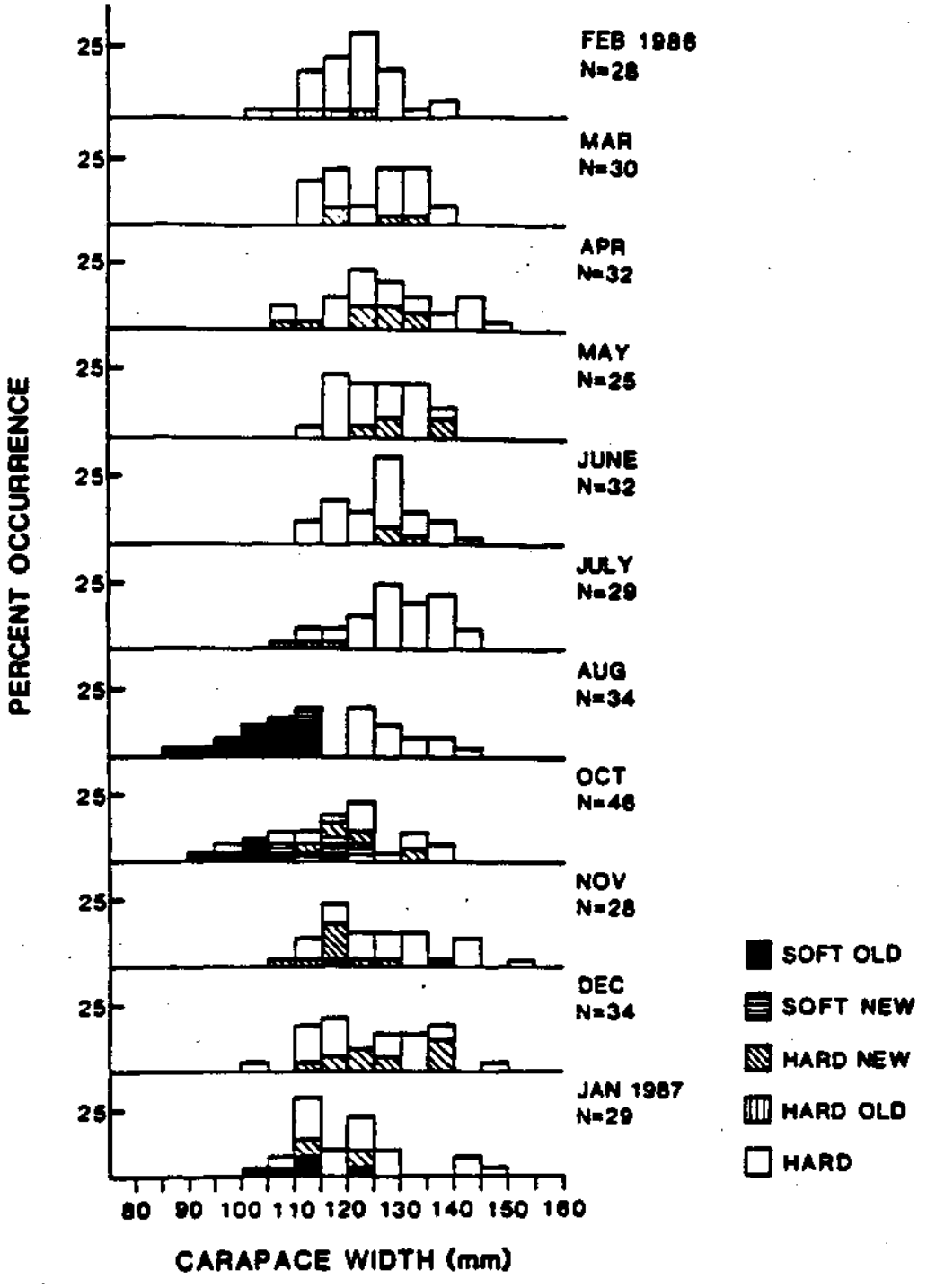

Figure 7. Monthly size frequency distributions of female Chaceon fenneri showing molt stages. Key to each stage is given in the figure. N represents the number of individuals examined.

many types of tags are lost during molting, thus tag and recapture studies must be planned and executed accordingly (Hartnoll, 1982).

The examination of growth in crustaceans encompasses the analysis of two major components; the molt increment or increase in size at each molt, and the intermolt period or time between successive molts. With increased size, the molt increment usually decreases and the intermolt period commonly increases (Kurata, 1962; Hartnoll, 1982). However, between sexes, females generally show a more drastic change in the growth format at the onset of sexual maturity. This is usually attributed to the energetic cost of reproduction and the accompanying period of egg brooding (Hartnoll, 1985).

Besides changes associated with size, sex and maturity, environmental factors such as temperature, light and food supply have also been shown to affect the growth format of crustaceans (Hartnoll, 1982). The majority of growth studies have been conducted under laboratory conditions where these determinants have been selectively controlled which further complicates analysis of actual growth in natural populations (Kurata, 1962). Studies of the later type are few in number and are limited to tag and recapture studies of species where commercial fisheries provide significant returns (Haefner, 1985).

Growth in deep-sea crustaceans is generally quite slow (Childress and Price, 1978; Roer et al., 1985). This is not surprising when one considers the low metabolic rates of deep-sea organisms as compared to those of species living elsewhere (Smith and Teal, 1973; Torres et al., 1979). The low rate of metabolic processes have been proposed as an adaptive response to the decrease in biomass and food supply that are characteristic of increased depth (Rowe, 1983). In particular, slow growth in deep-sea crustaceans may be attributed to a decrease in the molt increment, and increase in the intermolt period, or a combination of both (Roer et al., 1985).

Melville-Smith (1989) has developed a growth model for male *C. maritae* which indicates that growth in that species is extremely slow. The model is based on growth data from juvenile *C. quinquedens* (Van Heukelem et al., 1983), and tag and recapture data of adult *C. maritae* greater than 50 mm CW collected from the commercial fishery off South West Africa/Manibia. In general, smaller males (50-100 mm CW) showed an intermolt period of between 0.5-2.0 years, while larger males (100-150 mm CW) exhibited intermolt periods of between 3-5 years. The model also predicts age from the growth data and suggest that male *C. maritae* of 165 mm CW may be over 25 years old.

The low numbers of premolt and post-molt *C. fenneri* observed in this study also suggests that growth in this species is quite slow. Females showed a greater incidence of molting activity than males, but total numbers of both sexes in the SO, SN and HN stages comprised less than 12 percent of all individuals examined. Although *C. fenneri* reaches a greater maximum size than the majority of Geryoniadae, the growth model developed for *C. maritae* may be applied in general terms. As the present minimum size of male *C. fenneri* harvested by the commercial fishery is 130 mm CW, the model suggests that animals of this size enter the fishery in their sixteenth year. Larger males exceeding 170 mm CW may well be over 30 years of age."

3.1.3 Reproductive Biology

The following background is from Erdman (1990):

"Reproductive cycles of marine invertebrates may be classified as rhythmic or continuous. Rhythmic patterns, which may be weekly, monthly, annual or biennial, involve a distinct gametogenic cycle. This includes the production and release of gametes followed by a period of inactivity during which energy reserves accumulated and gonad tissue regenerates prior to the onset of the next successive cycle. Thus, most reproductively active individuals of a population will reproduce synchronously when environmental conditions are correct (Giese, 1959; Giese and Pearse, 1974). Precise timing requires that initiation and regulation of gonad development is in synchrony with changes in the external environment, leading to the production of new individuals during conditions which are most optimal for their survival (Sastry, 1975).

Continuous reproduction implies a successive series of gametogenic cycles by each individual. As there is no synchrony between individuals, the population appears to be reproducing continuously with the regulation of gonad development varying among each individual (Giese and Pearse, 1974).

The reproductive cycle is affected by exogenous factors such as temperature, photoperiod, salinity, and food supply. Temporal changes in these factors act as "zeitgebers" (triggers) that synchronize gametogenesis such that reproduction occurs under favorable conditions (Giese and Pearse, 1974). considering the environmental consistency of the deep sea, continuous reproduction patterns are expected (Thorson, 1950; Scheltema, 1972). This pattern had been reported in a variety of deep-sea invertebrates: branchiopods (Rokop, 1974), bivalve mollusks (Sanders and Hessler, 1969; Rokop, 1974), isopods (Sanders and Hessler, 1969; Rokop, 1977), amphipods (Rokop, 1977), decapods (Haefner, 1977; Tyler et al., 1985; Melville-Smith, 1987c), and ophiuroids (Rokop, 1974; Grant, 1985). In virtually all of these studies, the absence of seasonality has been proposed to be responsible for the continuous patterns observed.

Annual reproductive patterns in the deep sea have only been reported for a few species of bivalve mollusks (Lightfood et al., 1979), isopods (George and Menzies, 1967, 1968), decapods (Hartnoll and Rice, 1985) and ophiuroids (Schoener, 1968; Lightfood et al., 1979). However, the data presented have often been questionable (presence/absence of ovigerous females; George and Menzies, 1967, 1968) and the recognition of specific "zeitgebers" has proved to be quite difficult if not impossible.

Although continuous reproduction may predominate in the deep sea, comprehensive data on many deep-sea invertebrates remains scarce. Certain species may show annual patterns, yet it is obvious that the mode of development, evolutionary history, phylogenetic status and trophic dynamics of the species in question must be examined to ascertain the significance of this type of reproduction pattern in the deep sea."

Golden crab reproductive biology was also studied in the South Atlantic Bight by Wenner et al. (1987). Their results are also included in Sections 3.1.3.3 and 3.1.3.4.

3.1.3.1 Reproductive Cycle

The following text and Figures 12-14 are from Erdman (1990):

"The monthly incidence of ovigerous females examined indicates an annual reproductive cycle with a single batch of eggs produced each year (Figure 12). Oviposition begins in mid-August and continues through early October. Thirty-three percent of females collected in August were ovigerous and had spent/redeveloping ovaries, while 17% had mature ovaries prior to oviposition. In October, 29% were ovigerous with ovaries in either spent/redeveloping or early developmental stages, while 8% had mature ovaries (Figure 13).

Eggs are light purple or burgundy after oviposition, gradually becoming dark purple and purple=brown prior to hatching. They are carried from approximately six months after which larvae hatch during late February and March. Seven percent of females examined in February and 57% from March had egg remnants on the pleopods. Larvae were hatched from two ovigerous females held in the laboratory during early March, but larval culture was not successful.

Analysis of mean monthly oocyte diameter further illustrates the annual reproductive cycle of *C. fenneri* (Figure 14). The minimum oocyte diameter recorded in October coincided with the greatest incidence of ovigerous females with redeveloping and early stage ovaries. Mean monthly oocyte diameter gradually increased each month and reached a maximum during July, prior to the initiation of oviposition in August. Mean oocyte diameter of 188.2 μm recorded in August included both mature and spent/redeveloping ovaries."

The reproductive cycle of golden crab was studied in the eastern Gulf of Mexico by Hinsch (1988):

"...females of *Geryon fenneri* were ovigerous from September to March in this study. The presence of some females in early October without egg masses suggests that these had yet to oviposit their eggs, since most had mature purple oocytes within their ovaries. Other ovigerous females at the time had small cream yellow ovaries. The latter contain immature oocytes that have not initiated vitellogenesis and are indicative of ovaries that have recently been spawned. All females collected until February were ovigerous. During February and March, some females released larvae when collected and some contained empty egg cases attached to their pleopods. No female crabs collected during April and May possessed egg masses attached to their pleopods. The reproductive pattern seen in *G. fenneri* suggests that an annual spawning season exists each year.

Changes in the reproductive tract of the male golden crab *Geryon fenneri* paralleled those of the female. The males examined over the period of this study showed progressive changes in the large numbers of follicles containing primary spermatocytes in October-November to large numbers of follicles filled with mature sperm in February-March. The increase in the number of mature sperm in the testes was followed by an increase in the diameter of the regions of the vasa deferentia. This increase initially became apparent in the anterior portion, but ultimately included middle and posterior portions as well. Such changes from September through May suggested a seasonality of reproduction in males of *G. fenneri* as well."

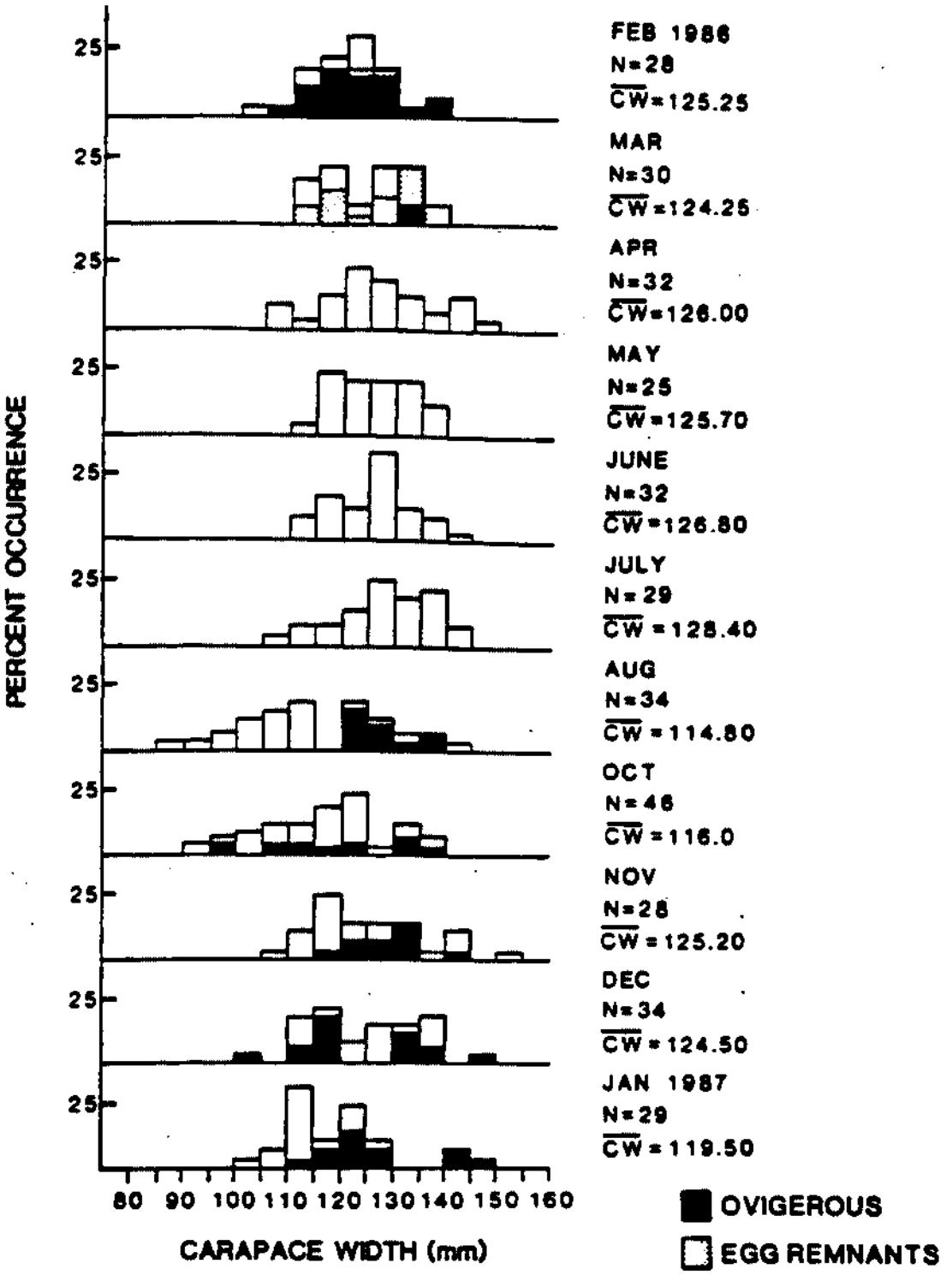

Figure 12. Monthly size frequency distributions of female Chaceon fenneri collected from southeast Florida, including number of individuals (N) and mean carapace width (CW).

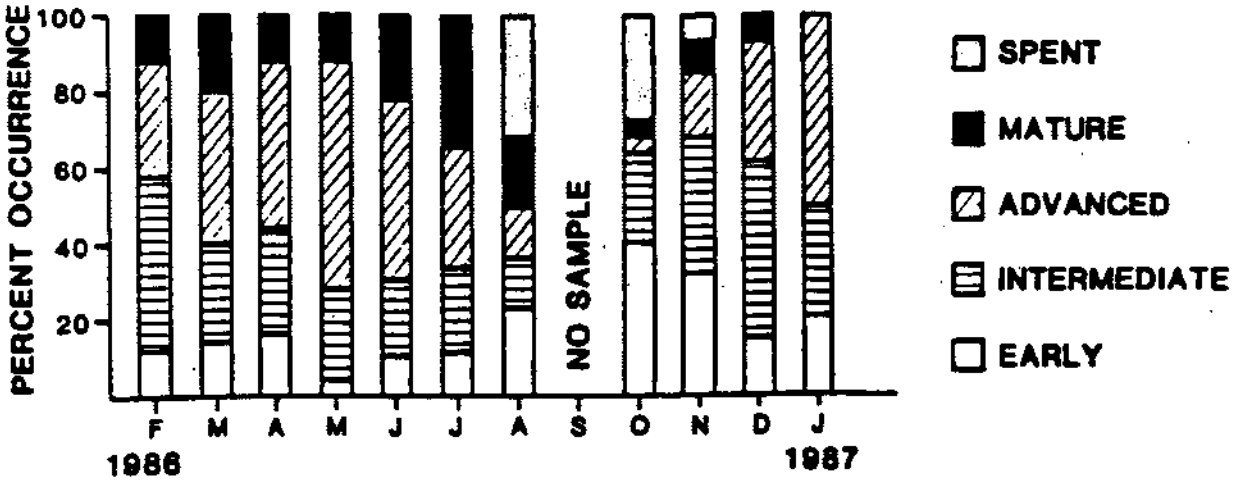

Figure 13. Monthly ovarian stages of Chaceon fenneri collected from southeast Florida. Key to ovarian stages is given in the figure.

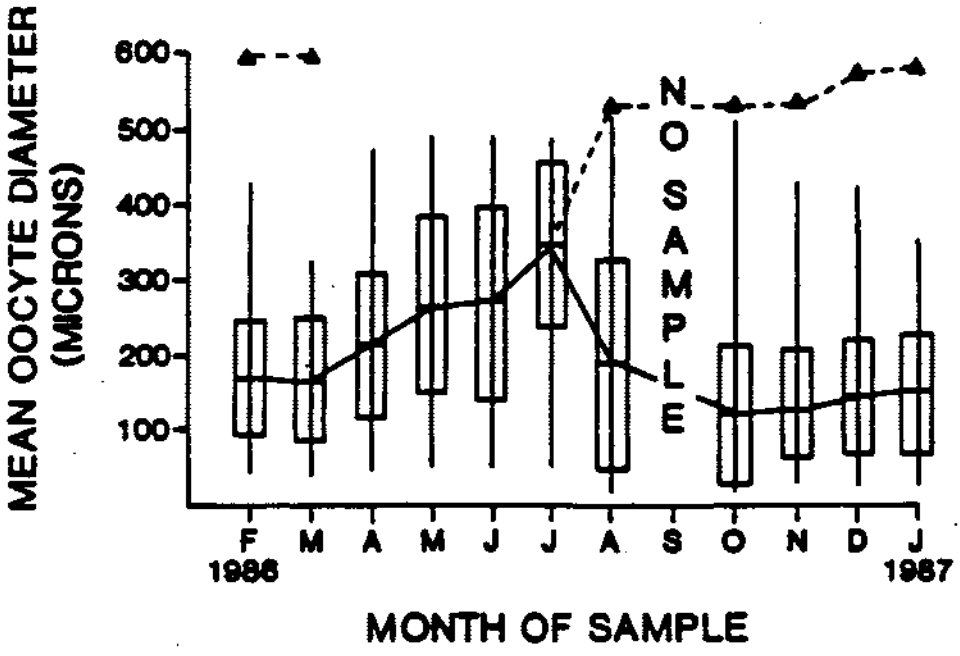

Figure 14. Mean oocyte diameter of Chaceon fenneri by month of sample including standard deviation and oocyte diameter size range. Triangles represent size of extruded eggs.

3.1.3.2 Fecundity

The following text and Figures 14 and 15 are from Erdman (1990):

"Mean egg diameter for *C. fenneri* is 540 µm at the time of oviposition. This increases with development to between 580 and 600 µm prior to hatching (Figure 14). Regression analysis of egg number on carapace width is shown in Figure 15. The number of eggs per female increased with increasing carapace width as described by:

Number of Eggs = 4,465.7 CW - 346,105 $r^2 = 0.64$

Thus, the number of eggs extruded is directly correlated with the size of the female. Egg number for the twelve females examined ranged from 131,000 through 347,000."

3.1.3.3 Size at Sexual Maturity

The following text and Figure 16 are from Erdman (1990):

"In addition to the onset of ovarian development and the presence of extruded eggs, other characteristics must also be considered in the assessment of size at sexual maturity in brachyurans. Following the pubertal molt, the abdomen and gonopores show changes that are generally accepted as external morphological indications of sexual maturity and subsequent mating (Hartnoll, 1969).

Chaceon fenneri exhibits the simple pattern of gonopores described by Hartnoll (1967), with three distinct types recognized. Type A gonopores which are narrow and slit-like are present on sexually immature animals. Type B gonopores which follow the pubertal molt are elongate and ovoid in shape, while type C is a modification of type B differing only in that the gonopore is more elongate and gaping as a result of mating during the immediate post-molt period. In addition, type C gonopores often exhibit a blackened margin due to abrasion by the male pleopods during mating.

Carapace width of the 347 females examined ranged from 89 to 156 mm. Eighty-five females were ovigerous (25%) and ranged in size from 97 to 147 mm CW (Figure 16). All ovigerous females examined exhibited type C gonopores (elongate and gaping) with 74% having blackened margins. Type C gonopores were also observed on non-ovigerous females ranging in size from 103 to 156 mm CW, with 60% of the females examined having sperm in the spermetheca. Thus type C gonopores appear indicative of sexual maturity and previous mating. However, non-ovigerous females with type C gonopores and empty spermetheca may have previously undergone mating and oviposition but have yet to molt and mate again.

Twenty-six females ranging in size from 89 to 118 mm CW were observed in the immediate pre-molt stages during August and October. All individuals examined had ovaries in the immature or early developmental stage and had type A gonopores. Recently molted females collected during the period of October through December exhibited signs of recent mating. Seventy-one percent of females ranging in size from 105 to 120 mm CW had type C gonopores. Seven females were examined for spermetheca contents and five had sperm present. The remaining 29% of recently molted females had type B gonopores and

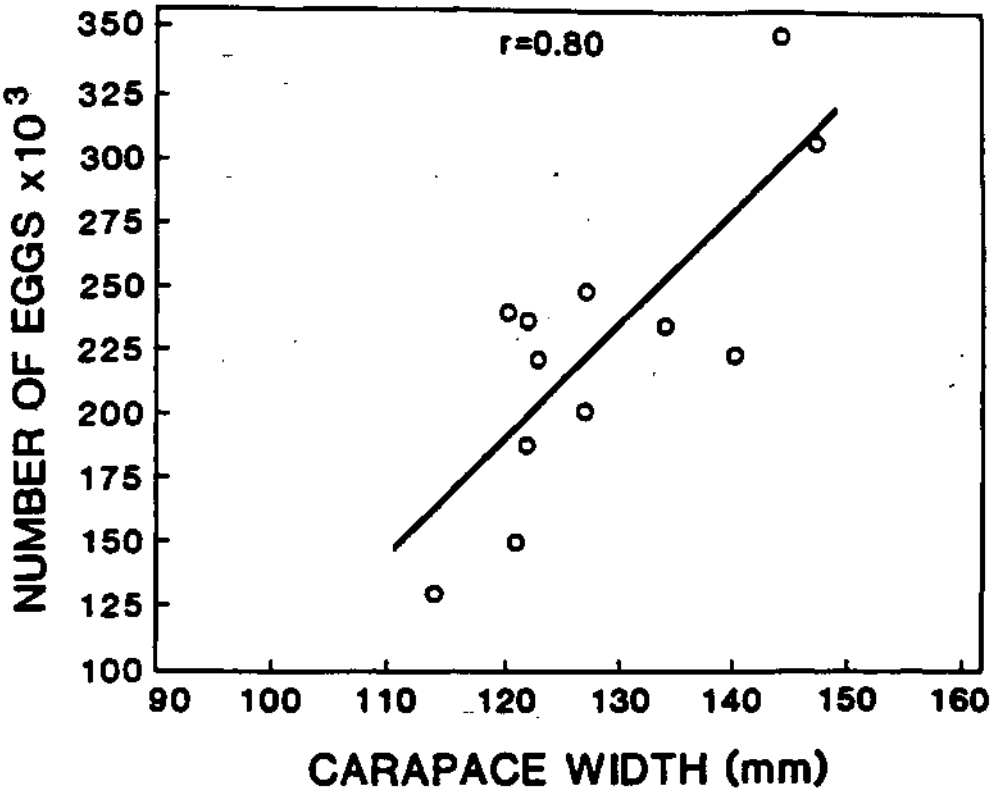

Figure 15. Relationship in Chaceon fenneri of brood size on carapace width as described by: number of eggs = 4,465.7CW - 346,105.

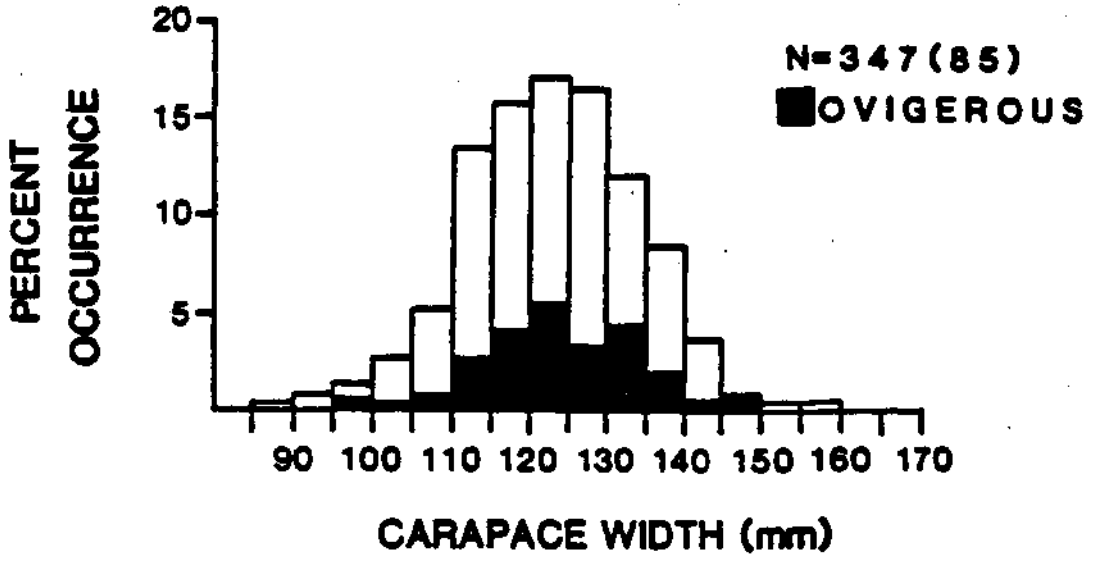

Figure 16. Cumulative size frequency distribution of 347 female Chaceon fenneri collected from southeast Florida. Solid areas indicate ovigerous females.

empty spermetheca. Ovaries from all recently molted crabs were either in the early or intermediate stage of development.

Considering the size ranges of ovigerous females, the stages of ovarian development, and changes in gonopore structure associated with the pubertal molt, size at sexual maturity of *C. fenneri* is between 85 and 100 mm CW."

Information for the South Atlantic Bight (Wenner et al., 1987) suggest that females may become sexually mature at 97 mm carapace width. In South Africa, the red crab matures at between 7 and 9 years old and 75 to 90 mm carapace width (Melville-Smith, 1987c).

3.1.3.4 Mating

Erdman (1990) observed mating behavior of golden crab held in captivity:

"Mating in Brachyuran crabs may occur immediately following ecdysis by the female (i.e., *Callinectes sapidus, Cancer magister, Mennippe mercenaria*) or may occur when the female is in the intermolt state (i.e. *Grapsus grapsus, Maja squinado, Pinnotheres maculatus*)(Hartnoll, 1969). Post-molt mating often encompasses complex behavior patterns that include a premolt cradle and post-molt embrace of the female by the male. The embrace is associated with copulation and continues until the female exoskeleton has sufficiently hardened for resumption of normal activities. Conversely, intermolt mating does not exhibit complex courtship patterns and is often of short duration. The contrast in mating patterns has been attributed to differences in gonopore structure (Hartnoll, 1969).

Mating following female ecdysis has been reported in two species of *Chaceon*: *C. longipes* (Mori and Rellini, 1982) and *C. quinquedens* (Elner et al., 1985); however, the mating pattern of *C. fenneri* remains unknown. Although the pattern of mating following molting might be expected to be present throughout the Geryonidae, intra-family differences have been noted in the Xanthidae and Majidae (Hartnoll, 1969).

The following observations are based on two separate episodes of molting and mating of *C. fenneri* held in captivity. Data of this nature when combined with field observations of population structure, reproduction and growth may provide additional insight to the life history of this slope dwelling species. Of particular importance may be the application of these observations to the low frequency of reproduction pattern proposed for *C. fenneri*.

Case 1

Precopulatory behavior was first noted on August 13, when the male formed a protective cage around the female with his walking legs. The male clasped the female by the carapace, dorsal side up, with the first pair of walking legs (2nd periopods). While carrying the female, the male continued to move about on the dactyls of the walking legs and feed at regular intervals. The female was not observed to feed during the premolt embrace. On September 9, the female molted with the male still forming a cage with his walking

legs. Unfortunately, the female was unable to back out of the old carapace; hence, mating was unsuccessful.

The soft shell female was dissected to observe the stage of ovarian development. The ovary was slightly swollen and cream in color, an indication of early development. This stage was confirmed through histological examination.

Case 2

On December 10, 1988, the largest male in the aquarium (180 mm CW) formed a cage around the premolt female with his walking legs. The female folded all appendages close to the carapace and was carried dorsal side up beneath the male. The male used the first pair of walking legs (2nd periopods) to grasp the female between the first set of her walking legs (periopods 2 and 3). This carrying behavior continued for 28 days until the female molted. During this period, the male continued to feed at regular intervals and on occasion offered food to the female; however, the female was not observed to feed prior to molting.

Molting began on January 7, 1989. Immediately prior to molting, the male released the female to the substrate and formed a protective cage around her with his walking legs. During this period, the male was observed to repel the two additional males present in the aquarium. The female remained motionless, dorsal side up until the suture at the posterior margin of the carapace was completely open. Typical brachuran molting followed with the female slowly backing out of the old exoskeleton. The male remained in the cage position but did not assist with molting.

Within two hours of the completion of ecdysis, the copulatory embrace began; the pair clasped sternum to sternum with the female inferior, ventral side up. The female was held off the substrate by the male walking legs as previously described. Mating occurred with the extended abdomens of both crabs overlapped and the first pair of male pleopods inserted into corresponding female gonopores.

Following molting and the onset of copulation, the mated pair moved away from the discarded exoskeleton. At this time, the smallest male in the aquarium was observed to cradle and attempt copulation with the discarded exuviae. This peculiar behavior continued for approximately two hours until the male released the exoskeleton; this exoskeleton was removed for remeasurement of premolt morphometrics.

This copulatory embrace continued until February 10, 1989, a duration of 34 days. During this period the male fed actively and was observed to offer food to the female on many occasions. The female was observed to feed on three occasions while still in the copulatory embrace. The male walking legs were not always used to carry the female; often the female was carried by the male pleopods which remained inserted in the gonopores.

The female broke free on February 10, 1989, when the new carapace had hardened sufficiently for increased locomotory activity. Upon examination, the new carapace was brittle and slightly flexible, and bright creamy gold in color. Carapace width was 139 mm, an increase of 13 mm. Gonopores were type 3 with prominent blackened margins from abrasion during copulation. Blackened discoloration was also

visible on the merus of the second periopods from abrasion by the male walking legs during the copulatory embrace.

Discussion

Mating of *C. fenneri* in the immediate post-molt stage conforms to one of the two basic Brachyuran mating patterns described by Hartnoll (1969). This pattern of long duration premolt and post-molt mate guarding has also been observed in *C. longipes* (Mori and Rellini, 1982) and *C. quinquedens* (Elner et al., 1985). This behavior has obvious survival benefits in that the soft-shell female is protected from potential predation during a period of great vulnerability. The long duration of the premolt embrace also suggest the presence of a pheromone released by the female to attract potential mate (Ryan, 1967).

Of greater significance is that the second female was sexually mature when collected. Thus, molting of this female which had shown signs of previous reproductive activity suggests multiple mature instars rather than a single mature instar (Melville-Smith, 1987c).

The ovarian condition and gonopore stage of the first molting female infers that if successful, this molt would be the pubertal molt associated with the onset of sexual maturity. The 91 mm premolt carapace width of this individual was well within the proposed carapace width range of 85-100 mm that is the size at sexual maturity in this species. As molting occurred in early September, a period when oviposition occurs in reproductively active females, this individual would be expected to undergo oviposition the following fall. This suggests that sperm may remain viable for up to 12 months in this species. Delayed oviposition following mating has also been reported for *C. quinquedens* (Elner et al., 1985).

The second female was sexually mature when collected and the presence of blackened type 3 gonopores is indicative of pervious mating activity. Of greater significance were the egg remnants on the pleopods which indicate that this female had recently hatched eggs prior to collection in February. This female did not undergo oviposition during the fall moths after collection, yet the December period of molting conformed to molting patterns observed from southeast Florida and the eastern Gulf of Mexico. Thus, the temporal incidence of molting in both females held in captivity was temporally asynchronous to the reproductively active members of the sampled populations, yet showed a degree of synchrony with those members of the populations observed to undergo molting. The alternate pattern of molting and mating provides further evidence for the low frequency of reproduction pattern suggested for this species."

During their study of the South Atlantic Bight (Wenner et al., 1987), a captured female was maintained in an aquarium: "Observations on molting and mating of a female (110 mm CW), which had been held in a refrigerated aquarium since February 1986 and had completed ecdysis in late May 1986, confirmed that female golden crab molt just before mating occurs."

In the eastern Gulf of Mexico, golden crabs appear to mate in the hardened state Hinsch (1988):

"The presence in the females of swollen seminal receptacles filled with seminal fluids and sperm serves as evidence for the time of mating. Female *Geryon fenneri* with immature ovaries contained sperm plugs in their seminal receptacles, suggesting that these might have mated following the molt to maturity.

Not all female crabs mate at the time of the molt to maturity. Female crabs of the family Majidae mate initially and thereafter in the hardened condition sometime after the terminal molt (Hartnoll, 1963; Hinsch, 1972). The presence of barnacles and blackened spots on the carapace of many female golden crabs are indicative of a long time since molting, suggesting that female golden crabs can mate in the hardened condition as well. The presence of sperm in the seminal receptacles suggests that the crabs may even be capable of holding sperm from one copulation over for successive seasons. In the spider crab *Libinia emarginata* (see Hinsch, 1972), a single mating may suffice to provide sperm for several broods. Transmolt retention of sperm in the seminal receptacles has been reported in *Menippe mercenaria* (see Cheung, 1968)."

3.1.3.5 Larval Distribution & Recruitment

The following text and Figure 1 are from Lockhart et al. (1990):

"The distribution patterns of *Chaceon fenneri* and possibly *C. quinquedens* in the eastern Gulf of Mexico suggest a causal role for the Loop Current System (Maul 1977) in basic life history adaptations. Female distribution within these species' geographic ranges and the timing of larval release supports this hypothesis. Ours was the first study to discover female golden crabs in any significant numbers and was also the first to find a major population of female red crabs in the Gulf of Mexico. Both of these concentrations of females were seemingly shifted counter-current to the Loop Current circulation. We hypothesize that this counter-current shift is linked to larval release and transport, and serves to maximize recruitment into the parent population by minimizing risk of larval flushing.

Similar counter-current shifts of other female decapods have been reported or hypothesized. In the Gulf of Mexico, spawning female blue crabs (*Callinectes sapidus*) have been hypothesized to undergo a late summer spawning migration in the northeastern Gulf of Mexico that is counter to the Loop Current system (Oesterling and Adams 1979). Female western rock lobsters (*Panulirus cygnus*) are hypothesized to undergo migration to favor recruitment back into the parent population (Phillips et al. 1979). Kelly et al. (1982) proposed that only those red crab larvae (*Chaceon quinquedens*) released up-current in the species' range will recruit back into the parent population. Melville-Smith (1987a, 1987b, 1987c) in a tagging study of red crabs (*C. maritae*) off the coast of southwest Africa, showed that the only segment of the population exhibiting significant directional movement were adult females: 32% of recaptures had moved greater than 100 km and the greatest distance traveled was 380 km over 5 yr. This directional movement was later shown to be counter to the prevailing surface currents (Melville-Smith 1990). Thus, within decapods in general, and the genus in particular, adult females are capable of, and appear to undergo, long-distance directional movement in their lifetimes.

A similar migration of adult female golden crabs, counter-current to Loop Current circulation in the Gulf of Mexico (Fig. 1), would produce the geographic population structure observed off the southeastern United States. Females would be most common farthest up-current whereas males would be most common intermediate in the species geographic range. Wenner et al. (1987) reported a 15:1 (M:F) sex ratio in the

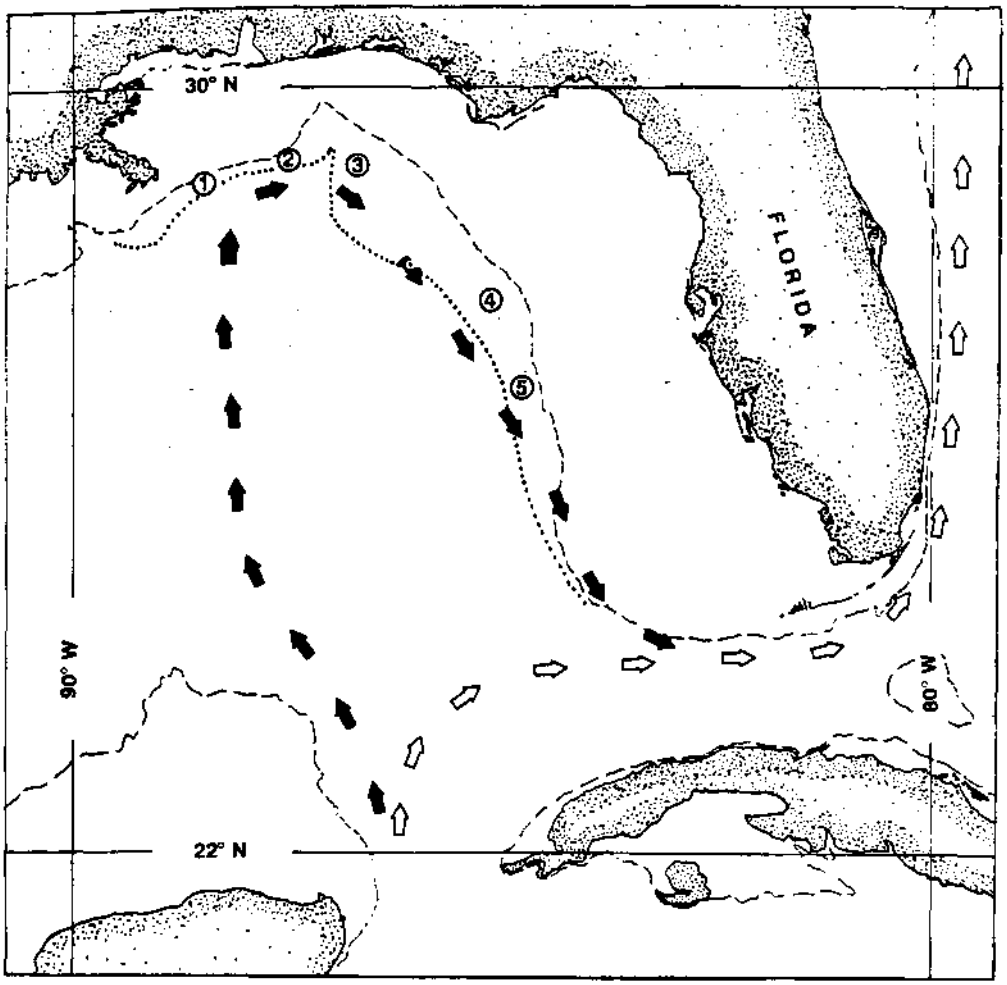

FIG. 1. Map of the eastern Gulf of Mexico with sampling areas indicated by numbered circles. Dashed line shows the 183 m isobath. Dotted line shows the 400 fathom 732 m isobath. Arrows show approximate minimum (open arrows) and maximum (closed arrows) annual penetration of the Gulf Loop Current.

South Atlantic Bight and in this study, we had an overall sex ratio of 1:4 — both consistent with hypothesized net female movements to accommodate larval retention and offset the risk of larval flushing.

In fact, given this, two female strategies could maximize recruitment in a prevailing current. The first is for females to position themselves far enough up current so that entrainment would return larvae to the parent population (Sastry 1983). The second is to avoid larval entrainment altogether and thus avoid flushing of the larvae out of the system. Female *Chaceon fenneri*, and perhaps *C. quinquedens*, appear to use both strategies but rely mainly on the latter.

Female golden crabs release larvae offshore in depths usually shallower than 500 m. If larvae were released directly into the Loop Current-Gulf Stream System, they would be entrained for their entire developmental period. Given a developmental time of 33-40 d at 18°C (K. Stuck, Gulf Coast Research

Laboratories, Ocean Springs, Mississippi, pers. comm.) and current speeds of 10-20 cm/sec (Sturges and Evans 1983), transport of the larvae would be 285 km to 690 km downstream. Thus, larvae released on the Atlantic side of Florida are in danger of being flushed out of the species' range before recruiting to the benthic stock. Likewise, larvae released directly into the current in the southeastern Gulf of Mexico would be flushed from the Gulf.

Female golden crabs release larvae from February to March (Erdman and Blake 1988; Erdman et al. 1989) and the greatest concentration of female golden crabs to date found in this study was in the northeastern Gulf of Mexico off central Florida. Only during this period and in this region (Maul 1977), can female golden crabs avoid complete entrainment and possible flushing of larvae out of the system. Partial entrainment of larvae might still occur, but its duration should be much reduced, and the risk of larval flushing minimal. This hypothesis predicts that most larvae should be found near the concentrations of females we found in the northeastern Gulf of Mexico with decreasing settlement further downstream. The abundance of juveniles should show a similar pattern.

One need not invoke similar counter-current movements for male geryonid crabs. In particular, males moving perpendicular to adult females (i.e. males moving up and down the continental slope) would have a greater encounter rate with females than males moving along the slope with females. Given low female reproductive frequency (Erdman et al. 1989), intense male-female competition (Lindberg and Lockhart 1988), and probability of multiple broods (Hinsch 1988) from a single protracted copulation (H. M. Perry, pers. obs.), the male strategy should be to intercept relatively rare receptive females all along the species' range, not to aggregate with presumably inseminated females. This hypothesis would predict a relatively uniform abundance of males along their geographic range. In addition, the incidence of inseminated females should be high farthest upstream with an ever decreasing percentage down-stream. Our study supports the former hypothesis but we cannot address the latter.

The distributional patterns of geryonid crabs we observed are consistent with those reported from elsewhere. Furthermore, these patterns lead us to suggest that the Loop Current System has had a causal role in life history adaptations of *Chaceon fenneri* and perhaps *C. quinquedens*. In general, females are expected to release larvae during a time and in a region where risk of larval flushing is minimal (Sinclair 1988), whereas males are expected to compete intensely for rare, receptive mates."

The coastal physical oceanography in the Florida Keys was described by Yeung (1991) in a study of lobster recruitment:

"The strong, northward-flowing Florida Current is the part of the Gulf Stream system confined within the Straits of Florida. It continues from the Loop Current in the Gulf of Mexico, and proceeds beyond Cape Hatteras as the North Atlantic Gulf Stream.

The mean axis of the Florida Current is approximately 80 km offshore of Key West and 25 km off Miami (Lee et al. 1991). Mean annual cross-stream surface current speed in the Straits of Florida is approximately 100 cm/s (U.S. Naval Oceanographic Office 1965).

Brooks and Niller (1975) observed a persistent countercurrent near Key West extending from surface to the bottom, and from nearshore to approximately 20 km seaward. They believed that it was part of the cyclonic recalculation of the Florida Current between the Lower and Middle Keys.

The presence of a cold, cyclonic gyre was confirmed by physical oceanographic data collected in the SEFCAR cruises. It was named the Pourtales Gyre since it occurs over the Pourtales Terrace -- that area of the continental shelf off the Lower and Middle Keys (Lee et al. 1991). When the Florida Current moves offshore, the Pourtales Gyre forms over the Pourtales Terrace, and can last for a period of 1-4 weeks.

The Pourtales Gyre could entrain and retain locally spawned planktonic larvae for a short period. The combination of the cyclonic circulation and enhanced surface Ekman transport could also advect foreign arrivals into, and concentrate them at, the coastal boundary (Lee et al. 1991).

Vertical distribution of the larvae within the 3-dimensional circulation will subject them to complicated hydrographic gradients, which might influence their development time, and hence their dispersal potential (Kelly, Sulkin, and van Heukelem 1982; Sulkin and McKeen 1989). Thus, variability in the circulation features and water mass properties can lead to variability in larval transport and recruitment."

The Pourtales Gyre may provide a mechanism for entrainment of golden crab larvae spawned on the Florida east coast, and also as a mechanism to entrain and advect larvae from the Gulf and Caribbean (e.g., Cuba). This possibility is supported by the conclusion of Yeung (1991) suggesting that larvae of a foreign origin supply recruits to the Florida spiny lobster population:

"The foreign supply of pre-recruits arriving with the Florida Current might easily meet the same fate as the locally spawned larvae, that is, passing on with the Florida Current. The Pourtales Gyre may play a significant role in recruitment by providing a physical mechanism to entrain and advect larvae into the coastal boundary.

The Pourtales Gyre, even if linked with the Dry Tortugas gyre or the Florida Bay circulation, may not be able to provide a pathway much more than 2 months in period. For locally spawned *Panulirus* larvae to be retained for their entire development would require several circuits -- not impossible, but unlikely"

The timing of the Pourtales Gyre provides a mechanism for local recruitment of *Scyllarus* larvae (Yeung, 1991) and may also provide a similar mechanism for golden crab larvae. The following figure (Figure 12) is a generalized pathway for lobster larvae (Moe, Jr., 1991). Golden crab larvae from the Gulf of Mexico, Cuba, and possibly other areas of the Caribbean, probably provide larvae to the South Atlantic population. The proportion of local recruitment is unknown but could be significant.

3.1.4 Feeding

Feeding habits are very poorly known. Golden crabs are often categorized as scavengers that feed opportunistically on dead carcasses deposited on the bottom from overlying waters (Hines, 1990).

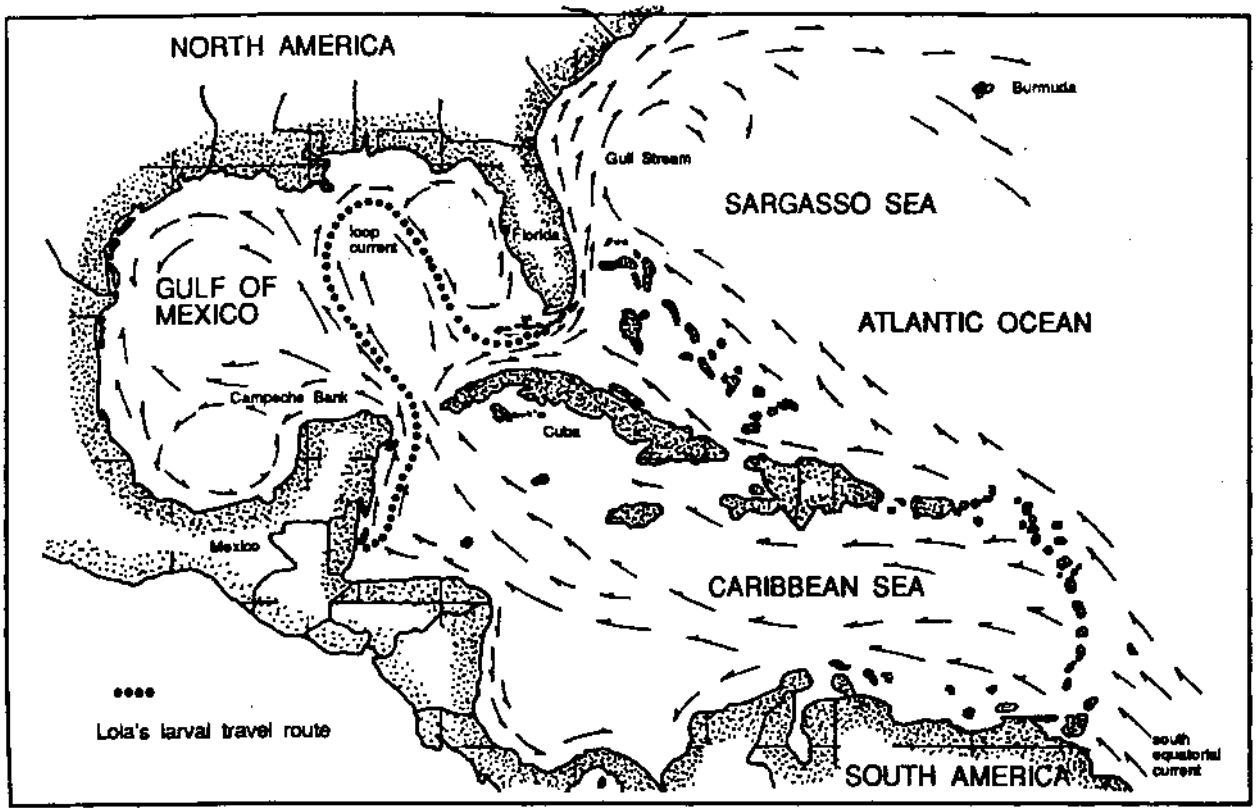

Figure 12. Lola's travel route as a phyllosome larva.

3.1.5 Movement

Wenner et al. (1987) found in the South Atlantic Bight that: " Size-related distribution of *G. fenneri* with depth, similar to that reported for red crab, may occur in the South Atlantic Bight. We found the largest crabs in the shallowest (274-366 m) and deepest (733-823 m) strata. A clear trend of size-related up-slope migrations such as Wigley et al. (1975) reported for *G. quinquedens* is not apparent, however, because of trap bias for capture of larger crabs of both sexes. Otwell et al. (1984) also noted no pattern in size of golden crab by depth for either sex. Tagging studies of red crab off southern New England provided no evidence for migration patterns and indicated instead that tagged crabs seldom moved more than 20 km from their site of release (Lux et al., 1982)."

Lindberg and Lockhart (1993) found in the Gulf of Mexico: " The golden crab *Chaceon fenneri* in the eastern Gulf of Mexico exhibits a typical bathymetric pattern of partial sex zonation and an inverse size-depth relationship, as first reported for red crabs (*C. quinquedens*: Wigley et al., 1975; *C. maritae*: Beyers

and Wilke, 1980). Sex segregation, with females shallower than most males, was more evident in our results than in those of Wenner et al. (1987) from the South Atlantic Bight, primarily because our trap catch had a higher proportion of females (25.9% compared to 5.2%)."

3.1.6 Mortality Rates

No mortality information is available for golden crabs. Melville-Smith (1988) studied the red crab off southwest Africa and estimated total mortality from catch curves. Total mortality (Z) for different fishing areas ranged 0.24 to 1.40.

Melville-Smith (1988) stated "With the limited information, there is no way of accurately calculating what portion of Z is made up by natural mortality (M). Also, there is very little comparative information on decapod natural mortality in the literature. Most studies of cold-water crabs and lobsters have used an assumed or roughly calculated low value, 0.1 (Thomas, 1973) and 0.02 (Ennis, 1979) for *Homarus americanus*, 0.1 for *Jasus edwardsii* (Annala, 1980), and 0.14 for *Cancer pagurus* (Bennett, 1979). For warmer water lobsters, M has tended to be quoted as higher, 0.14-0.52 for *Panulirus argus* (Munro, 1974 quoted by Cobb and Wang, 1985) and 0.226 for *Panulirus cygnus* (Morgan, 1977).

G. maritae is slow growing (Melville-Smith in press b) and lives in cold water at temperatures of 4.5-10.4°C (Beyers and Wilke, 1980). Furthermore, size frequency analysis of the catch (Fig.3) reveals that large crabs are abundant in areas where the rate of commercial exploitation is low. These factors suggest that the rate of natural mortality is low. Therefore, calculations involving M in this paper have been made with three values of M, 0.05, 0.10 and 0.15, the true value (which is unlikely to be constant over the whole grounds), probably lying somewhere within that range."

3.1.7 Abundance

Golden crab abundance studies are limited. Data from the South Atlantic Bight (Wenner et al., 1987) estimated abundance from visual assessment was 1.9 crabs per hectare while traps caught between 2 and 10 kg per trap. Wenner and Barans (1990) estimated the golden crab population in small areas of 26-29 square km between 300-500 m off Charleston to be 5,000-6,000 adult crabs. In the eastern Gulf of Mexico adult standing stock was estimated to be 7.8 million golden crabs and the biomass was estimated to be 6.16 million kg (13.6 million pounds) (Lindberg et al., 1989). Experimental trapping off Georgia yielded an average catch of 7 kg per trap (Kendall, 1990).

3.1.8 Present Condition

Unknown due to lack of data.

Sea Grant (Florida and South Carolina) hosted a research workshop on Geryonid Crabs and Associated Continental Slope Fauna in January 1989 (Lindberg and Wenner, 1990). The Rapporteur's

comments (taken directly from Armstrong, 1990) on crab management and the east coast United States Geryonid fisheries provides useful insight into the potential for a golden crab fishery:

1. In general, participants at the conference were not overly optimistic about the prospects for large and sustained fisheries for these species because of their deep water distribution, evidence of infrequent recruitment, slow growth, older age at reproductive and legal size, and fairly low density over extended regions of the species' range.

2. Crab management was reviewed and as in the case of most crab fisheries, much of the management is directed toward providing safeguards for reproductive effort by excluding females from the fisheries and setting minimum sizes to allow for adequate male reproduction before capture by the fisheries (Table 1).

3. Fisheries prospects for golden crab in the South Atlantic Bight to the Gulf of Mexico are more tenuous than for the red crab fishery in the northeast United States. Golden crabs seem to be distributed at very low densities but have the capacity to locate food and traps over an apparently great distance (Wenner, 1990; Wenner et al., 1987) which portends rapid depletion in areas heavily fished. Given aspects of both species' life history (Hines, 1990) such as deep water distribution at cold temperatures, slow growth and relatively advanced age at maturity and legal size, it seems that high sustained yield is not likely. As in the case of other crab fisheries listed in Table 1, managers could take a conservative approach (as apparently has been done) that allows capture only of males of a size and age beyond reproductive maturity, with the objective of maintaining species reproductive effort quite apart from the knowledge of biotic and abiotic factors that affect year class strength.

4. In order to provide some likelihood of reasonable annual catch by participating fishermen, managers may want to consider a limited entry fishery as has been done with a number of Australian invertebrate species. Given the expense of capitalization for such deep water fishing, it seems that fishermen are vulnerable to the vagaries of surplus male abundance which could be quickly reduced by unrestricted participation. Without an annual preseason survey and resultant catch quota at the present, there is no basis to attenuate excessive annual exploitation and spread capture of large males over several years, particularly if year classes reaching legal size are infrequently strong as hypothesized for *P. camtschatica* in the Bering Sea. Limited entry (and effort) might achieve this goal of more stable yield, although somewhat blindly since state fisheries agencies will likely not conduct surveys to estimate stock abundance as a means to index the degree of annual exploitation by a limited entry fishery.

5. Another option as practiced for some west coast Canadian invertebrate fisheries that are not well studied and regulated is that of "boom and bust". So long as rudimentary guidelines safeguard reproductive effort, the fishery is allowed to grow to any size (unrestricted vessel participation) and achieve 100% exploitation as it is able. Eventual decrease in abundance and reduction in landings are a consequence to which fishermen must adjust as they either stay with golden crab or move to other fisheries.

Species	Sex Fished	Size Limit (mm carapace width)	Estimated Minimum Age in Fishery (YR)	Season Closure	Pre-Season Survey	Gear	Range of Landings (over last 15 yrs) (lb x 10^6)	Quota	Comment
Red King Crab[1] (*Paralithodes camtschatica*)	M	165	8-10	Yes	Extensive	Pot	3-130 Bering Sea	"harvest range" guidelines	
Tanner Crab[2] (*Chionoecetes bairdi*)	M	140	6-8	Yes	Extensive	Pot	47-146 all Alaska	"harvest range" guidelines	
Dungeness Crab[3] (*Cancer magister*)	M	165	3-5	Yes	Virtually None	Pot	16-60 Cal-Alaska plus British Columbia	None	Pre-season survey for male shell condition only
Blue Crab[4] (*Callinectes sapidus*)	M, F	75-125	2	Yes; variable between states	No	Pot, dredge, trawl, trotlines	40-104 Chesapeake Bay	None	
Stone Crab[5] (*Menippe mercenaria*)	M, F	claws only, propodus >70	2-3	Yes	No	wooden trap	0.5-3.0 Florida	None	
Red Crab[6] (*Chaceon maritae*)	M, F	None gear 100% selective for crab >75mm	6-8	No	No	Pot	7.7-13.1 SW Africa	None	Japanese fishery off SW Africa; age of catch estimated to be between 8-16 yrs. of age
Golden Crab[7] (*Chaceon fenneri*)	M, F	None	?	No	No	Pot	?	None	

[1]Otto 1986; NPFMC 1988
[2]Otto 1981; NMFS Fisheries stats 1983-88, Alaska Sea Grant 1982
[3]Alaska Sea Grant 1985; PMFC 1987
[4]Millikin and Williams 1984; Jamieson 1986; Cronin 1987
[5]Ehrhardt and Restrepo 1989
[6]Melville-Smith 1988
[7]Workshop Participants

Table 1. Representative crab fisheries and comparison of major features of management and landings.

3.1.9 Maximum Sustainable Yield

Information to calculate maximum sustainable yield (MSY) is extremely limited. Ideally, one would like to have catch and effort data for 10 years, information on size and age of the catch, fishery independent data, and information relating spawning to recruitment. If these types of data were available for golden crab, surplus production models, spawner/recruit models, and catch-at-age models (e.g., virtual population analysis) could be used to conduct a stock assessment. Faced with such a severe lack of data, the Council had no choice but to use a more simple approach relating the fishing mortality rate to the rate that would produce the maximum sustainable yield.

This is not necessarily all bad as described by Hilborn and Walters (1992: 4):

"A management authority can go about the difficult business of making choices among quantitative alternatives in three ways. First, it may simply mimic choices made under similar circumstances by other authorities under the assumption that previous decision making has already involved careful evaluation of alternatives. Second, it may make an initial choice that 'looks reasonable' on intuitive grounds, then plan to systematically vary the choice while monitoring biological and economic responses, so as to eventually find the best choice by an empirical process of trial and error. Third, it may engage in formal stock assessment, the construction of quantitative models to make the best predictions possible about alternative choices based on whatever data are available to date, and then base its choices on the models while expecting to refine or modify the choices later as more data become available. A combination of the second and third approaches, using a mixture of quantitative modelling and empirical management experimentation, has come to be called 'adaptive management' (Walters and Hilborn 1976, Walters 1986)."

The following discussion concerning MSY based on natural mortality is from an examination of reference points (RPs) for fishery management with application to straddling and highly migratory resources (FAO, 1993). The FAO document was prepared to offer technical input on practical options for management of these resources. Straddling resources includes species which occur within the jurisdiction of multiple countries and for which management should be coordinated. As such, the theory and approach is useful for golden crab which are known to occur in the U.S., Bahamas, and Cuba. In addition, the information presented below is generic to any species as it relates basic principles of population dynamics.

"New fisheries usually develop in the absence of adequate assessment information, and management has to proceed on the basis of information available at that point in time. It is important that the rate of fishing during the early stages does not exceed the rate of learning (e.g. Hilborn and Sibert 1988). A more cautious approach may result in underexploitation, but this will not necessarily lead to a loss of potential yield (see later sections on Risk). In the 1960-70s, many new fisheries developed in different parts of the world, for which the only data on stock status was one or several estimates of biomass from exploratory fishing campaigns or fishery surveys. In an attempt to provide some basis for fleet and fishery development, a simple empirical formula for the MSY was proposed by Gulland (1973) in terms of the virgin biomass B_0 and the natural mortality rate M, notably MSY = 0.5 M B_0. (A reformulation of the

second yield equation in Annex I), and follows the symmetrical Schaefer yield model in assuming that MSY will occur at half the virgin stock size B_0, and that at MSY, the fishing mortality and natural mortality rates will be equal. Later, a more cautious approach was used, and Gulland generalized the equation to $MSY = x.M.B_0$ with the value of x being related to the stock characteristics. Garcia et al. (1989) proposed several estimators for MSY when historical data series are not available.

There is in fact little empirical evidence that $F_{MSY} = M$ for a majority of stocks. Beddington and Cooke (1983) suggested that x is generally smaller than 0.5, while for tropical penacids Garcia and Lereste (1981) suggested that values x = 0.32 to 0.44 are appropriate. From a limited set of 11 stocks, Caddy and Csirke (1983) found values were bounded by x = 0.33 to at least x = 4, the lowest values being shown by short-lived shrimp and a sardine populations, and the highest by two northern demersal finfish; apical predators with low natural mortality rates. From an analysis of a series of small pelagic stocks, Patterson (1992) found that only low exploitation rates (no more than 40%) corresponding to not more than x = 0.33 are sustainable. The point of mentioning these very approximate benchmarks is that for many straddling stocks off developing coastal countries, setting 'Precautionary' RPs might still have to draw upon such procedures."

Because of the lack of both fishery-dependent and fishery-independent data from the golden crab fishery, it has not been possible to develop a MSY estimate for the golden crab fishery in the south Atlantic. A preliminary analysis was prepared with the assistance of Dr. John Merriner, NMFS SEFSC Beaufort Lab.

Preliminary MSY Analysis

Mortality estimates are available from work on the red crab off southwest Africa (Melville-Smith, 1988): Natural mortality (M) range = 0.05, 0.10, and 0.15 (see Section 3.1.6 Mortality Rates).

The biomass (B_0) of golden crab in the south Atlantic is unknown. An estimate of adult golden crab biomass for the eastern Gulf of Mexico is available (Lindberg et al., 1989). Based on research from the eastern Gulf of Mexico, adult biomass was estimated to be 13.6 million pounds (see Section 3.1.7 Abundance).

The quantity of habitat suitable to golden crab in the south Atlantic is unknown. For purposes of the preliminary MSY analysis, habitat in the south Atlantic was assumed to be equal to and two times the quantity of habitat in the eastern Gulf of Mexico.

Finally, the sex ratio was assumed to be either 1M:1F or 2M:1F. This recognizes results of research which show a higher proportion of females in the south Atlantic.

Using these estimates, maximum sustainable yield can be calculated (Table 2) using the formula:

$$MSY = 0.5\ M\ B_0$$

Table 2. Maximum sustainable yield based on estimated abundance of golden crab in the Gulf of Mexico.

Natural Mortality (M)	Total Biomass Pounds	SATL Habitat = GM MSY Sex ratio 1M:1F	SATL Habitat = GM MSY Sex ratio 2M:1F	SATL Habitat twice GM MSY Sex ratio 1M:1F	SATL Habitat twice GM MSY Sex ratio 2M:1F
0.05	13,600,000	170,000	227,800	340,000	455,600
0.10	13,600,000	340,000	455,600	680,000	911,200
0.15	13,600,000	510,000	683,400	1,020,000	1,366,800

Based on the preliminary analysis, maximum sustainable yield was estimated to range between 170,000 and 1,366,800 pounds. This information was included in the September 1995 draft fishery management plan which was reviewed by the public, attendees at public hearings, the Council's Golden Crab Advisory Panel, the Council's Scientific and Statistical Committee, and the South Atlantic Council.

SC DNR Analysis

In addition to the preliminary analysis, the Council requested Dr. Elizabeth Wenner, Mr. Glenn Ulrich, and Dr. Charles Barans from the South Carolina Department of Natural Resources examine their data from the South Atlantic Bight and provide an estimate of MSY for golden crab in the south Atlantic. The analysis provided was reviewed by the Council's Scientific and Statistical Committee, the Golden Crab Advisory Panel, and the Council. This information was also distributed to members of the public prior to the final public hearing during the October 1995 Council meeting. The complete analysis as outlined in a letter from Dr. Elizabeth L. Wenner, Mr. Glenn F. Ulrich, and Dr. Charles Barans, which was FAXED on October 11, 1995 is as follows:

"The following information is provided for use of the South Atlantic Fishery Management Council in determining standing stock estimates and MSY for *Chaceon fenneri* (golden crab). Since neither the true density of crabs nor their habitat distributions are known for the entire South Atlantic Bight from Cape Hatteras to Cape Canaveral or beyond, standing stock can be estimated in several ways to obtain a range of values that might be considered conservative or liberal. We are providing estimates based on an expansion of in situ crab densities from a relatively small geographic and bathymetric area to develop our first estimate. A second approach is based on trap catches and effective fishing area (EFA) within the most productive areas surveyed in 1985-86.

In the first estimate, the surface area of ocean bottom of golden crab (*Chaceon fenneri*) distribution was estimated from a NOAA, National Ocean Survey series of detailed bathymetric maps (transverse mercator projections) with depths contoured at 50 m intervals. Using each of the map sheets necessary between Cape Canaveral (28°30'N) and Cape Fear (34°00'N), the depth contours for 350 m and 550 m were located and visually approximated as straight lines (1 cm = 2.5 km). These depth contours were chosen because they contain most of the trapping effort, greatest catches of golden crab, and visual observations from a submersible. Flat surface area from the chart was calculated for the resulting triangular and

trapezoidal figures representing areas between the 350-550 m depths. Areas (km^2) were summed throughout the region. Using this method, a total bottom area estimated from flat map surface was 19,517.7 km^2.

From submersible observations, a density of 1.9 crabs/ha (190 crabs/km^2 averaged over several habitat types) was found by Wenner and Barans (1990) for depths of 300-600 m. Expanding to the area from Cape Canaveral-Cape Fear, an estimated number of 3.7 million crabs is obtained. This estimate is dependent on the assumption that unbiased visual observations of crabs were made from a submersible and that these density estimates are applicable to the entire area under consideration.

Based on a sex ratio of 22M:1F (3039 males, 135 females from traps; Wenner et al. 1987) for depths of 300-600 m, the standing stock of males is 3,541,124 and that of females 166,876. Assuming an average weight of 927 g (2.04 lbs) per male crab in depths of 274-549 m (Wenner et al. 1987), the total biomass of males is 7,223,893 lbs.

Using Gulland's formula, MSY = 0.5 M B_0, where MSY is maximum sustainable yield in kg, M is the instantaneous rate of natural mortality based on a range of values determined for *C. maritae* (Melville-Smith In press), and B_0 is the estimated total biomass of males, the following estimates of MSY from the first method are derived:

M	B_0 (in millions)	MSY (millions of lbs.)
0.05	7.2	0.18
0.10	7.2	0.36
0.15	7.2	0.54

In the second population estimate, EFA of traps (3625m^2) was calculated using the observed crab density in some of the more productive habitats from first year submersible work (0.8 crabs/1000 m^2) in conjunction with mean crab catch (2.9 crabs/trap, from 274-549 m) collected concurrently in the same areas. This assumes that EFA is the same for all geographic and depth areas where it has been applied.

The linear distance from due east of Charleston, SC to Cape Canaveral, FL along the 150 fathom (275 m) contour is 518.6 km and the average width of each 50 fathom stratum in the area where our sampling occurred was 3.7 km. An assumption that this is the average width of these depth strata for more productive areas throughout the region was made.

Depths 274 - 366 m: Area = 518.6 km x 3.7 km = 1918.8 km^2.
Depths 367 - 457 m: Area = 518.6 km x 7.4 km = 3837.6 km^2.

Total golden crabs taken in year 1 & 2 for each depth zone were divided by total number of traps set to yield the following:

274 - 366 m: 162 crabs in 59 traps = 2.7 crabs/trap.
367 - 549 m: 4147 crabs in 446 traps = 9.3 crabs/trap.

For depths 274-366, a density estimate and standing stock estimate was obtained as follows:

$$\frac{2.7 \text{ crabs/trap}}{.003625 \text{ km}^2\text{/trap}} = 744.8 \text{ crabs/km}^2.$$

744.8 crabs/km^2 x 1918.8 km^2 = 1,429,122 crabs
1,429,122 crabs x 0.956(% males) = 1,366,241 male crabs
1,366,241 x 0.927 kg/crab = B_0 of 1,266,505 kg or 2,786,311 lbs.

M	B_0 lbs.	MSY lbs.
0.05	2,786,311	69,658
0.10	2,786,311	139,316
0.15	2,786,311	208,973

For depths of 367-549 m, a density estimate and standing stock estimate was obtained as follows:

$$\frac{9.3 \text{ crabs/trap}}{.003625 \text{ km}^2\text{/trap}} = 2565.5 \text{ crabs/km}^2.$$

2565.5 crabs/km^2 x 3837.6 km^2 = 9,845,363 crabs
9,845,363 crabs x 0.956 (% males) = 9,412,167 male crabs
9,412,167 x 0.927 kg/crab = B_0 of 8,725,079 kg or 19,195,174 lbs.

M	B_0 lbs.	MSY lbs.
0.05	19,195,174	479,879
0.10	19,195,174	959,759
0.15	19,195,174	1,439,638

Total MSY estimates for Method 2:

M	274-366 m	367-549 m	Total lbs.
0.05	69,658	479,879	549,537
0.10	139,316	959,759	1,099,075
0.15	208,973	1,439,638	1,648,611

In addition to the population estimates presented here, substantial areas on the Blake Plateau may support significant numbers of crabs although a very limited number of trap sets in these areas indicates that the density is lower than in the shallower strata. In the 400-500 fathom area between 30 and 31°N, 87 traps caught 63 crabs; a mean of 0.7 crabs/trap. Additionally, in these sets males made up only about 40% of the catch.

Golden crabs also occur in the 100-150 fathom stratum and may be abundant in certain areas or at certain times. Drew Kendall of GAMAREX has reported good catch rates in these depths during some of their survey efforts. This data should be examined to determine if it can be utilized to expand the population estimates to these depths.

We hope that you will find this information useful in management proposals for golden crab. Differences in estimates of MSY between methods reflect choices of crab densities and habitat area variables for calculations. Should you need any clarification or additional information about these estimates, please give us a call."

Table 2. Summary of MSY estimates.

Preliminary Estimate	MSY	=	170,000	to	1,366,800 pounds
SCDNR Method #1*	MSY	=	180,000	to	540,000 pounds
SCDNR Method #2*	MSY	=	550,000	to	1,650,000 pounds

*For the area Cape Hatteras, NC to Cape Canaveral, FL only.

The Council's Scientific and Statistical Committee reviewed the preliminary estimate and the two SC DNR estimates of MSY and were requested to address the following questions (Memorandum to SSC from Gregg Waugh dated 10/12/95):

1. What is the best available estimate of MSY for the Cape Canaveral, Florida to Cape Fear, North Carolina area?

2. What is the best available estimate of MSY for the Cape Canaveral, Florida area south? This is the area where virtually 100% of the 600,000 pounds caught thus far in 1995 have originated.

3. What are your recommendations about including a numerical estimate of MSY in the document at this time? What about a numerical estimate for the Cape Canaveral to Cape Fear area only and no numerical estimate for the entire fishery?

The SSC discussed the MSY methodology, the source of the distribution and abundance data, the need for adaptive management, and the concern that golden crabs could be easily overfished. There was concern expressed that there was not sufficient data to calculate MSY. SSC members stated that they are not speaking negatively of the information collected and complimented the researchers on their work; however, members concluded there was insufficient information upon which to calculate MSY at this time. The following motions was approved: "The SSC recommends that the Council not present current estimates of MSY in the document because we question the scientific soundness of these estimates." Their intent is that data be collected and an estimate of MSY be calculated as soon as sufficient information becomes available.

The Council's Golden Crab Advisory Panel reviewed the information concerning MSY and concluded there was not sufficient information available to estimate MSY at this time.

The NMFS SEFSC reviewed the preliminary estimate of MSY contained in the September 1995 public hearing document and concluded: "It should be emphasized that this MSY is a very rough estimate which needs to be monitored and modified as more information on the fishery becomes available." "MSY estimates on pages 40-41 (Note: referring to the September 1995 draft FMP document) are based on published data from the Gulf of Mexico and range from 0.17 to 1.37 million pounds depending upon the assumed sex ratio, comparative stock sizes, and assumed mortality rates. There is no scientific basis for the choice of 'best point estimate of 1.4 million pounds,' (also see page 90, Option 4) (Note: referring to the September 1995 document). There is no explanation as to how this choice was arrived at. SCMRRI scientists are evaluating their research data in an attempt to provide B_0 and MSY estimates for a large portion of the U.S. South Atlantic area. Upon review of their data and the process for data expansion by Council staff, SSC, SEFSC, etc. those values may replace the estimate in Table 2, page 41 (Note: referring to the September 1995 document). It is encouraged that population estimates for the Atlantic coast area be used in the MSY calculations. Please note that sex ratios for the South Atlantic collections were quite high for males, 15:1, p.33) (Note: referring to the September 1995 document)."

The South Atlantic Council reviewed the MSY estimates, the methodology, review comments by the NMFS SEFSC, SSC, and Golden Crab AP and concluded, based upon the best available information, not to specify a total MSY for the golden crab resource within the Council's area of jurisdiction. The Council did however conclude there is sufficient information to use in making a very preliminary estimate of potential yield for the area Cape Canaveral, Florida through Cape Fear, North Carolina. The real shortcoming of the available data is the lack of any estimate for the area south of Cape Canaveral, Florida where the majority of the fishery takes place. Therefore, no estimate of MSY is specified at this time. The data collection measures specified in the management plan will generate data useful for calculating MSY. In fact, the Council requested, and NMFS has implemented, a voluntary logbook program beginning in November

1995 to start the data collection process. As soon as sufficient information becomes available to calculate MSY, the framework procedure will be used to incorporate the MSY figures into the management plan.

3.1.10 Probable Future Condition

Golden crabs are a long-lived, slow growing, deep water (cold environment) species. Their reproductive biology is likely to result in periodic recruitment and their abundance in the South Atlantic Council's area is unknown. These life history characteristics suggest conservative management to prevent overfishing.

The rapid development already exhibited by this fishery is expected to accelerate in the immediate future. Southeastern fishermen continue to seek diversification opportunities to alleviate problems experienced in fisheries for traditional species, such as user group conflicts, declining resources and over-capitalization. The net ban in the State of Florida, extensive closures in New England, and large reductions in crab fisheries in the northwest could result in significant influxes of effort into the golden crab fishery. The number of vessels thought to be actively fishing increased from two vessels in January 1995 to about 37 vessels fishing as of August 1, 1995. However, data from the State of Florida and discussions with fishermen, indicate up to 80 individuals have documented landings as of April 7, 1995. An additional 33 individuals would qualify by September 1, 1995 based on data from Florida and discussions with fishermen.

Without management the golden crab resource will become rapidly overfished. This is not a species that can withstand the high fishing mortality from a fleet as large as is likely to enter the fishery.

3.2 Habitat and Environmental Requirements

3.2.1 Habitat Description

Information from Wenner et al. (1987), based on exploratory trapping, indicate that golden crab maximum abundance occurs between 367 and 549 meters in the South Atlantic Bight. Information on sediment composition suggest that golden crab abundance is influenced by sediment type with highest catches on substrates containing a mixture of silt-clay and foraminiferan shell. Wenner et al. (1987) further notes: "Other studies have described an association of *G. quinquedens* with soft substrates. Wigley et al. (1975) noted that bottom sediments throughout the area surveyed for red crab from offshore Maryland to Corsair Canyon (Georges Bank) consisted of a soft, olive-green, silt-clay mixture. If golden crabs preferentially inhabit soft substrates, then their zone of maximum abundance may be limited within the South Atlantic Bight. Surveys by Bullis and Rathjen (1959) indicated that green mud occurred consistently at 270-450 m between St. Augustine and Cape Canaveral, FL (30°N and 28°N). This same depth range from Savannah, GA to St. Augustine was generally characterized by Bullis and Rathjen (1959) as extremely irregular bottom with some smooth limestone or "slab" rock present. Our study indicates, however, that the bottom due east between Savannah and St. Catherines Island, GA at 270-540

m consists of mud and biogenic ooze. Further north from Cape Fear, NC to Savannah, bottom topography between 270 and 450 m is highly variable with rocky outcrops, sand and mud ooze present (Low and Ulrich, 1983)."

In a subsequent study using a submersible, Wenner and Barans (1990) found the greatest abundance in rock outcrops:

"Observations on density and habitat of golden crab, *Chaceon fenneri*, were made from a submersible along 85 transects in depths of 389-567 m approximately 122 km southeast of Charleston, South Carolina. Additional observations on habitat were made on 16 transects that crossed isobaths between 293-517 m. Seven habitat types were identified during dives: a flat foraminiferon ooze habitat (405-567 m); coral mounds (503-555 m); ripple habitat (320-539 m); dunes (389-472 m); black pebble habitat (446-564 m); low outcrop (466-512 m); and soft-bioturbated habitat (293-475 m). A total of 109 *C. fenneri* were sighted within the 583,480 m^2 of bottom surveyed. Density (mean no. per 1,000 m^2) was significantly different among habitats, with highest values (0.7 per 1,000 m^2) noted among low rock outcrops. Lowest densities were observed in the dune habitat (<0.1 per 1,000 m^2), while densities for other habitats were similar (0.15-0.22 per 1,000 m^2)."

A similar submersible study in the eastern Gulf of Mexico (Lindberg and Lockhart, 1993) found similar results with higher abundance on hard bottom: "Within the bathymetric range of golden crabs, crab abundance may be related more to habitat type than to depth. The greatest density (36.5 crabs/ha) occurred on or near hard-bottom canyon features."

3.2.2 Condition of the Habitat

Golden crab occupy offshore oceanic waters along the Atlantic and Gulf of Mexico coasts as adults. Offshore areas used by adults are probably the least affected by habitat alterations and water quality degradation. Currently, the primary threat comes from oil and gas development and production, offshore dumping of dredged material, disposal of chemical and other wastes, and the discharge of contaminants by river systems.

3.2.3 Habitat Areas of Particular Concern

No habitat areas of particular concern are proposed or designated for golden crab. However, important habitat includes those areas required during the golden crab's life cycle. Offshore and nearshore areas of particular concern include those habitats required during larval, postlarval, and adult stages. Although these areas are generally less vulnerable to habitat alteration than the salt marsh and estuarine areas, deep water mining (oil, gas and sand) and fishing gear-related damage (traps, anchors and grapples) can result in habitat and water quality degradation.

Oculina coral (*Oculina varicosa*) is distributed along the South Atlantic shelf with concentrations occurring off the central east coast of Florida (Reed, 1992). According to Reed (1980) the majority of

massive *Oculina* growth occurs between 27° 30' N. latitude and 28° 30' N. latitude. *Oculina*, a slow growing coral species, constitutes essential habitat to a complex of species, including those managed under the snapper grouper fishery management plan (SAFMC, 1983) .

Deep water coral communities support a very rich and diverse community composed of large numbers of species of mollusks, amphipods, echinoderms with *Oculina varicosa* , *Lophelia prolifera*, and *Emallopsamia profunda* constituting the dominant species. The diversity of this system is equivalent to that of many tropical reef systems (Reed, 1992). The geomorphological nature of the deep water Oculina Banks is characterized by high current regimes which trap fine sand, mud and coral debris forming the basis for the diverse invertebrate community (Reed, 1992).

Lophelia prolifera is similar in gross morphology to *Oculina varicosa* but is distributed in depths from 60-2,170 meters. *Emallopsamia profunda* banks are found at depths from 500-800 meters between Miami and South Carolina, and between 640 and 869 meters in over 200 banks mapped on the outer eastern edge of the Blake Plateau.

Reed (1992) contains a detailed description of submersible studies of deep water *Oculina*, *Lophelia* and *Emallopsamia* conducted along the shelf edge off central Florida over the last ten years and includes information on distribution, structure, and function of this protected coral resource and essential habitat.

To protect this fragile and limited coral habitat, a 92 square mile Oculina Bank Habitat Area of Particular Concern (HAPC) was established under the Federal Fishery Management Plan for Coral and Coral Reefs (GMFMC and SAFMC 1982) (see Figure on next page). Existing regulations protecting the Oculina HAPC are as follows:

Regulations in the Coral Fishery Management Plan

§638.23 Habitat areas of particular concern.

(c) The Oculina Bank. The Oculina Bank is located approximately 15 nautical miles east of Fort Pierce, Florida, at its nearest point to shore and is bounded on the north by 27°53'N. lat., on the south by 27°30'N. lat., on the east by 79°56'W. long., and on the west by 80°00'W. long. In the HAPC, fishing with bottom longlines, traps, pots, dredges, or bottom trawls is prohibited. See §646.26 (d) of this chapter for prohibitions on fishing for snapper-grouper in the Oculina Bank HAPC.

Regulations in the Snapper Grouper Fishery Management Plan

§ 646.26 Area limitations

(d) *Habitat area of particular concern* (HAPC). (1) The Oculina Bank, which is a coral HAPC under § 638.23(c) of this chapter, is bounded on the north by 27°53'N. latitude, on the south by 27°30'N. latitude, on the east by 79°56'W. longitude, and on the west by 80°00'W. longitude.

(2) No fishing for fish in the snapper-grouper fishery may be conducted in the Oculina Bank HAPC; such fish may not be retained in or from the Oculina Bank HAPC. Fish in the snapper-grouper fishery taken incidentally in the Oculina HAPC by hook-and-line must be released immediately by cutting the line without removing the fish from the water. It is a rebuttable presumption that fishing aboard a vessel that is anchored in the HAPC constitutes fishing for fish in the snapper-grouper fishery.

(3) See §638.23(c) of this chapter for prohibitions on fishing with bottom longlines, traps, pots, dredges, and bottom trawls in the Oculina HAPC.

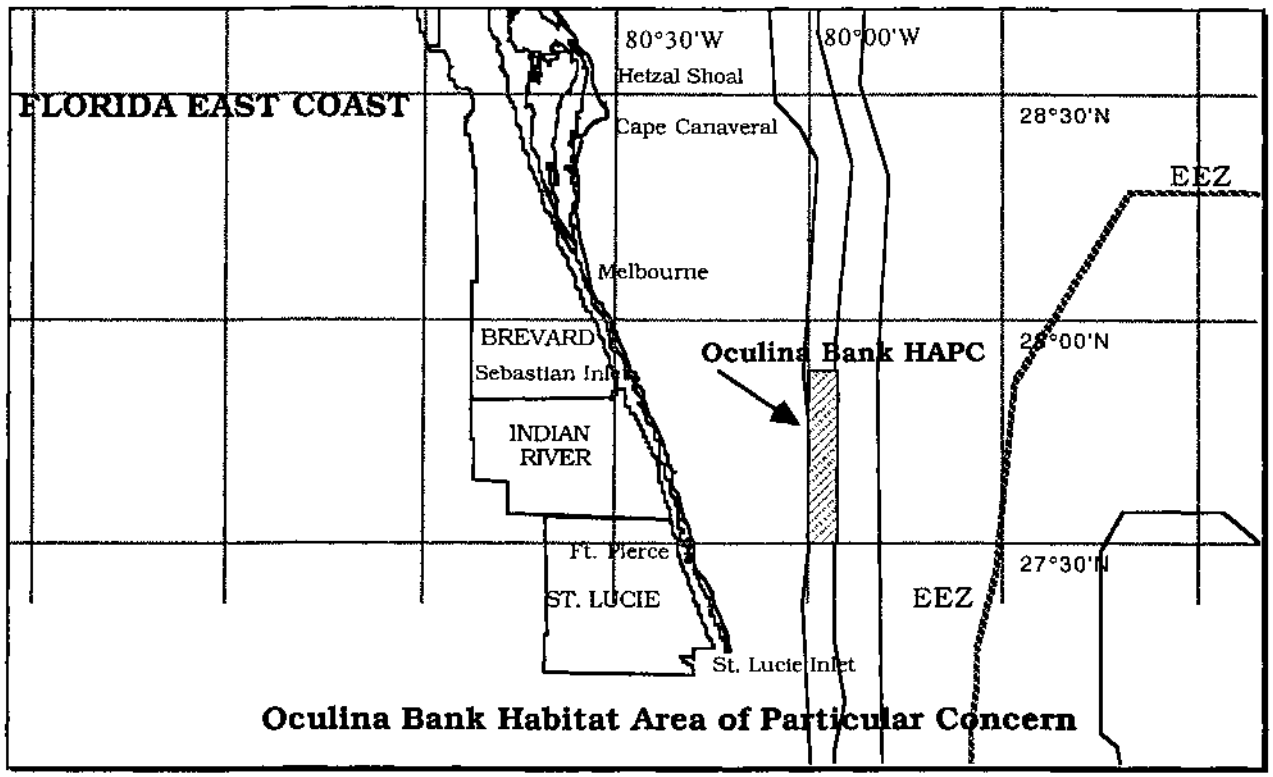

Figure 1. Florida east coast showing location of Oculina Bank Habitat Area of Particular Concern (HAPC).

3.2.4 Habitat Protection Programs

3.2.4.1 North Carolina

The Coastal Area Management Act was passed in 1974 to protect North Carolina's fragile coastal resources through planning and management at the state and local level. The Department of Environment, Health and Natural Resources administers the program. Policy direction is provided by the Coastal Resources Commission, a 15 member group of citizens appointed by the Governor. The coastal program requires that land use plans be developed and adopted by county governments. Municipalities may also elect to develop plans. The Coastal Resources Commission has authority to prepare plans should the county fail to do so. Once approved, these plans are the basis for permitting. Currently, there are approved land use plans for all 20 coastal counties and approximately 55 coastal municipalities. These plans are revised regularly to address new management concerns. The regulatory program applies in areas designated as Areas of Environmental Concern which are considered the most sensitive. Activities occurring in these areas require coastal development permits. Permits for "major development" are issued by the Department of Environment, Health and Natural Resources. All other development activity is considered "minor development" and the corresponding permits are issued by local government (Department of Commerce, 1987).

3.2.4.2 South Carolina

The Office of Ocean and Coastal Management implements the Coastal Management Act. The Office has authority to formulate and implement a comprehensive coastal management program and direct control through a permit program that oversees activities in critical areas that include coastal waters, tidelands, beaches, and primary ocean-front sand dunes. Indirect management authority of coastal resources is granted to the Office in counties containing one or more of the critical areas. In issuing permits, the Coastal Management Act requires that the Office consider the effects of proposed alterations on the production of fish, shrimp, oysters, crab, or any marine life, wildlife, or other natural resources.

3.2.4.3 Georgia

The State of Georgia, until recently, did not participate in the Federal Coastal Zone Management Program. However, the Coastal Marshlands Protection Act of 1970 and the Shore Assistance Act of 1979 were passed to protect the state's beaches, dunes, and marshes. These acts created two statutory committees to consider permit applications for developing or altering marshes or sand sharing systems (beaches, sand dunes, or near shore sand bars). The committees are composed of two top managers of the Georgia Department of Natural Resources, an oceanographer, and a professional engineer, who regularly convene at monthly public meetings.

Under authority of these acts, the Marsh and Beach Section, the Coastal Resources Division of the Georgia Department of Natural Resources, has resource management responsibility for marshes, dunes, and beaches. Management is administered by a permit system for all activities and structures that alter any marshland, sand dunes, beaches, and submerged sandbars and shoals.

In January 1992, Georgia Department of Natural Resources was designated as the lead agency to develop and implement Georgia's coastal management program. A management plan and program for the state is being developed with the input of an 18 member advisory committee appointed by the Governor. The goals of the program will be to protect coastal resources, manage coastal resources, and simplify the permitting process.

3.2.4.4 Florida

The Florida Coastal Management Program was approved by the Secretary of Commerce in September 1981. The Department of Environmental Protection is responsible for coordinating and monitoring implementation of the laws and rules which comprise the Coastal Management Program.

3.2.5 Pollution and Habitat Degradation along the Atlantic Coast

3.2.5.1 Concerns in the South Atlantic States

Effects of pollution on golden crab species are not well documented, yet generally it can be assumed that degradation of water quality and sediments in offshore environments will impact adults,

juveniles, larvae, and eggs to some degree. Pollutant-related stresses may reduce fecundity or viability of ova; decrease survival of larvae, postlarvae, juveniles, and adults, increase vulnerability to disease and predation; and reduce growth rates.

The Council's habitat and environmental protection advisory panel has developed a list of major fishery habitat concerns:

North Carolina•
- Non-point source pollution (i.e., nutrient loading).
- Impacts of high density development on barrier islands and ocean outfalls for island development.
- Marina development.
- Ulcerative mycosis and its occurrence in virtually all species in specific parts of the estuarine system.
- Identification of critical habitats such as nursery habitats.
- Hydrologic changes in instream flow.
- Land use changes resulting in freshwater impacts changing salinity regimes, phosphate mining, and loss of 404 wetlands.
- Chemical discharges from offshore phosphate mining.
- Impacts of peat mining.

South Carolina•
- Dredged material disposal for port development.
- Increased barrier island development.
- Impacts of beach renourishment projects.
- Non-point source pollution.
- Impoundment of wetland areas.
- Lack of chemical water quality standards.
- Instream flow and aquaculture in pumping water from the estuarine system.

Georgia•
- Freshwater drainage from silvaculture.
- Changing time period of water affecting low salinity nursery areas.
- Siting of marinas.
- Port development.
- Dredge disposal.
- Increased salinity of Savannah River.

Florida •
- Impoundments for mosquito control and need to pursue increased rotational impoundment management.
- Impacts of beach renourishment.
- The designation of a marine sanctuary in the Indian River Area.
- Dredge and fill operations.
- Freshwater inflow alterations.
- Water pollution.
- Seagrass dieoffs.
- Extensive coastal development and related problems.

3.2.5.2 SAFMC Habitat Priorities

In cooperation with the four state habitat advisory panels, the SAFMC developed a list of habitat priorities to aid in the review of projects or policies affecting fisheries habitat and in development of policy statements on such activities. The following list in priority order was approved by the SAFMC:

1. impoundment, dredging, or filling of wetlands
2. point and non-point source pollution
3. identification and acquisition of important fishery habitats
4. chemical water quality standards
5. beach renourishment
6. dredge and fill of seagrass beds
7. ocean incineration
8. offshore mineral mining
9. silvaculture
10. plastic pollution
11. ocean outfalls
12. aquaculture in wetlands
13. habitat restoration, enhancement, and artificial reefs
14. hurricane Hugo impacts on fisheries habitat
15. anchoring on reefs and groundings
16. habitat utilization documentation
17. impacts of fishing techniques
18. sea level rise
19. impacts of jetties and groins
20. mandatory boat access

3.2.5.3 Plastic Pollution (Persistent Marine Debris)

The production of plastic resin in the U.S. increased from 6.3 billion pounds in 1960 to 47.9 billion pounds in 1985. The increased production, utilization, and subsequent disposal of petro-chemical compounds known as plastics has created a serious problem of persistent marine debris. Marine ecosystems have, over the years, become the final resting place for a variety of plastics originating from many ocean and land-based sources including the petroleum industry, plastic manufacturing and processing activities, sewage disposal, and littering by the general public and government entities (commercial fishing industry, merchant shipping vessels, the U.S. Navy, passenger ships, and recreational vessels) (Department of Commerce, 1988c).

The impacts of persistent marine debris on the Atlantic Coast golden crab population are not well known at this time, but might include pollution related mortality resulting from ingestion of plastic materials. As part of the NMFS Marine Entanglement Research Program in the northern Gulf of Mexico, fish samples are being collected and evaluated to determine the presence of plastic particles small enough to be ingested by larval and juvenile fish. Researchers have noted the possibility of mapping the distribution and abundance of plastic particles relative to larval and juvenile fish concentrations (Department of Commerce, 1988b). Effective January 1, 1989, the disposal of plastic into the ocean is regulated under the Plastic Pollution Research and Control Act of 1987 implementing MARPOL Annex V.

Recognizing worldwide concern for preservation of our oceanic ecosystems, the Act prohibits all vessels, including commercial and recreational fishing vessels, from discharging plastics in U.S. waters and severely limits the discharge of other types of refuse at sea. This legislation also requires ports and terminals receiving these vessels to provide adequate facilities for in-port disposal of non-degradable refuse, as defined in the Act.

The utilization of plastics to replace many items previously made of natural materials in commercial fishing operations has increased dramatically. The unanticipated secondary impact of this widespread use of plastics is the creation of persistent marine debris. Commercial fishing vessels have historically contributed plastics to the marine environment through the common practice of dumping garbage at sea before returning to port and the discarding of spent gear such as lines, traps, nets, buoys, floats, and ropes. Two types of nets are routinely lost or discarded; drift gill nets and trawl nets (Department of Commerce, 1988c). These nets are durable and may entangle marine mammals and endangered species as they continue to fish or when lost or discarded.

An estimated 16 million recreational boaters utilize the coastal waters of the United States (Department of Commerce, 1988c). Disposal of spent fishing gear (e.g., monofilament fishing line), plastic bags, tampon applicators, six pack yokes, styrofoam coolers, cups and beverage containers, etc. is a significant source of plastic entering the marine environment.

In the mid 1970s, the National Academy of Science (NAS) estimated that approximately 14 billion pounds of garbage was disposed of annually into the world's oceans. Approximately 85% of total trash is

produced from merchant vessels, with 0.7% of that total, or eight million pounds annually being plastic. The use of plastics has risen dramatically since the NAS study. At present, 20% of all food packaging is plastic and by the year 2000 this figure may rise to 40% (CEE, 1987).

The main contribution of plastic to the marine environment from cruise ships is the disposal of domestic garbage at sea. Ships operating today carry between 200 and 1,000 passengers and dispose of approximately 62 million pounds of garbage annually, of which a portion is plastics (CEE, 1987).

The U.S. Navy operates approximately 600 vessels worldwide, carrying about 285,000 personnel and discharging nearly four tons of plastic refuse into the ocean daily (Department of Commerce, 1988a). The U.S. Coast Guard and NOAA operate 226 vessels which carry nearly 9,000 personnel annually and have internal operating orders prohibiting the disposal of plastic at sea. MARPOL Annex V does not apply to public vessels although the Plastic Pollution Research Control Act of 1987 requires all Federal agencies to come into compliance by 1994 (CEE, 1987).

3.2.5.4 Oil and Gas Exploration

Exploration for oil and gas in South Carolina and Georgia's coastal plain has not occurred. The major interest on the Atlantic coast is within the offshore areas. There have been six exploratory wells and one Continental Offshore Strategic Test well drilled in the South Atlantic Planning Area (SAPA). There have been 109 tracts (620,557 acres) leased in the SAPA. Currently, 19 tracts (108,170 acres) are leased in the SAPA. All oil and gas leasing and exploration activities in the Atlantic OCS are presently under a Suspension of Operations (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995). Potential adverse effects associated with offshore petroleum production include development effects from the construction of the pipeline, chronic small spills, and catastrophic spills of crude oil or refined products (Fish and Wildlife Service, 1980). Impacts associated with drilling include the introduction of large amounts of drilling muds into the marine environment. Secondary impacts include the proliferation of on-shore support facilities that could result in greater pressure to develop wetlands. If a pipeline is constructed from the site to the mainland, it is estimated that approximately one to three million cubic yards of dredge material will result from laying the line which would be 150 to 320 miles long. A large oil spill can be lethal to sea birds, marine mammals, marsh vegetation, fish, and invertebrates. Wetland vegetation may suffer from smothering or toxicity. Benthic marine life and larval fishes are often eliminated (Fish and Wildlife Service, 1980). In addition to leases previously mentioned, pre-sale information and Environmental Impact Statements have been prepared for Sales 78 and 90, and for the Final Environmental Report on Proposed Exploratory Drilling Offshore North Carolina (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995). Mobile Oil Exploration & Producing Southeast, Inc.'s Exploration Plan for Manteo Block 467 was rejected by North Carolina's Division of Coastal Management

finding it inconsistent with the State Coastal management Program on November 19, 1990 (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995). The State of North Carolina had previously found Mobil's proposed drilling discharges not consistent with the State's CMP for a National Pollutant Discharge Elimination System Permit with the Department of Commerce on July 27, 1990 (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995). Should Mobil be allowed to drill offshore North Carolina, the laying of pipe to North Carolina's shoreline facilities would likely have to traverse wetlands and/or barrier island grass flats. Local production could be adversely affected by dredging and pipe laying activities. Increased industrial activities could also affect adult and juvenile species behavior, since they react to man-made disturbances. Minerals Management Service has developed an Environmental Impact Statement for 1992-1997 offshore drilling leases and SAFMC recommendations submitted to MMS pertaining to this environmental assessment are contained in Section 3.2.6.

3.2.5.5 Ocean Dumping

The western Atlantic Ocean, including state territorial seas and the EEZ off the eastern United States, have long been used for disposal of such wastes as dredged material, sewerage sludge, chemical waste, plastic waste, and radioactive material. Approximately 149 million metric tons (wet) of dredge material is disposed in estuaries, the territorial seas, and areas of the EEZ along the entire Atlantic coast and Gulf of Mexico. Approximately 27.8 million metric tons (wet) of dredge spoil, is presently disposed of in the EEZ. Composition of dredge material varies among areas with some being contaminated with heavy metals and organic chemicals originating from industrial and municipal discharges and non-point source pollution. The U.S. Army Corps of Engineers classifies only a small portion of the total dredge material as contaminated, but presently has no specific numerical criteria to define such contamination (Office of Technology and Assessment, 1987). The SAFMC has adopted a policy statement on ocean dumping (Section 3.2.6.2) and a policy statement concerning dredging and dredge disposal activities (Section 3.2.6.3).

3.2.5.6 Relationship of Habitat Quality to the Ability to Harvest Golden Crab

Preservation of quantity and environmental quality of estuarine, near shore, and offshore habitat in the South Atlantic region is essential to maintaining golden crab stocks. Discharge of pollutants may result in direct mortality of golden crab at various stages of their life history. Exposure to certain chemicals could limit the desirability or the possibility of consumption, as occurred in bluefish with PCBs. Presently there is no information on the concentrations or occurrence of chemicals such as PCBs or Dioxin in golden crab coastwide.

3.2.6 Habitat Preservation Recommendations

3.2.6.1 SAFMC Habitat and Environmental Protection Policy

In recognizing that golden crab are dependent on the quantity and quality of their essential habitats, it is the policy of the SAFMC to encourage efforts to protect, restore, and develop habitats upon which the golden crab fishery depends; to increase the extent of their distribution and abundance; and to improve their productive capacity for the benefit of present and future generations. For purposes of this policy, "habitat" is defined as the physical, chemical, and biological parameters that are necessary for continued productivity of the species that is being managed. The objectives of the SAFMC policy will be accomplished through the recommendation of no net loss or significant environmental degradation of existing habitat. A long-term objective is to support and promote a net-gain of fisheries habitat through the restoration and rehabilitation of the productive capacity of habitats that have been degraded, and the creation and development of productive habitats where increased fishery production is probable. The SAFMC will pursue these goals at state, Federal, and local levels. The Council shall assume an aggressive role in the protection and enhancement of habitats important to golden crab, and shall actively enter Federal, decision-making processes where proposed actions may otherwise compromise the productivity of fishery resources of concern to the Council.

3.2.6.2 SAFMC Policy Statement on Ocean Dumping

The SAFMC is opposed to ocean dumping of industrial waste, sewage sludge, and other harmful materials. Until ocean dumping of these materials ceases, the SAFMC strongly urges state and Federal agencies to control the amount of industrial waste, sludge, and other harmful materials discharged into rivers and the marine environment, and these agencies should increase their monitoring and research of waste discharge. The SAFMC requests that the Environmental Protection Agency continue to implement and enforce all legislation, rules, and regulations with increased emphasis on the best available technology requirements and pretreatment standards. The SAFMC requests that EPA require each permitted ocean dumping vessel (carrying the above described material) to furnish detailed information concerning each trip to the dump site. This might be monitored with transponders, locked Loran C recorder plots of trips to and from dump sites, phone calls to the EPA when a vessel leaves and returns to port, or other appropriate methods. Also the EPA should take legal action to enforce illegal (short or improper) dumping. The SAFMC requests that fishermen and other members of the public report to the EPA, Coast Guard, and the Councils any vessels dumping other than in approved dump sites. The SAFMC supported the phase out of ocean dumping of the above described materials.

3.2.6.3 SAFMC Policy Statement Concerning Dredging and Dredge Material Disposal Activities

3.2.6.3.1 Ocean Dredged Material Disposal Sites (ODMDS) and SAFMC Policies

The shortage of adequate upland disposal sites for dredged materials has forced dredging operations to look offshore for sites where dredged materials may be disposed. These Ocean Dredged Material Disposal Sites (ODMDSs) have been designated by the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) as suitable sites for disposal of dredged materials associated with berthing and navigation channel maintenance activities. The South Atlantic Fishery Management Council (SAFMC; the Council) is moving to establish its presence in regulating disposal activities at these ODMDSs. Pursuant to the Magnuson Fishery Conservation and Management Act of 1976 (the Magnuson Act), the regional fishery management Councils are charged with management of living marine resources and their habitat within the 200 mile Exclusive Economic Zone (EEZ) of the United States. Insofar as dredging and disposal activities at the various ODMDSs can impact fishery resources or essential habitat under Council jurisdiction, the following policies address the Council's role in the designation, operation, maintenance, and enforcement of activities in the ODMDSs:

The Council acknowledges that living marine resources under its jurisdiction and their essential habitat may be impacted by the designation, operation, and maintenance of ODMDSs in the South Atlantic. The Council may review the activities of EPA, COE, the state Ports Authorities, private dredging contractors, and any other entity engaged in activities which impact, directly or indirectly, living marine resources within the EEZ.

The Council may review plans and offer comments on the designation, maintenance, and enforcement of disposal activities at the ODMDSs.

ODMDSs should be designated or redesignated so as to avoid the loss of live or hard bottom habitat and minimize impacts to all living marine resources.

Notwithstanding the fluid nature of the marine environment, all impacts from the disposal activities should be contained within the designated perimeter of the ODMDSs.

The final designation of ODMDSs should be contingent upon the development of suitable management plans and a demonstrated ability to implement and enforce that plan. The Council encourages EPA to press for the implementation of such management plans for all designated ODMDSs.

All activities within the ODMDSs are required to be consistent with the approved management plan for the site.

The Council's Habitat and Environmental Protection Advisory Panel when requested by the Council will review such management plans and forward comment to the Council. The Council may review the plans and recommendations received from the advisory sub-panel and comment to the appropriate agency. All federal agencies and entities receiving a comment or recommendation from the Council will provide a detailed written response to the Council regarding the matter pursuant to 16 U.S.C.

1852 (i). All other agencies and entities receiving a comment or recommendation from the Council should provide a detailed written response to the Council regarding the matter, such as is required for federal agencies pursuant to 16 U.S.C. 1852 (i).

ODMDSs management plans should indicate appropriate users of the site. These plans should specify those entities/ agencies which may use the ODMDSs, such as port authorities, the U.S. Navy, the Corps of Engineers, etc. Other potential users of the ODMDSs should be acknowledged and the feasibility of their using the ODMDSs site should be assessed in the management plan.

Feasibility studies of dredge disposal options should acknowledge and incorporate ODMDSs in the larger analysis of dredge disposal sites within an entire basin or project. For example, Corps of Engineers analyses of existing and potential dredge disposal sites for harbor maintenance projects should incorporate the ODMDSs. as part of the overall analysis of dredge disposal sites.

The Council recognizes that EPA and other relevant agencies are involved in managing and/or regulating the disposal of all dredged material. The Council recognizes that disposal activities regulated under the Ocean Dumping Act and dredging/filling carried out under the Clean Water Act have similar impacts to living marine resources and their habitats. Therefore, the Council urges these agencies apply the same strict policies to disposal activities at the ODMDSs. These policies apply to activities including, but not limited to, the disposal of contaminated sediments and the disposal of large volumes of fine-grained sediments. The Council will encourage strict enforcement of these policies for disposal activities in the EEZ. Insofar as these activities are relevant to disposal activities in the EEZ, the Council will offer comments on the further development of policies regarding the disposal/ deposition of dredged materials.

The Ocean Dumping Act requires that contaminated materials not be placed in an approved ODMDS. Therefore, the Council encourages relevant agencies to address the problem of disposal of contaminated materials. Although the Ocean Dumping Act does not specifically address inshore disposal activities, the Council encourages EPA and other relevant agencies to evaluate sites for the suitability of disposal and containment of contaminated dredged material. The Council further encourages those agencies to draft management plans for the disposal of contaminated dredge materials. A consideration for total removal from the basin should also be considered should the material be contaminated to a level that it would have to be relocated away from the coastal zone.

3.2.6.3.2 Offshore and Near shore Underwater Berm Creation

The use of underwater berms in the South Atlantic region has recently been proposed as a disposal technique that may aid in managing sand budgets on inlet and beachfront areas. Two types of berms have been proposed to date, one involving the creation of a long offshore berm, the second involving the placement of underwater berms along beachfronts bordering an inlet. These berms would theoretically reduce wave energy reaching the beaches and/or resupply sand to the system.

The Council recognizes offshore berm construction as a disposal activity. As such, all policies regarding disposal of dredged materials shall apply to offshore berm construction. Research should be conducted to quantify larval fish and crustacean transport and use of the inlets prior to any consideration of placement of underwater berms. Until the impacts of berm creation in inlet areas on larval fish and crustacean transport is determined, the Council recommends that disposal activities should be confined to approved ODMDSs. Further, new offshore and near shore underwater berm creation activities should be reviewed under the most rigorous criteria, on a case-by-case basis.

3.2.6.3.3 Maintenance Dredging and Sand Mining for Beach Renourishment

The Council recognizes that construction and maintenance dredging of the seaward portions of entrance channels and dredging borrow areas for beach re-nourishment occur in the EEZ. These activities should be done in an appropriate manner in accordance with the policies adopted by the Council.

The Council acknowledges that endangered and threatened species mortalities have occurred as a result of dredging operations. Considering the stringent regulations placed on commercial fisherman, dredging or disposal activities should not be designed or conducted so as to adversely impact rare, threatened or endangered species. NMFS Protected Species Division should work with state and federal agencies to modify proposals to minimize potential impacts on threatened and endangered sea turtles and marine mammals.

The Council has and will continue to coordinate with Minerals Management Service (MMS) in their activities involving exploration, identification and dredging/mining of sand resources for beach renourishment. This will be accomplished through membership on state task forces or directly with MMS. The Council recommends that live bottom/hard bottom habitat and historic fishing grounds be identified for areas in the South Atlantic region to provide for the location and protection of these areas while facilitating the identification of sand sources for beach renourishment projects.

3.2.6.3.4 Open Water Disposal

The SAFMC is opposed to the open water disposal of dredged material into aquatic systems which may adversely impact habitat that fisheries under Council jurisdiction are dependent upon. The Council urges state and federal agencies, when reviewing permits considering open water disposal, to identify the direct and indirect impacts such projects could have on fisheries habitat.

The SAFMC concludes that the conversion of one naturally functioning aquatic system at the expense of creating another (marsh creation through open water disposal) must be justified given best available information.

3.2.6.4 SAFMC Policy on Oil & Gas Exploration, Development and Transportation

The SAFMC urged the Secretary of Commerce to uphold the 1988 coastal zone inconsistency determination of the State of Florida for the respective plans of exploration filed with Minerals Management Service (MMS) by Mobil Exploration and Producing North America, Inc. for Lease OCS-G6520 (Pulley Ridge Block 799) and by Union Oil Company of California for Lease OCS-G6491/6492 (Pulley Ridge Blocks 629 & 630). Both plans of exploration involve lease blocks lying within the lease area comprising the offshore area encompassed by Part 2 of Lease Sale 116, and south of 26° North latitude. The Councils objection to the proposed exploration activities is based on the potential degradation or loss of extensive live bottom and other habitat essential to fisheries under Council jurisdiction.

The SAFMC also supported North Carolina's determination that the plans of exploration filed with MMS by Mobil Exploration and Producing North America, Inc. for Lease OCS Manteo Unit are not consistent with North Carolina's Coastal Zone Management program.

The Council has expressed concern to the Outer Continental Shelf Leasing and Development Task Force about the proposed area and recommends that no further exploration or production activity be allowed in the areas subject to Presidential Task Force Review (the section of Sale 116 south of 26° N latitude).

The SAFMC recommends the following to the MMS when considering proposals for oil and gas activities for previously leased areas under Council jurisdiction:

1) That oil or gas drilling for exploration or development on or closely associated with live bottom habitat, or other special biological resources essential to commercial and recreational fisheries under Council jurisdiction, be prohibited.

2) That all facilities associated with oil and gas exploration, development, and transportation be designed to avoid impacts on coastal wetlands and sand sharing systems.

3) That adequate spill containment and cleanup equipment be maintained for all development and transportation facilities and, that the equipment be available on site within the trajectory time to land, and have industry post a bond to assure labor or other needed reserves.

4) That exploration and development activities should be scheduled to avoid northern right whales in coastal waters off Georgia and Florida as well as migrations of that species and other marine mammals off South Atlantic states.

5) That the EIS for lease Sale 56 be updated to address impacts from activities related to specifically natural gas production, safety precautions which must be developed in the event of a discovery of a "sour gas" or hydrogen sulfide reserve, the potential for southerly transport of hydrocarbons to near shore and inshore estuarine habitats resulting from the cross-shelf transport by Gulf Stream spin-off eddies, the development of contingency plans to be implemented if problems arise due to the very dynamic oceanographic conditions and the extremely rugged bottom, and the need for and availability of onshore

support facilities in coastal North and South Carolina, and an analysis of existing facilities and community services in light of existing major coastal developments.

The SAFMC recommends the following concerns and issues be addressed by the MMS prior to approval of any application for a permit to drill any exploratory wells in Lease Sale 56 and that these concerns and issues also be included in the Environmental Impact Statement for the Outer Continental Shelf (OCS) Leasing Plan for 1992-1997:

1) Identification of the on-site fisheries resources, including both pelagic and benthic communities, that inhabit, spawn, or migrate through the lease sites with special focus on those specific lease blocks where industry has expressed specific interest in the pre-lease phases of the leasing process. Particular attention should be given to critical life history stages. Eggs and larvae are most sensitive to oil spills, and seismic exploration has been documented to cause mortality of eggs and larvae in close proximity.

2) Identification of on-site species designated as endangered, threatened, or of special concern, such as shortnose sturgeon, striped bass, blueback herring, American shad, sea turtles, marine mammals, pelagic birds, and all species regulated under federal fishery management plans.

3) Determination of impacts of all exploratory and development activities on the fisheries resources prior to MMS approval of any applications for permits to drill in the Exploratory Unit area, including effects of seismic survey signals on fish behavior, eggs and larvae; temporary preclusion from fishing grounds by exploratory drilling; and permanent preclusion from fishing grounds by production and transportation.

4) Identification of commercial and recreational fishing activities in the vicinity of the lease or Exploratory Unit area, their season of occurrence and intensity.

5) Determination of the physical oceanography of the area through field studies by MMS or the applicant, including on-site direction and velocity of currents and tides, sea states, temperature, salinity, water quality, wind storms frequencies, and intensities and icing conditions. Such studies must be required prior to approval of any exploration plan submitted in order to have an adequate informational database upon which to base subsequent decision making on-site specific proposed activities.

6) Description of required existing and planned monitoring activities intended to measure environmental conditions, and provide data and information on the impacts of exploration activities in the lease area or the Exploratory Unit area.

7) Identification of the quantity, composition, and method of disposal of solid and liquid wastes and pollutants likely to be generated by offshore, onshore, and transportation operations associated with oil and gas exploration development and transportation.

8) Development of an oil spill contingency plan which includes oil spill trajectory analyses specific to the area of operations, dispersant-use plan including a summary of toxicity data for each dispersant, identification of response equipment and strategies, establishment of procedures for early detection and timely notification of an oil spill including a current list of persons and regulatory agencies to be notified

when an oil spill is discovered, and well defined and specific actions to be taken after discovery of an oil spill.

9) Studies should include detailing seasonal surface currents and likely spill trajectories.

10) Mapping of environmentally sensitive areas (e.g., spawning aggregations of snappers and groupers); coral resources and other significant benthic habitats (e.g., tilefish mudflats) along the edge of the continental shelf (including the upper slope); the calico scallop, royal red shrimp, and other productive benthic fishing grounds; other special biological resources; and northern right whale calving grounds and migratory routes, and subsequent deletion from inclusion in the respective lease block(s).

11) Planning for oil and gas product transport should be done to determine methods of transport, pipeline corridors, and onshore facilities. Siting and design of these facilities as well as onshore receiving, holding, and transport facilities could have impacts on wetlands and endangered species habitats if they are not properly located.

12) Develop understanding of community dynamics, pathways, and flows of energy to ascertain accumulation of toxins and impacts on community by first order toxicity.

13) Determine shelf-edge down-slope dynamics and resource assessments to determine fates of contaminants due to the critical nature of canyons and steep relief to important fisheries (e.g., swordfish, billfish, and tuna).

14) Discussion of the potential adverse impacts upon fisheries resources of the discharges of all drill cuttings that may result from activities in, and all drilling muds that may be approved for use in the lease area or the Exploration Unit area including: physical and chemical effects upon pelagic and benthic species and communities including their spawning behaviors and effects on eggs and larval stages; effects upon sight feeding species of fish; and analysis of methods and assumptions underlying the model used to predict the dispersion and discharged muds and cuttings from exploration activities.

15) Discussion of secondary impacts affecting fishery resources associated with on-shore oil and gas related development such as storage and processing facilities, dredging and dredged material disposal, roads and rail lines, fuel and electrical transmission line routes, waste disposal, and others.

The following section addresses the recommendations, concerns and issues expressed by the South Atlantic Council (Source: Memorandum to Regional Director, U.S. Fish and Wildlife Service, Atlanta, Georgia from Regional Director, Gulf of Mexico OCS Region dated October 27, 1995):

"The MMS, North Carolina, and Mobil entered into an innovative Memorandum of Understanding on July 12, 1990, in which the MMS agreed to prepare an Environmental Report (ER) on proposed drilling offshore North Carolina. The scope of the ER prepared by the MMS was more comprehensive than and EIS would be. The normal scoping process used in preparation of a NEPA-type document would not only "identify significant environmental issues deserving of study" but also "deemphasize insignificant issues, narrowing the scope" (40 CFR 1500.4) by scoping out issues not ripe for decisions.

Of particular interest to North Carolina are not the transient effects of exploration, but rather the downstream and potentially broader, long-term effects of production and development. The potential effects associated with production and development would normally be "scoped out" of the (EIS-type) document and would be the subject of extensive NEPA analysis only after the exploration phase proves successful, and the submittal of a full-scale production and development program has been received for review and analysis. The ER addressed three alternatives: the proposed Mobil plan to drill a single exploratory well, the no-action alternative; and the alternative that the MMS approve the Mobil plan with specific restrictions (monitoring programs and restrictions on discharges). The ER also analyzes possible future activities, such as development and production, and the long-term environmental and socioeconomic effects associated with such activities. The MMS assured North Carolina that all of the State's comments and concerns would be addressed in the Final ER (MMS, 1990).

The MMS also funded a Literature Synthesis study (MMS, 1993a) and a Physical Oceanography study (MMS, 1994), both recommended by the Physical Oceanography Panel and the Environmental Sciences Review Panel (ESRP). Mobil also submitted a draft report to the MMS titled, Characterization of Currents at Manteo Block 467 off Cape Hatteras, North Carolina. The MMS also had a Cooperative Agreement with the Virginia Institute of Marine Science to fund a study titled, Seafloor Survey in the Vicinity of the Manteo Prospect Offshore North Carolina (MMS, 1993b). The MMS had a Cooperative Agreement with East Carolina University to conduct a study titled, Coastal North Carolina Socioeconomic Study (MMS, 1993c). The above-mentioned studies were responsive to the ESRP's recommendations as well as those of the SAFMC and the State of North Carolina.

Citations:

USDOI, MMS. 1990. Atlantic Outer Continental Shelf, Final Environmental Report on Proposed Exploratory Drilling Offshore North Carolina, Vols. I-III.

USDOI, MMS. 1993a. North Carolina Physical Oceanography Literature Study. Contract No. 14-35-0001-30594.

USDOI, MMS. 1993b. Benthic Study of the Continental Slope Off Cape Hatteras, North Carolina. Vols. I-III. MMS 93-0014, -0015, -0016.

USDOI, MMS. 1993c. Coastal North Carolina Socioeconomic Study. Vols. I-V. MMS 93-0052, -0053, -0054, -0055, and -0056.

USDOI, MMS. 1994. North Carolina Physical Oceanographic Field Study. MMS 94-0047.

Copies of these studies can be acquired from the address below:
Minerals Management Service
Technical Communication Services
MS 4530
381 Elden Street
Herndon, VA 22070-4897
(703) 787-1080"

3.2.6.5 Additional Recommendations to Protect Golden Crab Habitat

The SAFMC is concerned about any deep water drilling, mining, or disposal that might impact golden crab and recommends any project be reviewed for potential negative impacts on the golden crab resource.

3.3 Fishery Management Jurisdiction, Laws, and Policies

3.3.1 State Management Institutions

3.3.1.1 North Carolina

The Division of Marine Fisheries, an agency within the Department of Environment, Health, and Natural Resources, has responsibility for managing coastal fisheries including the shrimp fishery. The division is governed by the North Carolina Marine Fisheries Commission, a body composed of 15 members appointed by the Governor, which is responsible for promulgating regulations for management, protection, preservation, and enhancement of marine and estuarine resources of the state including commercial and sport fisheries regulations.

General statutes deal primarily with licenses, taxes, record keeping, enforcement, and leasing procedures. All other aspects of management, including opening or closing of seasons and areas and gear and equipment restrictions, are promulgated by the Division.

3.3.1.2 South Carolina

The South Carolina Department of Natural Resources, Marine Resources Division, is responsible for conservation and management of the state's marine resources. The Department is governed by a nine member board, the South Carolina Wildlife and Marine Resources Commission. The Division is responsible for managing and developing South Carolina's commercial and recreational shellfish, crustacean, and finfish resources; collecting and analyzing fisheries statistics; evaluating permit applications from the Coast Guard, Corps of Engineers; and the South Carolina Coastal Council; developing environmental impact statements; and developing marine recreational fisheries. The Department is also responsible for enforcing fishery regulations.

Most of the regulatory authority of the Division is specified by statute, including provisions for legal trawling areas, gear restrictions, licenses, and taxes. The Division has control over the shrimp season in coastal waters and any area where trawling is permitted may be opened or closed at any time.

3.3.1.3 Georgia

The Georgia Department of Natural Resources, Coastal Resources Division, is responsible for conservation and management of Georgia's estuarine and marine resources. The Department is headed by a Commissioner and a 15 person board. The Georgia General Assembly, in 1989, passed Act 644 which

empowered the Board of Natural Resources to adopt rules and regulations to control the harvest of seventeen species of marine fish. Enforcement of fishery regulations is the responsibility of the Georgia Game and Fish Division. Many of the regulations pertaining to the shrimp fishery are specified by state legislation. The board has authority to promulgate regulations pertaining to coastal fisheries not contrary to existing statutes.

3.3.1.4 Florida

The Florida Marine Fisheries Commission, created in 1983 and composed of seven members appointed by the governor and cabinet, has full rule-making authority over fisheries and marine life (except endangered species), subject to final approval by the governor and cabinet. The Florida Department of Environmental Protection is charged with administration, supervision, development, and conservation of natural resources within the state. Within the Department, the Marine Research Institute conducts research directed toward fisheries management. The Florida Marine Patrol is responsible for enforcing all marine resource-related laws and all rules and regulations of the Department.

3.3.2 Federal Management Institutions

3.3.2.1 Regional Fishery Management Councils

The South Atlantic Fishery Management Council, under the Magnuson Act, is charged with preparing fishery management plans for fisheries within its area of management authority, from the Florida East coast to the North Carolina/Virginia border. The Council prepares plans that cover foreign and domestic fishing, and submits them to the Secretary of Commerce for approval and implementation. Once implemented, it is the responsibility of the National Marine Fisheries Service (NMFS) and the U.S. Coast Guard to enforce the laws and regulations.

3.3.2.2 Atlantic States Marine Fisheries Commission

The Atlantic States Marine Fisheries Commission (ASMFC) was formed in 1942. The purpose of the Commission is to promote the better utilization of the marine, shell, and anadromous fisheries of the Atlantic seaboard by the development of a joint program for the promotion and protection of such fisheries, and by the prevention of the physical waste of the fisheries from any cause. It is the policy of the Commission that its Interstate Fishery Management Program promote the conservation of Atlantic coastal fishery resources, based on the best scientific information available, and provide adequate opportunity for public participation.

On November 22, 1993, Congress approved the Atlantic Coastal Fisheries Cooperative Management Act. The Act directs the ASMFC to adopt fishery management plans for coastal fisheries, and establishes an affirmative obligation on the part of the states to implement the Commission's plans. The Commission must adopt standards and procedures to ensure that fishery resources are conserved, that

the best scientific information is used, and that the public has adequate opportunity to participate in the process. The Commission is required to continuously review state implementation, and report its results to the Secretaries of Commerce and Interior. If it finds that a state is not in compliance, the Commission must report that finding to the Secretaries of Commerce and Interior. If the Secretary of Commerce agrees with the Commission, he may impose a moratorium on all fishing for the species in question within the offending state until they come into compliance.

3.3.2.3 National Marine Fisheries Service (NMFS)

NMFS, under the National Oceanic and Atmospheric Administration (NOAA), collects commercial and recreational fishery statistics, develops fish stock assessments, and provides technical expertise to facilitate the regional Councils' conservation and management of fisheries through the development of fishery management plans. NMFS responsibilities also include habitat, marine mammals, and endangered species. NMFS shares responsibility for enforcing Magnuson Act regulations with the U.S. Coast Guard.

3.3.2.4 Office of Ocean and Coastal Resource Management

The Office of Ocean and Coastal Resource Management asserts authority through National Marine Sanctuaries pursuant to Title III of the Marine Protection, Research, and Sanctuaries Act. Several sites have been designated marine sanctuaries along the Atlantic coast (e.g., Florida Keys National Marine Sanctuary). This office also establishes standards for approving and funding state coastal zone management programs. A fishery management plan is forwarded to the states to determine if the plan is consistent to the maximum extent practicable with their approved coastal zone management program.

This golden crab management plan has been distributed to North Carolina, South Carolina, and Florida. The State of Georgia is developing a state coastal zone management plan and program; a copy of the plan has been provided to the State of Georgia.

3.3.2.5 National Park Service

The National Park Service, under the Department of Interior, establishes coastal and near shore national parks and monuments such as the Everglades National Park, and retains authority to regulate fishing practices within their area of jurisdiction.

3.3.2.6 U.S. Fish and Wildlife Service

The U.S. Fish and Wildlife Service, under the Department of Interior, manages fish pursuant to the Endangered Species Act (Section 7.4.5) and the Fish and Wildlife Coordination Act (Section 7.4.7). They review and comment on proposed activities affecting navigable waters that are sanctioned, permitted, assisted, or conducted by Federal agencies, focusing on impacts to fish, wildlife, and the habitat on which they depend.

3.3.2.7 Environmental Protection Agency

The Environmental Protection Agency regulates the discharge of pollutants into marine waters. Certain standards must be met before a National Pollutant Discharge Elimination System permit will be issued by the agency.

3.3.2.8 Corps of Engineers

The U.S. Army Corps of Engineers (COE), pursuant to the Clean Water Act, regulates the disposal of dredged material. A number of state and Federal agencies comment on proposed projects which are considered by COE before issuing permits.

3.3.2.9 U.S. Coast Guard

The U.S. Coast Guard shares the responsibility for enforcing regulations promulgated pursuant to the Magnuson and Lacey Acts with the NMFS.

3.3.3 Summary of State and Local Laws, Regulations and Policies

There are no state regulations that apply to the golden crab fishery.

3.3.4 International Treaties and Agreements

Foreign fishing is prohibited within the EEZ for anadromous species and continental shelf fishery resources beyond the EEZ out to the limit of United States jurisdiction under the Convention of the Continental Shelf unless authorized by an international agreement which existed prior to passage of the Magnuson Act and is still in force and effect or authorized by a Governing International Fishery Agreement which has been issued subsequent to the Magnuson Act. There are no pre-Magnuson Act agreements affecting golden crab.

3.3.5 Federal Laws, Regulations, and Policies

3.3.5.1 Magnuson Fishery Conservation and Management Act of 1976

The Magnuson Act provides a national program for the conservation and management of fisheries to allow for optimum yield (OY) on a continuing basis and to realize the full potential of the nation's fisheries resources. Under the Act, eight Regional Fishery Management Councils are charged with preparing fishery management plans for the fisheries within their areas of management authority. The Councils prepare management plans that cover foreign and domestic fishing and submit them to the Secretary of Commerce for approval and implementation. Once implemented, it is the responsibility of the NMFS and the U.S. Coast Guard to enforce the laws and regulations.

3.3.5.2 National Marine Sanctuary Act of 1972

The National Marine Sanctuaries Act (NMSA) of 1972, 16 U.S.C. 1431 et seq., as amended, authorizes the Secretary of Commerce, through an administrative process, to routinely designate national marine sanctuaries. Section 304(a)(4) of the NMSA requires the terms of designation establish the area included in the Sanctuary (FKNMS, 1995); the characteristics of the area that give it conservation, recreational, ecological, historical, research, educational, or aesthetic value; and the types of activities that will be subject to regulation by the Secretary of Commerce to protect those characteristics. This Section also specifies that the terms of designation may be modified only through the same procedures by which the original designation was made. Thus the terms of designation serve as the charter for the Sanctuary.

3.3.5.3 Oil Pollution Act of 1961

The Oil Pollution Act regulates intentional discharge of oil or oily mixtures from ships registered in the U.S. and thus provides some degree of protection to fishery resources. Tankers cannot discharge oil within 92 km (50 nm) of the nearest land. Ships other than tankers must discharge as far as practicable from land. The quantity of oil which can be discharged is also regulated.

3.3.5.4 Coastal Zone Management Act

The Coastal Zone Management Act of 1972 (16 U.S.C. 1451) establishes a national policy placing responsibility for comprehensive land and water management of the coastal zone upon the coastal states. Federal actions directly affecting a state's coastal zone must be as consistent as possible with approved state coastal zone management plans. In the South Atlantic region, North Carolina, South Carolina, and Florida have programs approved by the Secretary of Commerce. In January 1992, Georgia Department of Natural Resources was designated as the lead agency to develop and implement Georgia's coastal management program.

3.3.5.5 Endangered Species Act of 1973

The Endangered Species Act provides for the listing of plant and animal species as threatened or endangered. The taking or harassment of listed species is prohibited. The Act establishes a process which seeks to ensure that projects authorized, funded, or carried out by Federal agencies do not jeopardize the existence of these species or result in destruction or modification of habitat determined by the Secretary to be critical.

3.3.5.6 National Environmental Policy Act

The National Environmental Policy Act requires that Federal agencies prepare environmental impact statements prior to undertaking major activities which might significantly affect the quality of the

human environment. These impact statements are to evaluate any alternatives to the proposed action which may better safeguard environmental values.

3.3.5.7 Fish and Wildlife Coordination Act

Under the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service and the NMFS review and comment on fish and wildlife aspects of proposals by Federal agencies which take place in or affect navigable waters. The review focuses on potential damage to fish and wildlife and their habitat.

3.3.5.8 Fish Restoration and Management Projects Act

The Fish Restoration and Management Projects Act appropriates funds to state fish and game agencies for fish restoration and management projects. Additional funds for the protection of threatened fish communities located within state waters, including marine areas, could be made available under the Act.

3.3.5.9 Lacey Act Amendment of 1981

The Lacey Act Amendments of 1981 strengthen and improve enforcement of Federal fish and game laws and provides Federal assistance in enforcement of state laws. The Act prohibits import, export, and interstate transport of illegally taken fish or wildlife.

3.3.5.10 Commercial Fishing Industry Vessel Liability Act of 1987

The Commercial Fishing Industry Vessel Compensation and Safety Act establishes guidelines for timely compensation for temporary injury incurred by seamen on fishing vessels.

3.3.5.11 Plastics Pollution Research and Control Act (MARPOL Annex 5)

The Marine Plastics Pollution Research and Control Act of 1987 implements Annex V of the International Convention for the Prevention of Pollution by Ships and prohibits all vessels, including commercial and recreational fishing vessels, from discharging plastics in U.S. waters and severely limits the discharge of other types of refuse at sea. This legislation also requires ports and terminals receiving these vessels to provide adequate facilities for in-port disposal of non-degradable refuse, as defined in the Act.

3.3.5.12 Clean Water Act & Water Quality Act of 1987

The Clean Water Act requires that a National Pollutant Discharge Elimination System permit be obtained before any pollutant is discharged from a point source into U.S. waters. Issuance of this permit is based primarily on the effluent guidelines found in 40 CFR 435. However, additional conditions can be

imposed on permit issuance on a case by case basis to protect valuable resources in the discharge area (Department of Commerce, 1987).

The Water Quality Act of 1987 reauthorized and amended the Clean Water Act. The amendment requires the Environmental Protection Agency to identify and establish numerical limits for each toxic pollutant in sewage sludge and establish management practices to achieve the set limits. It also authorized the National Estuary Program to address estuarine pollution, which is probably the greatest threat to the shrimp population on the Atlantic coast.

3.3.5.13 The National Aquaculture Improvement Act of 1985

The intent of the National Aquaculture Act, is to stimulate development of the domestic aquaculture industry, replenish depleted fisheries, and reduce the trade deficit in fishery products. Research and development continues on shrimp mariculture.

3.3.5.14 The Coastal Barrier Resources Act of 1982

The Coastal Barrier Resources Act established a system of 186 undeveloped barrier units comprising 452,839 acres along 667 miles of the Atlantic and Gulf of Mexico shoreline. The barrier island legislation was enacted to create economic disincentives for developing coastal barrier islands by prohibiting expenditure of Federal funds for flood insurance, road and channel construction, and utility construction. Preservation of coastal barriers and associated wetlands helps protect essential shrimp habitat.

3.3.5.15 The Marine Mammals Protection Act Amendments of 1988

The Marine Mammal Protection Act of 1982 prohibited the taking of marine mammals incidental to commercial fishing unless authorized by a general incidental take permit or a small take exemption. On November 23, 1988, PL 100-711 was signed into law reauthorizing and amending the act. The amendments replace existing provisions for granting incidental take authority by commercial fishermen with an interim exemption system valid until October 1, 1993. Exemptions are available only to U.S. vessels or foreign vessels with valid fishing permits issued under Section 204(b) of the Magnuson Act.

3.4 Description of Fishing Activities

3.4.1 Recreational Fishery

There is no recreational fishery for golden crabs due to the depth of water (greater than 600 feet) where golden crab occur and the gear necessary to harvest golden crabs (golden crab pots and large hydraulic pot haulers).

3.4.2 Commercial Fishery

The following information is from a trip Gregg Waugh, SAFMC Staff, took aboard the Nielsen's vessel "Lady Mary" and from a presentation by fishermen at the April 1995 Council meeting. The Council wishes to thank the Nielsen family for providing Council staff the opportunity to observe their fishing operation first hand and for their time and effort spent briefing the Council on the golden crab fishery and their fishing operation. Development of this fishery management plan would have been much more difficult without the cooperation of the Nielsen family and all the other fishermen who have cooperated.

Overview of Fishing Operation

A typical trip begins at 3:00 a.m. as the vessel leaves the dock in Ft. Lauderdale. They steam south through the intracoastal waterway and at around 7:30 a.m. get ready to pick up the first string of traps. On the ride out the bait wells that will be put in the traps are prepared. The bait consists of fish heads and frames that are available, i.e., snapper grouper species, mackerel, or any other species available from a fishhouse or dealer.

Buoys are not used due to problems with the current. Trap location is noted using LORAN. The tricky part of the operation is grappling the mainline around 1,000 feet below the surface. Successfully hooking the mainline depends on the currents and sea conditions. At different times of the year, when the current is not running as fast or depending on direction, it is easier to get the grapple on the bottom. The grapple, consisting of links of large chain, is used to hook the mainline towards one end of the string. On the observed trip, there was never anything on the grapple. Sometimes you get a little bit of mud coming up on the trap itself. Once the grapple hooks the mainline, the line is pulled up and looped over the pulley, and they pull towards the first trap. The string is worked towards the short end of the line, stacking the traps on board. Upon reaching one end of the string, the vessel turns around and they pull towards the other end of the string of traps.

The traps have two entrances, one on the top and one on the bottom. As they bring each trap aboard, the empty bait wells are replaced with full bait wells. There is a spike coming up from the bottom side of the frame that the bait well sticks into. Traps are stacked on the stern of the boat and there are approximately 30 to 35 traps on a string. By the time they get the string in, there is approximately two and a half miles of line on the boat. The traps go out from the stern of the vessel which is open; they drop a weight on the other end and take a LORAN fix and then run the string out.

There's a large ice hold towards the stern of the vessel. As the traps come on board, the crabs are removed by hand. The crabs go straight into plastic boxes or coolers where they are layered with ice. In the plastic containers, the crabs are placed half way up, a layer of ice, then more crabs and then a layer of ice. They don't spend hardly any time at air temperature. Each crab is checked as they are removed from the trap. The crabs are somewhat lethargic when they come up, but not entirely, and you have to be careful handling them. Of the three strings they pulled (about 100 pots), there were only about 20 to 25

crabs thrown back over the side. Any small crabs less than a pound and a quarter get thrown over the side as well as all females. The reason so few crabs are released at the surface is because of the escape panels, with the largest part of the culling being done on the bottom. Thus the crabs aren't even retained in the traps which demonstrates how effective culling is with escape gaps.

The traps are wired shut with a metal wire that is defined now in existing black seabass pot regulations as a latch or some mechanism to hold a latch that is considered degradable. The bait wells which sit down on the spike are also wired in on two points from the top using the same type of wire.

The largest crab they measured was approximately 190 millimeters carapace width and according to the Nielsen's was one of the largest, if not the largest, they have found. This crab weighed four pounds or a little over. Out of all the crabs they caught that day, there were two berried females and, of course, they were released. There was one string of traps left out longer than the others which had about a 10-day soak, and the crabs in that string of traps were larger than the others. Once the bait is gone after about ten days, you will find the escape rate increases.

It takes about two hours to work a string of traps. The determining factor in how long they'll be out fishing on a particular day is how fast they can grapple each string of traps.

They are only harvesting male crabs because fishermen felt from the start one of the integral parts of protecting this resource was not to harvest the females. The females are smaller and would have less meat in them and are less marketable.

Detailed Trap Description

The evolution of trap design was described by Mr. Nielsen, Sr. (presentation at the April 1995 Council meeting). They have been fishing for golden crab for the past ten years. It was in 1992 they went full-time commercial at this. The first trap they built was 6 feet long, 4 feet wide and 30 inches high and very cumbersome. It had a yield of 100 pounds per trap when they first started in this fishery. The trap they brought to display is the 1995 model as every year he has changed it. Hopefully he thinks trap design is at the point where there should not be any more changes. The materials of the trap include 3/8" smooth rebar and is available in Ft. Lauderdale. The smooth rebar makes it a lot easier to put the stainless steel hog rings on them to hold the wire in place. The trap is 4 feet long, 30 inches wide, and 18 inches high. The wire is 1" X 2" mesh and 14 gage galvanized with a plastic coating on it. The zinc in the corner is zinc they put on the traps. If you don't put it on, in 11 months, from the experience they've had in the past with fish traps, the wire would totally disintegrate. The zincs are replaced when they wear out and when the electrolysis attacks the zincs, it wears. In a period of four or five months, they replace them and put a new one on which protects the trap because the wire that holds the zinc is bonded to the frame and to the wire and the coating is taken off the wire to make the bond. Traps have about $100 worth of material in them.

The trap has two funnels in it. About a year ago as they proceeded to go deeper for the golden crabs, and there were problems with the currents and grappling methods. They started ten years ago in 700 feet

and they are now working in 1,000 feet. If he were to say we won't be able to go much further, he'd be lying to himself as it seems like they are able to keep creeping out there and finding new ways to do it. It's been a real learning experience in this fishery and something they have spent a lot of time and money doing. When they were out to 900 feet they had no problem with the trap turning over and they had a funnel in the center of the trap. When they got out further, they found conditions changed and they do not know what changed, but out of 30 traps, 9 traps in the middle of the trawl would be upside down and the funnel would be covered so no crabs could go in the trap. The only crabs that did go in the trap were the smaller ones that went through the escape holes. It concerned them for several weeks and they finally came up with the idea of taking the funnel out of the center and staggering it to one side as well as putting one on the bottom and staggering it to one side. This way, if the trap landed upside down, it was still able to catch crabs. It worked and it worked well.

The bait container is something they devised. They are put upside down and you throw your bait into them. The bait consists of cod fish, snapper, grouper, dolphin, mackerel, and anything they can get their hands on at the markets-that's heads and racks. They fill it up with bait, close it down and hook it. When the trap comes up, the old bait container comes out and a new container goes in. The spike on the bottom is to hold the bait container in the trap. They use degradable wires to lock the trap. To release the wires, they cut them off. They are inexpensive and they buy them by the thousands. They are efficient. Regarding the bait, per year, for catching golden crabs, the bait goes in the water to catch golden crabs plus feeding smaller crabs and other animals on the bottom; 65 tons of bait per year is used. That's a very conservative figure. They've always tried to do their best in any fishery they have been in. They certainly want a trap that has degradable panels on it and bait to feed the crabs and invertebrates. They feel they are putting something back into the ocean.

The back of the trap opens for emptying purposes and is closed with two degradable wires that are just twisted. The wires are cut off every time they haul a trap on the boat for expediency and the efficiency of opening up the back door of the trap. The door is lifted up and held open by a bungee cord. The crabs are then taken out of the traps. This could be and is an escape panel that can open up when the wire degrades if the trap becomes lost. They don't seem to have a problem with it because you're looking at a trap now they built themselves and is very complex. He has a fit when they lose one. They probably lost ten traps in the last ten years. They do not like to lose traps and try to make sure they don't. The front of the trap has an escape panel. The hole he has cut in there is larger than the narrow part of the throat to the funnel so that if the trap gets lost, the panel falls off and the crabs are able to get out. One thing they feel is the escape panels are fine. They know they have to have them, but they also feel, as Mr. Waugh said, in one trawl they hauled that had a 10-day set on it had larger crabs but less crabs than other trawls they are setting for shorter periods of time. He just visualizes a golden crab reaching up and grabbing the funnel with his claw from inside the trap and pulling himself up. He feels if he was a crab, he could come out of this trap easily. If you could see it at the bottom of the ocean and had a camera for 10 to 12 days, you would

see a lot of crabs going out of the trap. He doesn't believe you would catch a crab if you didn't put any bait in it. Crabs like to eat. When they fill the container full with bait, if they don't get back to the gear in 7 to 8 days, it all turns to bones. Bones are calcium for the crabs and they need it for their shells to get hard. He believes this is when the crabs start working their way out of the trap.

The regulations that were proposed require either the front end panel or the back panel, and with the two degradable wires, would be sufficient. Either one would suffice for a regulation and they would certainly approve of it. The rope around the trap is for the purpose of chaffing on the deck of the boat so the fiberglass isn't damaged. It's just for protection of the boat itself and not so much for the bottom. The bottom of the ocean, as they pointed out to Mr. Waugh, is a sandy, clay bottom where they are fishing and they have no problem with traps chaffing on the bottom of the ocean. There is about a 6-foot gangion that ties on to a ground line that goes to the next trap. The traps are about 70 fathoms apart and about 2 1/2 miles of half-inch line going out of the boat to take care of thirty of these traps. Two and half miles is a long way to go and the rope is very expensive. They've put a lot of time and money into the fishery the past three years and now they've got it down. The market has opened up for them and they are here to get some regulations.

Regarding the escape gaps, from day one in the picture they passed around, they couldn't put escape gaps and nylon webbing thus they made stainless steel rings. The original ring he had, when they really didn't know better, was 5 inches in diameter. It would let about a 1 1/2 pound crab out. The new ring is 4 1/2" in diameter. He designed it to be very similar to the cross-section of the rectangular escape gap they put in the trap. It's pretty close to allowing the one-pound crabs to get out. The escape gap they cut-in was very simple and works very nicely on the wire, three meshes up and two meshes this way. It's suppose to be 3"X4" but if you measure it out, it's actually smaller than that. It's 3 7/8" long and 2 7/8" high. They like it; it's easy, practical and allows that small crab, as well as, females to get out of the trap so they don't have to bring them up in 1,000 feet of water and then throw them back in the water again.

Mr. Nielsen, Jr. said when they first started making these traps, they forgot to cut the hole in a couple of them. There were two traps and they put them in the ocean. When they hauled one of the traps up, it was literally three-quarters full of undersized, immature crabs which surprised him. At the meeting Mr. Ulrich was at in Tampa approximately 10 years ago, he asked where all the little crabs live as they don't see them. At the time, they were using the monstrosity trap and it had a 5-inch mesh on it and all the little crabs were going right through the mesh. Then they used this trap with the escape panel and they didn't see any baby crabs. Then, all of a sudden after they forgot to cut the hole, the trap came up loaded with them. He wanted, when Mr. Waugh was coming down, to cover some of the holes so that he could see this for himself; however, the weather was bad and he didn't have a chance to get out and do it. He said the crabs are there sitting, however, they just don't see them because of the escape holes. The escape rate of the small crabs is amazing. The larger crabs are more aggressive. The smaller ones probably go in there to eat and when the larger ones come along, he's not sure if they chase them off. He doesn't have any scientific

reason to believe that other than he saw what happened without the escape gap. He would have to attribute it to aggression.

Mr. Nielsen, Jr. said on the escape hole, they've moved them up and down. Originally they started about 4 meshes up. They really haven't seen much difference at all. They like it on the side of the trap as opposed to top or bottom. If this trap lands on one side, they still have one on the other side which is the whole purpose for two of them.

Mr. Glenn Ulrich (SC DNR) said it was interesting what they said about the escape panels being covered up and they caught the small crabs. They had no escape panels in their traps and caught very few crabs. As he pointed out, 90% of the catch was over a 4" carapace crab. It may be a healthy indication of the population in their area that there are small crabs there. Also, he's amazed they haven't experienced a much higher bait loss. He asked if they ever find the three-quarters to an inch isopods in their bait well. He doesn't think their bait would last no matter how much they put in there.

Mr. Nielsen, Sr. said they call them sand fleas and have seen them in New England. They will cover that whole bait well and eat the flesh right down. In the area they are fishing, they don't see them concentrated. Maybe they come off the bait on the way up. As he said, 7 days with this container full of bait, it will take 7 days before they wear it down. You've got to remember, you were using herring which is a very soft fish with very small bones, whereas, they are using cod fish, dolphin racks and heads and even though it ends up being bones, it's still part of the bait system they are hanging on to.

Dr. Joe Kimmel (NMFS SERO) asked if they use exclusively this type of trap anymore? Mr. Nielsen, Jr. said yes, they use the newer type trap. Dr. Kimmel asked how many traps they said they put on a line? Mr. Nielsen, Jr. said 35.

OTHER ASPECTS OF THE COMMERCIAL FISHERY

Bait

In Ft. Lauderdale they have a huge wholesaler who services restaurants and they're lucky that he gives the heads and frames to them; they're lucky because it is very expensive these days. They were asked if several other boats get into this fishery, is bait going to be available for everyone? Mr. Nielsen Jr. said you don't have to use racks and heads. You can get mullet, porgies, mackerel heads, shark heads. There are all kinds of bait available if you want to buy it. In the south Florida area, most of the fish heads go into the dump. They are not utilized. From his perspective, they are serving a very valuable service to the community in taking 65 tons of stuff that would go to their dump in south Florida.

Mr. Fulton Love (Council member, Georgia) asked if they have ever tried any different size mesh in their bait well? Maybe using a smaller mesh would help solve the problem of bait loss; or have they tried moving the escape holes anywhere and if you have, has it worked the best where they are now? Mr. Nielsen, Sr. said some fishermen have taken plastic bottles with the big covers on them like mayonnaise bottles and put 1/8" holes to keep the isopods out so they wouldn't eat the bait down. It probably would

work, however, they decided on a 1" X 1" mesh to allow the crab to get in there and pull some of the meat out. He's in there doing that and the other crabs are on the outside, and he thinks it's going to entice the other crabs to go in there a lot better. They don't have any problem as far as the bait disappearing in two or three days as theirs lasts for about 7 days. What works, they go with and they don't see much sense in making the mesh any smaller. They feel larger would be no good because it would allow the bait to come out. You also have to remember, it's the smell of the bait that draws the crab on the bottom of the ocean. The more bait you pack in there, the more smell is getting out and the more the trap is efficient for catching the crab.

Predation and Dead Crabs

Fishermen were asked if they run into problems with predation as has occurred in the Carolinas? Do they have any lines being cut by sharks? The fishermen said no. Dr. Kimmel asked if they ever catch crabs that are dead when they get them to the surface. Mr. Nielsen, Jr. said every once in awhile they will have a crab that is dead in a trap. They don't know what kills it as the crab is intact and the whole interior of the crab has been eaten by those little tiny isopods. It's very rare. He has not, to this date, seen cannibalism in crabs which is very unusual in a crustacean. He's never seen a crab come up where its legs are chewed down to its body like you would see in a New England lobster or different crab.

Release Survival

On the issue of release survival, Mr. Nielsen Jr. didn't think there would be that much, but there was one project that tried to tag them electronically and one crab was recaptured. They've been maintained in tanks in South Carolina and the Gulf for months after capture, thus they do survive.

Interaction With Other Vessels

You wouldn't think out at the depths being fished you would have potential competition with other vessels but as they were setting out the line, there was a sports fisherman who was coming across the stern and had to be waved off so they wouldn't go over the line as it was going out over the stern.

Incidental Catch

One of the concerns with any fishery is bycatch and he doesn't feel you could design a more perfect fishery. In the whole trip, they caught two live isopods; there were two shells of isopods and one Jonah crab out of approximately 100 traps that were pulled.

Commercial Fishery in the Gulf of Mexico

The fishery in the Gulf of Mexico was described in a memo to Dr. Andrew Kemmerer from William Antozzi (NMFS SERO) dated April 5, 1995:

"The fishery for golden crab initially developed in the mid 1980's (1984-1986). The three companies involved were based in Mobile, Miami, and St. Petersburg. At most, five or six vessels were involved at any one time. Unfortunately, landings figures are not available since a statistical category for golden crab did not exist. The Gulf and South Atlantic Fisheries Development Foundation funded a Florida Sea Grant project to assist in the development of the golden crab fishery (report produced May, 1994). The Florida Bureau of Seafood Marketing produced recipe brochures. Although a fishery continued operating sporadically out of southeast Florida, the GOM fishery went dormant until it's recent revival.

Two Alaskan vessels arrived in the GOM with the beginning of the 1995 new year. Using Port Manatee, Florida as a home base, the vessels operate crab trap longlines far from shore and in very deep water (ie: 150 miles and 300 fathoms). Male crabs are targeted because of their significantly larger size, as compared to females. This is possible because golden crabs depth-stratify by sex.

The re-development of the GOM golden crab fishery is happening at a time when there is a dearth of large crabs in the marketplace. The Alaskan snow crab fishery closed on Feb. 17 when the quota of 55 million pounds was reached. Snow crab has been on a precipitous decline since record landings of 357 million pounds occurred in 1991. Other Alaskan crab fisheries (king and tanner) are also depressed. This fits a pattern: the 1984-1986 golden crab fishery also took place during a snow crab shortage. Not coincidentally, golden crab is very similar to snow crab in size and meat quality. Snow crab quotas are expected to begin rising as recruitment of a large year class to the fishery occurs during the next few years.

Presently, there are approximately 300 mostly idle crab vessels in Alaska, waiting for the next crab fishery opening to occur in November. Should we expect more vessels to relocate to the GOM to participate in the golden crab fishery? So far, a mass migration has not materialized. Reportedly, a third Alaskan crab vessel is on the way to join the current operation (steaming time is 4-5 weeks). However, the "jury is still out" as to the profitability of this fishery. This uncertainty is expected to dampen the expansion of the golden crab fishery for the near future."

In addition, NMFS observers have made several trips on commercial operations in the Gulf of Mexico. This information was requested but was not made available to the Council.

3.4.3 Discards and Bycatch

Bycatch associated with deep water trapping of *Chaceon* was studied in the north central Gulf of Mexico by Perry et al. (1995):

"Bycatch associated with deepwater trapping of *Chaceon* is reported for outer shelf and slope waters of the north central Gulf of Mexico. Bycatch was dominated by the isopods, *Bathynomus giganteus*. Other crustacean megafauna consisted of the majid crab, *Rochina crassa*, and the portunid crabs, *Benthochascon schmitti* and *Bathynectes longispina*. Finfish bycatch included hagfish, *Eptatretus springeri*, deepwater shark, *Centrophorus uyato* and hake, *Urophycis cirrata*."

Based on one observer trip made by Gregg Waugh (South Atlantic Council staff) on the Nielsen's boat, the observed bycatch from approximately 100 traps consisted of 2-3 large isopods and one Jonah crab (*Cancer borealis*).

3.4.4 Interactions with Threatened and Endangered Species

Five species of sea turtles regularly spend part of their lives in U.S. coastal waters of the Atlantic Ocean and Gulf of Mexico. These species are Kemp's ridley, *Lepidochelys kempii;* loggerhead, *Caretta caretta*; green turtle, *Chelonia mydas*; hawksbill, *Eretmochelys imbricata*; and leatherback, *Dermochelys coriacea.* These sea turtles are either threatened or endangered and are protected under the Endangered Species Act. Section 7.3 lists the whales that occur in these areas; the manatee is also present.

Available information indicates that in the golden crab fishery there is no interaction with threatened and endangered species.

3.4.5 Competition and Conflict

Traps are set in strings of 30-35 traps per string and are set in very deep water. Golden crab habitat is limited in areas and when combined with increasing fishing effort, the potential for competition and conflict increases. Reports of limited gear conflict have surfaced in the Florida Keys among trap fishermen using cable and rope mainlines. Recreational fishing vessels have had to be waived away from the trap line as it was being set in the southeast Florida area where vessel congestion is a problem. In addition, conflict with golden crab traps and pelagic swordfish longlines has been reported on the Florida east coast and in the Gulf of Mexico. A fishermen in the Gulf of Mexico reported losing several miles of longline gear.

3.4.6 Assessment and Specification of Domestic Annual Harvesting Capacity

Data available on golden crab catches in the South Atlantic Council's area of jurisdiction are limited. Georgia does not have any recorded landings of golden crab although some exploratory fishing has taken place in the past. South Carolina recorded no landings since 1990 but did record approximately 15,000 pounds in 1987; additional exploratory fishing has taken place in the past. No information was available from North Carolina. Detailed catch information for 1986-part of July 1995 summarized by year, coast, dealer and SPL (fisherman) was provided by Florida DEP (Martha Norris, pers. comm.). Florida west coast data was separated from Monroe County landings. Monroe County landings are almost all from the South Atlantic Council's area of jurisdiction (Ed Little, NMFS Port Agent). Catches as reported in the Florida data, increased from less than 25,000 pounds in 1986 to 508,000 pounds through part of July 1995. Data as of November 22, 1995 indicate 670,767 pounds have been landed in Monroe County and the east coast of Florida.

Catch data from eight fishermen and from the State of Florida indicate that the harvesting capacity of the 36-38 vessels thought to be fishing would exceed any reasonable estimate of MSY. Current estimates are that 80 individuals qualify for all zones and an additional 33 qualify for the northern zone. A fleet of this size would greatly exceed any reasonable estimate of MSY. The Council concluded that the capacity of the domestic fleet exceeds the amount of available resource and is proposing to limit the number and size of vessels by area in the fishery.

3.4.7 Assessment of Extent to which U.S. Fishermen will Harvest Optimum Yield

Optimum yield (OY) is all golden crab that are harvested legally under the provisions of the golden crab fishery management plan which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels, minimize the cost of fishing, produce a stable level of landings that would maximize returns to the fishermen, provide for a stable supply, and minimize management costs. Given the Council has concluded that it is necessary to limit the size and number of vessels by area in this fishery to prevent overfishing, the domestic fleet will harvest all of the optimum yield.

3.4.8 Assessment and Specification of Domestic Annual Processing Capacity

Domestic processing capacity at present exceeds the availability of domestic golden crab. There is a processing facility in Marathon and one in Tallahassee.

One major processor (Deep Atlantic) of golden crab is located in west central Florida and was visited by Council staff in July 1995. The processing plant has been in operation since January 1, 1995 and utilizes state of the art technology. The plant has storage facilities capable of holding up to one million pounds of product. The cold storage facility can be partitioned so that the area being refrigerated is reduced when product volume is low.

The crab arrive at the plant from both the east and west coast of Florida including the Keys in 150 lb containers. Product is delivered live to the plant where it is split, cleaned, and washed. It is then placed in 20 lb or 50 lb containers, depending upon the final destination, and steamed for approximately 18 minutes. The process is mostly automated once they have been placed into the smaller containers as they travel along conveyors or are hoisted by lifts. Once cooked, the crab are again washed then placed in brine tanks where the product is frozen. The frozen clusters are dipped in fresh water to retain a glaze which aids in preservation but also adds an aesthetic appeal to the crab. It is then boxed for storage and/or delivery.

At the time, the plant had 40 employees who were working part-time since landings for golden crab had been sporadic. At full capacity, the plant was expected to employ 100. The largest amount of crab processed had been 33,000 lb in one week, but most weeks had been far less due to the lack of product. The plant had three boats which were to sell direct. Another was being outfitted and would soon be fishing.

Only one dealer on Florida's east coast indicated processing and grading golden crab. This dealer wholesales the finished products in the domestic and export markets. Approximately 15 to 17 people are employed by this dealer when processing a steady supply of golden crabs.

3.4.9 Historical and Projected Transfers from U.S. Harvesters to Foreign Vessels

There is no evidence of historical or projected transfers of golden crab or golden crab products from U.S. harvesters to foreign vessels.

3.4.10 Foreign Fishing Activity

There is no foreign fishing activity or foreign catch of golden crab. There are no golden crab in the EEZ in excess of the domestic fishery's ability to harvest optimum yield, thus total allowable level of foreign fishing (TALFF) is zero.

3.4.11 Interactions Between Foreign and Domestic Participants

As there are no foreign participants in the golden crab fishery, there are no interaction between foreign and domestic participants. Neither are there interactions between domestic golden crab fishermen and foreign fishermen of other fisheries.

3.5 Description of the Economic Characteristics of the Fishery

Official reports of golden crab landings date back to 1986 although fishermen indicated they had landed golden crab in the early 1980s. The fishery mainly occurs at depths in excess of 700 feet. Some fishermen claimed to have fished for golden crab at depths up to 1,800 feet. Vessel size ranges from 34 feet to 180 feet in length. Approximately 58% of the vessels have fiberglass hulls, 32% have steel hulls and 11% have wooden hulls. These vessels are six to 27 years old. Crew size ranges from two for the smaller vessels to seven for the larger vessels. The smaller vessels operate in south Florida where the continental shelf is narrow. This makes it possible for fishermen to reach deep waters within six to ten miles offshore. Most of the vessels that operate off south Florida are also involved in the mackerel, stone crab or lobster fisheries. The larger vessels have only entered the golden crab fishery recently.

The number of vessels presently in the fishery cannot be determined with any certainty. This is because the Florida trip ticket system allows reporting by individual or vessel saltwater products license (SPL). In some cases, two or more SPLs are associated with one vessel. However, it is estimated that as of September 1, 1995 between 80 and 120 individuals have made landings of golden crab from the South Atlantic region.

Data provided by the industry indicate that average catch per trip ranged from 150 pounds for small vessels to 8,800 pounds for large vessels in 1995. The average trip length ranged from one to seven days. The minimum gross revenue per day needed to break-even was $150 for the smallest vessel and $8,000 for the largest vessel. Also, vessel variable costs per trip ranged from $100 to $10,000. Most of the information concerning vessel fixed costs included refitting and gear costs in computing vessel fixed costs per year. Thus, this information is not representative of actual vessel fixed costs. Crew share as a percentage of gross revenue ranges from 12.5% to 60%. Between January and July 1995, the average exvessel price per pound ranged from 99 cents to $1.20. Based on these figures, the average gross revenue per trip was $8,800 for the largest vessel and $150 for the smallest vessel.

3.6 Description of the Businesses, Markets, and Organizations Associated with the Fishery

The golden crab fishery is relatively new and the market has only started to develop. It was reported that one fish dealer in South Carolina handled golden crab during the early part of the 1980s. Recent information on this sector of the fishery indicate all of the dealers are located in Florida. At least two of the major dealers/processors are located on Florida's west coast. There are about five to seven dealers on the east coast. One of the dealers on the east coast indicated handling golden crab since 1983. Each dealer on the east coast handled between 10,000 pounds and 80,000 pounds of golden crab in 1994. (It should be noted that some of these dealers handle golden crabs harvested from the west coast.) This represents between 5% and 15% of their gross sales in 1994. As of September 1, 1995 these dealers have handled between 5,000 pounds and 400,000 pounds. Two dealers expect to handle close to 1.0 million pounds each by the end of 1995.

Only one dealer on the east coast of Florida indicated processing and grading golden crab. This dealer wholesales the finished products in the domestic and export markets. Approximately 5% of the products are currently exported to Japan and Taiwan. The other dealers/retailers on the Florida east coast keep golden crabs in live tanks and sell them as live products. They supply mainly restaurants and local consumers. Presently, prices have dropped due to the influx of Canadian crabs into the U.S. market. Dealers are reluctant to discuss prices because it creates problems for them with their clients. However, it is estimated that there is a mark– up of 50% to 100% on the exvessel price depending on market conditions. It is difficult to determine the number of people employed in processing golden crabs since these people are involved in processing other fish products for the most part. The dealer on the east coast of Florida that processes and exports golden crabs indicated that 15 to 17 people are engaged full-time in processing golden crabs at his plant when they have a steady supply.

The following report on market status was provided by Bill Antozzi (NMFS SERO; FAX dated 10/20/95):

"The re-development of the golden crab fishery is occurring at a time when other types of large crabs are in short supply (i.e., snow crab and king crab). This shortage has created a market environment conducive to the re-development of golden crab. The fishery developed initially in the mid-1980's when the last acute crab shortage occurred. Golden crab is partially filling the void because its taste and texture is very similar to the better known crabs, and it can be marketed in the same form - cooked clusters (2 sections consisting of half the body, legs and claws). As with king and snow crab, the golden crab sections are heated and served without further preparation. The consumer cracks the shell, removes the meat, and typically dips it in garlic-butter before eating.

The marketing of golden crab, however, is at a disadvantage when compared with snow crab marketing due to the fact that the shell does not turn red when cooked (as do the shells of king and snow crab). This red color is an important factor in consumer recognition/appeal. Golden crab wholesale prices are lower (roughly about two dollars a pound less than snow crab), and are greatly influenced by snow crab prices because, even thought snow crab is in short supply, it is still in much greater supply than golden crab.

I have been alerted by dealers in golden crab that they are experiencing market resistance to golden crab. An unlikely turn of events has precipitated this scenario. Early in the year, the short season on U.S. snow crab resulted in speculative buying by domestic companies of available supplies which they hoped to

sell later at high prices to Japan (normally a major buyer) and other markets. Unfortunately, Japanese buyers decided that the price was too high and made a decision (possibly in collusion) not to buy large quantities. In addition to this situation, the Canadian Atlantic production of snow crab reached a record this summer of 136 million pounds. As a result, wholesalers sitting on inventories finally "panicked" and began lowering prices. NMFS Market NEWS data (Seattle) shows that during the period of March to October, 1995, the wholesale price for Alaskan snow crab (5-8 oz. clusters) dropped as much as $1.50 per pound. This development has caused additional market resistance to golden crab (i.e., buyers are opting for snow crab at the new, lower price instead of golden crab). Significant downward pressure on the golden crab price structure is occurring, according to dealers.

There are indications that market resistance to golden crab due to snow crab may ease in the near future. Japanese buyers are expected to move to take advantage of lower prices for snow crab, which will firm up the soft snow crab market. In turn, golden crab markets are expected to improve.

Briefly, here is the outlook for the 1996-97 period. Fishery managers in the Northwest have arrived at a new quota of 51 million pounds for Alaskan snow crab (opilio) for 1996. This is slightly less than the 1995 quota of 56 million pounds (75 million pounds were actually landed). This bodes well for golden crab marketing in the near future, because it continues the overall short supply situation of snow crab (as a point of reference, Alaskan opilio snow crab landings reached the 350 million pound level in 1991). However, biologists are expecting snow crab to begin to rebound beginning in 1997, based on evidence of large numbers of immature opilio snow crabs. Hence, the expected outlook is for reasonable golden crab prices during 1996, and then for potentially lower prices in succeeding years if rebuilding of snow crab stocks and resultant increases in production occur. Any progress that the golden crab industry can make toward establishing a niche market will alleviate impacts caused by the recovering snow crab fishery."

3.7 Description of the Social and Cultural Characteristics of the Fishery

Fishing for golden crab in the South Atlantic region has been an occasional enterprise since the mid-1980s among fishermen in southeast Florida and South Carolina. Fishermen from south Florida supplemented their income by making trips to experiment with trapping golden crab by modifying fish traps used in the snapper/grouper fishery. South Carolina fishermen converted longline boats and worked the deep waters of their coast traveling as far as 100 miles offshore. Because of the depth fished, strong currents, and difficulties in handling golden crab there have been obstacles to developing both the fishery and a market for this product.

In the late 1980s fishermen from south Florida developed a golden crab trap and a method of handling golden crab that seemed to provide a stable harvest. In addition, a local market developed which provided incentive for expansion of the fishery (Lindberg and Wenner, 1990). Today, interest in the golden crab fishery is growing with vessels from Alaska and New England expressing interest in entering the fishery.

The fishery has grown substantially since the Council began consideration of a control date at its February meeting. At that time, information from fishermen suggested there were two boats fishing for golden crab in southeastern Florida. These individuals had been able to create a small local market for their crab but wished to ensure a sustainable market over time. To do that, they encouraged others to enter this fishery in order to expand the market through increasing supply and hopefully creating more demand for the product. There was some evidence of an expanding market due to a decline in the supply of snow crab from

Alaska. Since that time, fishermen and those involved in the intermediate sector, have concluded that the golden crab is carving out its own niche in the market. With this and other information, the Council decided to implement a control date at the February meeting which was published in the Federal Register on April 7, 1995.

The Council was made aware at its April meeting that there was an 85-foot vessel fishing off Florida's northeastern coast and that a much larger vessel from Alaska (180 feet in length) was being outfitted in Green Cove Springs, Florida. In addition, the Council was informed that a processing facility was presently operating in Tallahassee, Florida which would handle golden crab, exclusively. Several other individuals at the scoping meeting indicated they had entered or were anticipating entry into the fishery. One individual indicated he had been fishing off Florida's east coast and in the Key West area. He was processing crab on board his vessel, butchering, cooking, and freezing. Another stated he was outfitting a 120-foot vessel and expected to be fishing within the next few weeks.

With growing interest in the fishery, the Council decided to proceed with development of a fishery management plan. Council staff continued to receive inquiries concerning this fishery with more than 30 phone calls by the end of July. Because this fishery was relatively new, in that there has not been a sustainable fishery in the past, there was little socio-cultural or economic data concerning the participants. During the public hearing process, fishermen who volunteered information concerning their participation in the fishery allowed Council staff to develop a rudimentary profile of the fishery. During public hearings held in Charleston, SC; Cocoa Beach, FL; Ft. Lauderdale, FL; and Marathon, FL twenty-four individuals provided information pertaining to their fishing operations for golden crab. The following description was based upon the information they provided. The number of fishermen providing information for some characteristics will vary because individuals may not have commented on that particular aspect of their fishing operation. This description does not constitute a comprehensive overview of the golden crab fishery and should be considered an imprecise, yet, informative portrayal of the fishery.

During the public hearing process, 24 individuals indicated they had fished for golden crab in the South Atlantic (see Table 4). On average they were middle-aged and had long tenures as commercial fishermen. However, few had spent many years fishing for golden crab and only four individuals had more than five years experience in the fishery. This relative lack of experience within the fishery is evident as Table 4 indicates with an average of two years fishing experience for golden crab among those who contributed that information.

Over three quarters of those included in this profile were married and had children as shown in Table 5. Although fishing is largely a male occupation, the household unit often provides important support activity to the fishing operation by providing a ready supply of labor, procuring supplies, or other important tasks. The role of the family in the golden crab fishing operation is not fully known; it can only be assumed that the same type of support is provided by the families of golden crab fishermen. Over half of these fishermen had at least some college or attained a college degree with regard to their education level; none had

attained less than a high school diploma. If these individuals are typical, then golden crab fishermen may have a slightly higher education level on average than some of their counterparts in other fisheries of the south Atlantic. The majority of individuals in this profile were captain/owners or captains. There were three crew and two owners included with one crew member and one owner providing only socio-demographic information.

Table 4. Age and tenure as fishermen among golden crab fishermen who provided information during public hearings held from Aug. 7 through Aug. 17, 1995.

Variable	Minimum	Maximum	Average	n
Age	30	72	43	24
Years as a fisherman	5	45	24	24
Years fishing golden crab	0	10	2	24

Table 5. Socio-demographic characteristics for golden crab fishermen who provided information during public hearings held from August 7 through August 17, 1995.

Variable	Frequency	Percent	N
Marital status			n=23
Married	17	74%	
Not married	6	26%	
Dependents			n=24
Has children	18	75%	
Does not have children	6	25%	
Education			n=23
Grade school	-	-	
Some high school	-	-	
High school graduate	9	39%	
Vocational/tech school graduate	2	9%	
Some college	8	35%	
College graduate and more	4	17%	
Status			n=24
Captain/owner	13	54%	
Captain	6	25%	
Crew	3	13%	
Owner	2	8%	

One feature within the fishery that has become apparent from public scoping and hearings is the dissimilar size of vessels seeking to fish golden crab (see Table 6a.). The south Florida fishery has been primarily a small boat fishery with vessels ranging in size from 34 ft to 85 ft and fishing depths from 700 to 1,000 feet. With the expansion of the fishery, the participation of larger vessels has become evident as mentioned above.

Table 6a. Vessel characteristics for golden crab fishermen who provided information during public hearings held from August 7 through August 17, 1995.

Variable	Minimum	Maximum	Average	n
Boat Length	34	180	67	20
Number of crew	1	7	4	20
Maximum # of traps/vessel	20	1000	210	18
Number of traps/string	10	60	32	20

At present two large vessels, one 120 feet long and the other 180 feet long, are geared and will fish or have fished for golden crab and have indicated they will most likely fish north of Cape Canaveral or at least north of Ft. Pierce. These larger vessels will make longer trips, fish deeper water, and pull more traps. Other industry representatives indicated during the public scoping meeting and public hearings that they have or intend to outfit boats to fish for golden crab in both areas which led to early estimates of the maximum number of vessels in the fishery as possibly reaching forty (40), at that time. More recent information from the Florida trip ticket data indicated that the number of vessels is closer to thirty (30). It is still unclear as to how many vessels are actually fishing for golden crab and estimates of individuals who have landed golden crab by the April 7, 1995 control date have reached 65. Some of these individuals indicated they will fish golden crab part-time and may combine their fishing effort with others on one vessel. They intend to trap golden crab when other fisheries, like lobster, mackerel, or snapper grouper either close or offer less of an opportunity than golden crab for making ends meet. So, at this time it is difficult to determine the exact number of vessels that are actively participating in the golden crab fishery on a part-time basis.

Information from fishermen and testimony from public hearings and scoping suggests many part-time fishermen who will or have entered the golden crab fishery in the Keys and southern Florida are highliners from the lobster and stone crab fisheries. These individuals are very adept at trap fishing and will most likely contribute substantially to the landings in those areas. This movement to another fishery is part of the traditional, multi-species fishing that is practiced by the majority of fishermen in this region. Their yearly round of fishing activity encompasses several fisheries and at times different gear types. This type of behavior tends to mask the importance of a particular species on the entire fishing operation. While fishing for golden crab may not be critical to the overall fishing operation, it may supplement income when slack times occur in other fisheries which normally mean reduced income at that time of the year. The importance

of this additional income to the overall household income is unknown, but could become crucial if established over time. Many of these fishermen may have once participated in fish trapping prior to the ban implemented by the Council in 1991. Their search for other fisheries to fill a void left after the fish trap ban may have led to the golden crab fishery. With increasing regulation on other fisheries, effort limitations in some, increased competition in others, and outright bans on traditional fishing practices, the number of choices for a multi-species/fishery strategy is becoming smaller and smaller for fishermen. Although golden crab is not as economically significant as other fisheries, it may contribute an important part to this multi-species approach for some fishermen. For others, it will provide full-time employment and a considerable investment in time and money.

The issues of a large vessel and a small vessel fishery and a part-time/full-time fishery are important distinctions to be considered when developing management options. There will be significant variation in crew size and gear size depending upon vessel length and its multi-species approach as seen in Table 6a.

Of the fifteen individuals who indicated the state in which their vessel was registered (Table 6b.), all but three were registered in Florida. One vessel was registered in Alaska, one in Pennsylvania, and one in Virginia. The majority of vessels were constructed of fiberglass. All large boats, over 85 feet in length, were constructed of steel. Two individuals indicated their vessels were constructed of wood. No vessel in this sample was less than five years old; in fact, over 80% of the vessels included here are ten years old or older.

Table 6b. Vessel characteristics for golden crab fishermen who provided information during public hearings held from August 7 through August 17, 1995 continued

Variable	Frequency	Percent	N
State which vessel was registered			n=15
Florida	12	79%	
Alaska	1	7%	
Pennsylvania	1	7%	
Virginia	1	7%	
Vessel construction type			n=19
Steel	6	32%	
Wood	2	10%	
Fiberglass	11	58%	
Year vessel built			n=18
1975 & before	4	22%	
1976 - 1980	4	22%	
1981- 1985	7	39%	
1986 - 1990	3	17%	

Of those individuals who provided information concerning their traps, almost half used wire traps only (Table 7). Thirty-two percent or six individuals used a combination of trap types including wire, wood, plastic, and webbing. Four fishermen claimed they used the webbing type only. Rope was the preferred material for the mainline with 75% of fishermen indicating they used it solely. One individual used cable only, and four fishermen used a combination of rope and cable for their mainline.

Table 7. Trap characteristics for golden crab fishermen who provided information during public hearings held from August 7 through August 17, 1995.

Variable	Frequency	Percent	N
Trap Construction			n=19
Wire only	9	47%	
Wood only	0	-	
Plastic only	0	-	
Webbing only	4	21%	
Combination	6	32%	
Material for Mainline			n=20
Cable only	1	5%	
Rope only	15	75%	
Both	4	20%	
Biodegradable panel			n=18
Yes	13	72%	
No	4	22%	
Some	1	6%	
Escape gaps			n=19
Yes	14	74%	
No	4	21%	
Some	1	5%	
Buoys on mainline			n=20
Yes	14	70%	
No	5	25%	
Some	1	5%	

A noticeable majority of fishermen indicated they did use escape gaps and had degradable panels on their golden crab traps. Four individuals said they did not use either, and one individual said some traps had both escape gaps and degradable panels.

Most fishermen verified they do use buoys on their mainline, while five said they did not. One individual used buoys on some of his mainlines. The use of buoys is a function of the type of gear being used and the strength of the current. Gear that is too light can move when strong currents push buoys along making them impractical. With heavier gear, buoys are unlikely to move as easily and can be used to identify gear location. When buoys are not used, mainlines must be grappled from the bottom using loran or other locational electronics.

Little information is available concerning catch per unit of effort. However, some information does exist on one fishing operation (Lindberg and Wenner, 1990). Over a two year period approximately 75,000 lb were taken from a six square mile area with an average of about 1,000 lb per week. The vessel was fishing at depths of 118 to 125 fathoms. Catches were sustained at 100 lb per trap per week but were reduced to approximately 50-60 lb once another fishermen began to set traps near the harvesting area. It is not clear why there was such a drop in CPUE given the effort increase of only one fisherman, however, it may indicate a much larger area needed per harvester if density or abundance for this crab is low.

One of the interesting characteristics of this fishery that became apparent during public comment was the informal use of territoriality among fishermen in south Florida and the Keys. Testimony by participants in the golden crab fishery indicated fishermen have informally agreed to divide territory among themselves to avoid setting gear on top of one another. At the heart of this issue was the use of cable mainline verses rope, yet it may have important implications for controlling harvesting effort within zones. Another important aspect of this conflict that surfaced during testimony was that a number of Hispanic fishermen use cable as mainline, rather than rope. Information from fishermen in the Keys suggested that lower initial costs with cable and the lack of storage room for rope may be the primary reasons for using cable as mainline.

At this time it is not known how many fishermen participate in these informal agreements or the effectiveness of these territorial arrangements. Fishermen seem to have resolved some of the conflicts regarding gear placement, but whether this territoriality will endure and be applicable to other issues related to the fishery remains to be seen. With little information on crab density or the impact of harvesting over time on abundance, the concept of territoriality and its efficacy need to be examined. If fishermen are willing to enter into territorial use rights agreements on their own, the Council may want to consider some type of co-management of this fishery in the future. Co-management can greatly reduce the costs of enforcement and administration of fishery management if successfully implemented. The small number of golden crab fishermen and their willingness to participate in management decisions makes this fishery a good candidate for co-management.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction

This section covers two major areas. The first addresses management measures and alternatives considered by the Council. The second depicts the consequences of management. The regulatory impact review (RIR) analysis and information for analyses required by the Regulatory Flexibility Act (RFA) are incorporated into the discussion under each of the proposed action items.

Each Action is followed by four subheadings: Biological Impacts, Economic Impacts, Social Impacts, and Conclusion. These are self explanatory with the first three presenting the impacts of each measure considered. The Council's rationale and consideration of topics like enforcement and vessel safety are presented under the heading "Conclusion".

The Council also considered options addressing (1) minimum size limits, (2) quota management, (3) transponders, (4) trip limits, and (5) limits on the number of traps per vessel. After evaluating the impacts of these proposed measures and reviewing the public comments, review comments, Scientific and Statistical Committee comments, and Golden Crab Advisory Panel comments, the Council decided not to propose taking action for any of these measures. The Council's evaluation and conclusions are included in Appendix C.

4.2 Management Options

4.2.1 OPTION 1. TRADITIONAL FISHERY MANAGEMENT PLUS CONTROLLED ACCESS

4.2.1.1 ADMINISTRATIVE

4.2.1.1.1 ACTION 1. Management unit.

The management unit is the population of golden crab occurring within the South Atlantic Council's area of jurisdiction along the U.S. Atlantic coast from the east coast of Florida, including the Atlantic side of the Keys, to the North Carolina/Virginia border. Red crab and Jonah crab are included in the fishery but not in the management unit because regulations in this plan only address golden crab at this time. Although all three species of crab are also harvested in the Gulf of Mexico and Mid-Atlantic/New England waters, the Council concluded the populations are sufficiently separated from one another to be managed separately.

Biological Impacts

The proposed action would provide for management of golden crabs in the Council's area of jurisdiction after settlement. Whether or not this management unit is self-sustaining is unknown. Section 3.1.3.5 describes potential larval distribution and notes there could be settlement from larvae spawned within the management unit, that is, the population could be self-sustaining. However, recruitment from

the Gulf of Mexico, Cuba, and the Bahamas cannot be ruled out. This management unit would allow for the biological protection of golden crabs after they have settled, and the measures specified would protect the spawning stock which will provide subsequent recruitment.

Economic Impacts

No direct economic impacts are expected by adding golden crab to the management unit. However, it allows the Council to propose and implement management measures for this fishery and to take timely actions when necessary. Successful implementation of management measures would likely result in increased net benefit to society in the long-term.

Social Impacts

The social impacts of adding golden crab to the management unit would likely be beneficial given that the majority of fishermen would like to see some type of management structure implemented. In addition, the biological evidence suggests a conservative approach to harvesting which raises questions about continuing an open access fishery. The Council is prevented from implementing any type of management unless golden crab is added to the management unit. Therefore, it is an initial step in creating any management program.

Although within the Gulf of Mexico this fishery has been a pulse fishery in the past, the growing interest in golden crab by harvesters and those in the intermediate sector signals a change in their perception regarding a sustainable harvest and viable markets. Pulse fishing in the past has most likely affected localized stocks and has not greatly impacted stocks overall. However, the obvious shift of effort that is evident from public hearings and scoping indicates a much greater potential for overharvesting, today. That potential has spurred the Council into developing a management program which would protect the resource, yet allow for a long-term, sustainable fishery to develop.

Managing golden crab within the South Atlantic's area of jurisdiction only will likely spark interest for this fishery in other areas like the Gulf of Mexico and the Mid-Atlantic. There has been a sporadic golden crab fishery in the Gulf since the early 1980s, but has been primarily a pulse fishery and has not been sustainable beyond a few years. The fishery which has developed most recently in the South Atlantic region, in particular near the Florida Keys, has been primarily a day fishery operating year round. With a management plan being developed by the South Atlantic Council and a control date already established, interest in golden crab within the Gulf of Mexico will certainly expand, but may remain the pulse fishery it has been. Whether the same interest will develop in the Mid-Atlantic is not clear with the limited information on golden crab there.

Because so little information exists on participants in this fishery, expanding the management unit to include either or both the Mid-Atlantic and the Gulf of Mexico Fishery Management Councils may exacerbate the information needs for all Councils. Because the South Atlantic Council feels timely action is necessary to protect the resource and participants, and the primary expansion of this fishery has been within

its borders, limiting the management unit to the South Atlantic at this time may be the most expeditious manner to develop a management framework.

Conclusion

The Council concluded the proposed management unit is appropriate for the golden crab fishery. Regulations specified will protect all females, allow smaller (juvenile) crabs to escape, and limit overall fishery mortality thereby protecting the reproductive potential of the population and providing for subsequent recruitment. To the extent larvae spawned in the management unit settle as juveniles within the management unit, the population will be sustained. To the extent there is settlement of larvae spawned outside the management unit, the population would benefit from protection of populations in the Gulf of Mexico, Cuba, and the Bahamas. It is hoped that management bodies in those respective areas will protect their populations of golden crab.

Also, the Council concluded the fisheries in the Gulf of Mexico and South Atlantic are sufficiently different from a fishery standpoint that they should be managed separately: (1) the Gulf of Mexico fishery is primarily a large boat, offshore fishery with only multi-day trips; (2) the South Atlantic fishery is primarily a small to medium boat fishery, near shore in the middle and southern zones (possibly a large boat fishery in the northern zone) with day and some multi-day trips; (3) the Gulf of Mexico fishery has been a pulse fishery and the economics have been allowed to "manage" the fishery; (4) the South Atlantic fishery has developed as a steady, year-round fishery and the South Atlantic Council decided to manage the fishery to provide a sustainable fishery for fishermen displaced from the fish trap ban in the snapper grouper fishery and other Council regulations; (5) landings from the Gulf of Mexico fishery are marketed through one or two large processors; and (6) landings from the South Atlantic fishery are marketed through several processors, retail outlets as live crabs, and are featured as a specialty at local restaurants. Representatives of these establishments have provided input that the golden crab provides revenue to replace lost revenue from prior regulations (e.g., fish trap ban, net ban in the State of Florida, mackerel regulations, etc.).

The Council concluded this management unit (within the South Atlantic Council's area of jurisdiction) is supported by the best available information and allows the Council to achieve the stated objectives. Also, defining the management unit is a required part of a fishery management plan. This action will allow the Council to proceed with management in a timely fashion and is supported by the industry, the Golden Crab Advisory Panel and the Scientific and Statistical Committee.

Rejected Options for Action 1:

Rejected Option 1. The management unit is the population of golden crab occurring along the U.S. Atlantic coast from the east coast of Florida to the New York/Connecticut border. This option would include the Mid-Atlantic Fishery Management Council in the management process.

Biological Impacts

See the discussion under the proposed action. In addition, this option would allow for management of golden crabs that occur within the Mid-Atlantic Council's area of jurisdiction. The amount of the resource

in that area is unknown. While golden crab are distributed as far north as Chesapeake Bay, the South Atlantic Bight represents the northern portion of its distribution. The abundance of golden crabs north of North Carolina is not expected to be great.

Economic Impacts

No economic impacts are expected by adding golden crab to the management unit.

Social Impacts

See Social Impacts under Action 1.

Conclusion

The Council rejected this option because including the Mid-Atlantic Council and their area of jurisdiction would provide minimal if any additional biological protection given the low abundance in that area and the fact that the area is at the extreme northern portion of the species' distribution. Involving the Mid-Atlantic Council in the process at this stage would delay management and was rejected by the Council. In addition, the Council's stated objectives and optimum yield would be more difficult to achieve given the delay and the potential involvement of more (and diverse) fishermen.

Rejected Option 2. The management unit is the population of golden crab occurring along the U.S. Atlantic coast from the east coast of Florida to the New York/Connecticut border and including the Gulf of Mexico. This option would include the Mid-Atlantic and Gulf of Mexico Fishery Management Councils in the management process.

Biological Impacts

See the discussion under the proposed action. In addition, this option would allow for management of the golden crabs that occur within the Mid-Atlantic and Gulf of Mexico Councils' areas of jurisdiction. The amount of the resource in the Mid-Atlantic is unknown. While golden crab are distributed as far north as Chesapeake Bay, the South Atlantic Bight represents the northern portion of its distribution. The abundance of golden crabs north of North Carolina is not expected to be great. While the resource in the Gulf of Mexico is also unknown, the abundance is expected to be equal or greater than that in the South Atlantic. To the extent larvae spawned in the Gulf of Mexico contribute to settlement in the South Atlantic, protecting the reproductive potential of the population in the Gulf would be of benefit.

Economic Impacts

No economic impacts are expected by adding golden crab to the management unit.

Social Impacts

See Social Impacts under Action 1.

Conclusion

The Council rejected this option because including the Mid-Atlantic and Gulf of Mexico Councils and their areas of jurisdiction would provide minimal if any additional biological protection given the low abundance in the Mid-Atlantic area while there could be some biological benefit from including the Gulf of Mexico. However, any biological benefit would be more than offset by involving the two Councils in the

process at this stage because it would delay management and was rejected by the Council. In addition, the Council's stated objectives and optimum yield would be more difficult to achieve given the delay and the potential involvement of more (and diverse) fishermen.

Rejected Option 3. The management unit is the population of golden crab occurring along the U.S. Atlantic coast from the east coast of Florida to the New York/Connecticut border and including the Gulf of Mexico. This option would designate the South Atlantic Council as true lead for the management plan but the Mid-Atlantic and Gulf of Mexico Fishery Management Councils would be included in the management process with a voting member on the golden crab committee. All decisions would be made solely by the South Atlantic Council.

Biological Impacts

See the discussion under the proposed action. In addition, this option would allow for management of the golden crabs that occur within the Mid-Atlantic and Gulf of Mexico Councils' areas of jurisdiction. The amount of the resource in the Mid-Atlantic is unknown. While golden crab are distributed as far north as Chesapeake Bay, the South Atlantic Bight represents the northern portion of its distribution. The abundance of golden crabs north of North Carolina is not expected to be great. While the resource in the Gulf of Mexico is also unknown, the abundance is expected to be equal or greater to that in the South Atlantic. To the extent larvae spawned in the Gulf of Mexico contribute to settlement in the South Atlantic, protecting the reproductive potential of the population in the Gulf would be of benefit.

Economic Impacts

No economic impacts are expected by adding golden crab to the management unit.

Social Impacts

See Social Impacts under Action 1.

Conclusion

The Council rejected this option because including the Mid-Atlantic and Gulf of Mexico Councils and their areas of jurisdiction would provide minimal if any additional biological protection given the low abundance in the Mid-Atlantic area while there could be some biological benefit from including the Gulf of Mexico. However, if research results indicate a significant amount of larval supply from the Gulf of Mexico, the Council will reexamine this option. By having the South Atlantic Council as true lead, any delays by involving the two Councils in the process would be eliminated.

Rejected Option 4. No action.

Biological Impacts

This option would not provide for management of golden crabs in the Council's area of jurisdiction. Lack of management would result in overfishing and damage to the reproductive potential of the golden crab resource.

Economic Impacts

No economic impacts are expected by not taking any action.

Social Impacts

The no action option for adding golden crab to the management unit would not appeal to some fishermen for they have requested the Council to implement a type of management program to help develop a sustainable fishery. Without the framework procedures the Council cannot implement any action which would protect the resource or control entry into this fishery. During scoping and public hearings fishermen expressed the need for some type of management to be put in place as quickly as possible, for there is concern about the resource's ability to withstand unlimited harvest. Although the action of adding golden crab to the management unit does not in itself have biological or economic impacts, it does tend to affect fishermen's perceptions concerning management's intentions regarding a resource. Clearly, by taking no action in this case, there will be golden crab fishermen who will be dissatisfied with this as a prudent management option because they wish to see biological and other forms of management measures put in place. There will be, however, some fishermen who may see the no action option as preferable for they like the nature of an open access fishery which provides them the widest range of possible choices with regard to their fishing activity.

Conclusion

The Council rejected this option because adding golden crab to the management unit is necessary to regulate the fishery. Also, defining the management unit is a required part of a fishery management plan.

4.2.1.1.2 ACTION 2. Optimum yield (OY).

Optimum yield (OY) is all golden crab that are harvested legally under the provisions of the golden crab fishery management plan which is equivalent to that level of golden crab harvest that would minimize user conflict among vessels, minimize the cost of fishing, produce a stable level of landings that would maximize returns to the fishermen, provide for a stable supply, and minimize management costs.

Biological Impacts

The biological impacts are discussed under each of the proposed Actions.

Economic Impacts

This should create a stable fishery and maintain economic benefits in the long-term.

Social Impacts

The term optimum yield is used in the first national standard of the Magnuson Act to achieve the greatest overall benefit to society through the harvest of any species without overfishing. It refers to the maximum number of fish that can be harvested safely as modified by social, economic, and ecological factors. The difficulty in determining optimum yield for golden crab comes from the limited information available within the social, economic, and ecological realms of this fishery. With golden crab there is a great deal of uncertainty as to what level of harvest would maximize protection of the resource, ensure

economic efficiency, and provide some social security for those involved. Setting optimum yield for golden crab at a very low level may ensure biological protection, but it may be too restrictive for any fishery to operate. On the other hand, setting optimum yield at a level high enough to allow unlimited harvest may endanger the long-term survival of the fishery, both biologically and socially.

The Council has chosen a preferred optimum yield definition which will allow for development of a sustainable fishery, yet provide enough information to make sound judgments regarding the biological integrity of both present and future harvest levels. Because much of the limited information available concerns the participants within the fishery, and many of these individuals have worked closely with the Council, this information has been key to forming options for the fishery management plan.

Conclusion

Information on golden crab is very limited which prevents use of a more quantitative definition of optimum yield at this time. MSY cannot be specified at this time based on the extremely limited data available throughout the South Atlantic Council's area of jurisdiction. The Council reviewed alternative specifications of OY but concluded, based on the limited data available, a simple statement of OY as the harvest resulting from the specified management regulations was the most appropriate alternative to allow the fishery to develop while protecting the biological integrity of the resource. As more data become available, the framework procedure will be used to modify the OY statement. The specified management measures protect the biological integrity of the golden crab resource by requiring escape gaps, biodegradable panels, return of all females, and specifying a limit on fishing effort. Therefore, the Council concluded: (1) current data deficiencies make the MSY concept as a basis for specifying OY of limited value at this time, (2) the specification of OY based on the specified management regulations is based on the best available information, and (3) the specified OY is measurable.

Rejected Options for Action 2:

Rejected Option 1. Optimum yield (OY) is any harvest level which maintains, or is expected to maintain, over time, a survival rate of biomass into the stock of spawning age golden crab to achieve at least a 30% spawning potential ratio (SPR) population level, relative to the SPR that would occur with no fishing. The Council's intent is to ensure the weight of spawning stock does not decrease below 30% of the spawning stock that would occur in an unfished fishery. Information from other species indicates stock collapse is a possibility if the spawning stock declines below the 30% level.

Biological Impacts

There is not sufficient information available to calculate the spawning potential ratio. There would be no way to measure whether or not OY was being achieved.

Economic Impacts

It is not possible to determine economic impacts because of lack of data.

Social Impacts

See Social Impacts under Action 2.

Conclusion

The Council rejected this option because there is not sufficient information available to calculate the spawning potential ratio and there would be no way to measure whether or not OY was being achieved.

Rejected Option 2. Optimum yield (OY) is any harvest level which maintains, or is expected to maintain, over time, a survival rate of biomass into the stock of spawning age golden crab to achieve at least a 20% spawning potential ratio (SPR) population level, relative to the SPR that would occur with no fishing. The Council's intent is to ensure the weight of spawning stock does not decrease below 20% of the spawning stock that would occur in an unfished fishery. Information from other species indicates stock collapse is a probability if the spawning stock declines below the 20% level.

Biological Impacts

There is not sufficient information available to calculate the spawning potential ratio. There would be no way to measure whether or not OY was being achieved.

Economic Impacts

Lack of data precludes any determination of economic impacts.

Social Impacts

See Social Impacts under Action 2.

Conclusion

The Council rejected this option because there is not sufficient information available to calculate the spawning potential ratio and there would be no way to measure whether or not OY was being achieved.

Rejected Option 3. Optimum yield (OY) is all golden crab that are harvested while maintaining the fishing mortality rate (F) equal to M, F_{msy}, $F_{0.1}$, or F_{max}.

Biological Impacts

There is not sufficient information available to calculate the fishing mortality rate at this time. There would be no way to measure whether or not OY was being achieved.

Economic Impacts

Lack of data precludes any determination of economic impacts.

Social Impacts

See Social Impacts under Action 2.

Conclusion

The Council rejected this option because there is not sufficient information available to calculate the fishing mortality rate and there would be no way to measure whether or not OY was being achieved.

Rejected Option 4. Optimum yield (OY) is equivalent to maximum sustainable yield (MSY).

Biological Impacts

The MSY cannot be specified at this time based on the extremely limited data available throughout the South Atlantic Council's area of jurisdiction.

Economic Impacts

Lack of data precludes any determination of economic impacts.

Social Impacts

See Social Impacts under Action 2.

Conclusion

The Council rejected this option because the MSY cannot be quantified at this time. As more data become available, the framework procedure will be used to estimate the MSY and the Council will evaluate incorporating MSY into the OY statement. The Council also concluded that a MSY strategy is risky based on management targeting MSY in other fisheries and rejected this option at this time.

Rejected Option 5. No action.

Biological Impacts

The biological impacts are discussed under the proposed measures.

Economic Impacts

Not defining optimum yield could lead to dissipation of economic benefits from the fishery in the long-term if overfishing occurs.

Social Impacts

Because every fishery management plan must define optimum yield, the no action option would preclude development of a management plan. Without such a definition, no plan would be approved for it is required by the Magnuson Act. Therefore, the social impacts for this option relate to the previous discussion under Action 1 social impacts which address the impacts of the Council's inability to act with regard to fishermen's concern over the biological, economic, and social problems they have identified within this fishery.

Conclusion

The Council rejected this option because defining optimum yield is necessary to regulate the fishery. Also, defining optimum yield is a required part of a fishery management plan.

4.2.1.1.3 ACTION 3. Overfishing definition.

Overfishing is defined as any rate of fishing mortality in excess of F_{msy} for golden crab in the South Atlantic Council's management area.

Biological Impacts

Data necessary to assess the condition of the fishery include: historical catch, sporadic in-season catch and effort data, and mortality. Such data are not presently available for golden crab.

Overfishing for stocks with this level of data has, in other fisheries, been defined as a fishing mortality rate in excess of F_{msy} where the maximum allowable fishing mortality rate is estimated to equal the natural mortality rate of mature male crabs (estimated to range between 0.05 and 0.15); in-season fishing mortality rate may be based on a change in the in-season ratio of catch-per-unit-effort (CPUE) of legal to mature male crabs or a proportionate reduction in average weekly CPUE. (Source: based on overfishing definition for red king crab and tanner crab.)

In the face of severely limited data, F_{msy} can be approximated as being equal to the natural mortality rate (M). Using this approximation, a likely range of F_{msy} is 0.05 to 0.15 based on the natural mortality estimates for red crab from South Africa.

Economic Impacts

This will preserve the biological integrity of the stock. Economic benefits will accrue in the long-term.

Social Impacts

In choosing this definition for overfishing the Council has attempted to address the requirements of the Magnuson Act, while allowing a sustainable fishery to develop. In the absence of biological information, the Council has adopted a definition for which the necessary information will become available most quickly. It will be imperative to determine an overfishing level as soon as possible if the Council wishes to avoid negative social and economic impacts like disruption of markets, overcrowding, and others which might develop if a stock is overfished. The Council's overall intention has been to allow for a sustainable harvest while protecting the resource and an overfishing definition is key to that goal.

Conclusion

Data are not available to estimate fishing mortality rate at this time. Permitting and reporting requirements under this plan will allow monitoring of the catch which is necessary to calculate fishing mortality rates and evaluate overfishing. Catch and effort records and biological sampling will also be required to ensure overfishing is prevented. The framework established under this plan will allow the Council to modify the management program once fishing mortality rates are estimated. It is anticipated that a preliminary estimate of fishing mortality can be made within 3-4 years whereas a more precise estimate usually requires data over a 10-year period.

Fishermen and dealers indicated they would be more than willing to provide data voluntarily. The South Atlantic Council requested (September 1995) NMFS to immediately begin a voluntary logbook program so that valuable data and time are not lost. This program was implemented during November 1995.

The Council chose this overfishing definition because it is the one most likely to be estimated in the least amount of time after data collection begins. This definition has been used in other crab fisheries (red king crab and tanner crab) in the northwest. This definition provides a specific, measurable definition of

overfishing and as soon as sufficient biological information are collected, the National Marine Fisheries Service will conduct a stock assessment and calculate the fishing mortality rate relative to F_{msy}.

There is a possibility that the Gulf of Mexico and South Atlantic golden crab populations may be linked at least in the Florida Keys. This could occur either by adult movement from the Gulf of Mexico to the South Atlantic in the Florida Keys, or transport of larvae from the Gulf of Mexico to the South Atlantic. Little more can be said concerning this potential linkage except this possibility exists. Although the lack of information on sustainable yield raises the possibility of overfishing, similar uncertainty exists for many other Atlantic coast fisheries. In this context, the golden crab fishery is similar to many other southeastern fisheries. The important difference here is that the Council is concerned about overfishing and intends to minimize this possibility.

The Council is proposing a number of biological and managerial measures to minimize the possibility of overfishing. Specifically, the catch is limited to male crabs that have attained sexual maturity. The use of escape gaps will ensure few small crabs (females and juvenile males) are taken. Also, the number of vessels that will participate in this fishery has been limited with most vessels being allowed in the southern zone where the golden crab is only one of several resources that are exploited seasonally. In essence, the golden crab fishery appears to be an off-season species for fishermen in the Florida Keys who fish primarily for stone crab, spiny lobster, king mackerel, and snappers and groupers. Conversely, the number of vessels in the middle zone is limited because alternative fishery resources in this zone are severely limited. Fishing in the northern zone (the largest area) requires a larger vessel due to distance from shore and fishing conditions. The available data indicates the potential yield is relatively low in the northern zone. On the other hand, fishermen believe the available yield is higher. Fishermen will be encouraged to switch to this area from more southern zones both to reduce fishing pressure in the southern zones and to obtain additional information in the northern zone.

The Council has proposed a management program which is designed specifically to obtain information about the fishery, minimize user conflicts, and minimize the possibility of overfishing the resource. Additionally, a framework procedure includes the ability to implement quotas (including zero quotas), trip limits, limits on number of gear, season/area closures including spawning closures, specifying and altering the MSY and total allowable catch (TAC) once sufficient data are available, and implementing and modifying a minimum size. It is the intent of the Council that once sufficient information becomes available to estimate MSY, TAC be limited by the upper end of an acceptable biological catch (ABC) and that no limit should be placed on the lower limit of ABC. Analyses of available data will be conducted on an annual basis and detailed catch and effort data will be obtained by vessel logbooks. These measures, in addition to the measures proposed for immediate implementation, should minimize the possibility of overfishing.

Because of the longevity of the golden crab and minimal fishing pressure prior to 1995, the fishery should experience "the fishing-up effect" as described by Ricker (1975: pages 260-264) in his classic

work. This effect is portrayed in Ricker's Figure 10.5 included below. The basic features of the fishing up effect is a temporary large increase in catch followed by a sustainable, but much lower level of landings. This is caused by fishing up the accumulated stock of older individuals followed by the fishery becoming dependent upon younger individuals that are recruited annually into the fishery. Fishing not only substantially changes the age structure of the population, but also promotes compensatory growth by thinning out the population. This phenomenon, particularly the temporary nature of the large increase in landings, is poorly understood by fishermen, but is a fundamental characteristic of a population responding to fishing. It is the intent of the Council to monitor landings closely during this transitional "fishing-up" phase and establish an appropriate MSY as soon as sufficient data become available. The framework procedure, in addition to the measures proposed for immediate implementation, will be used to minimize the possibility of overfishing.

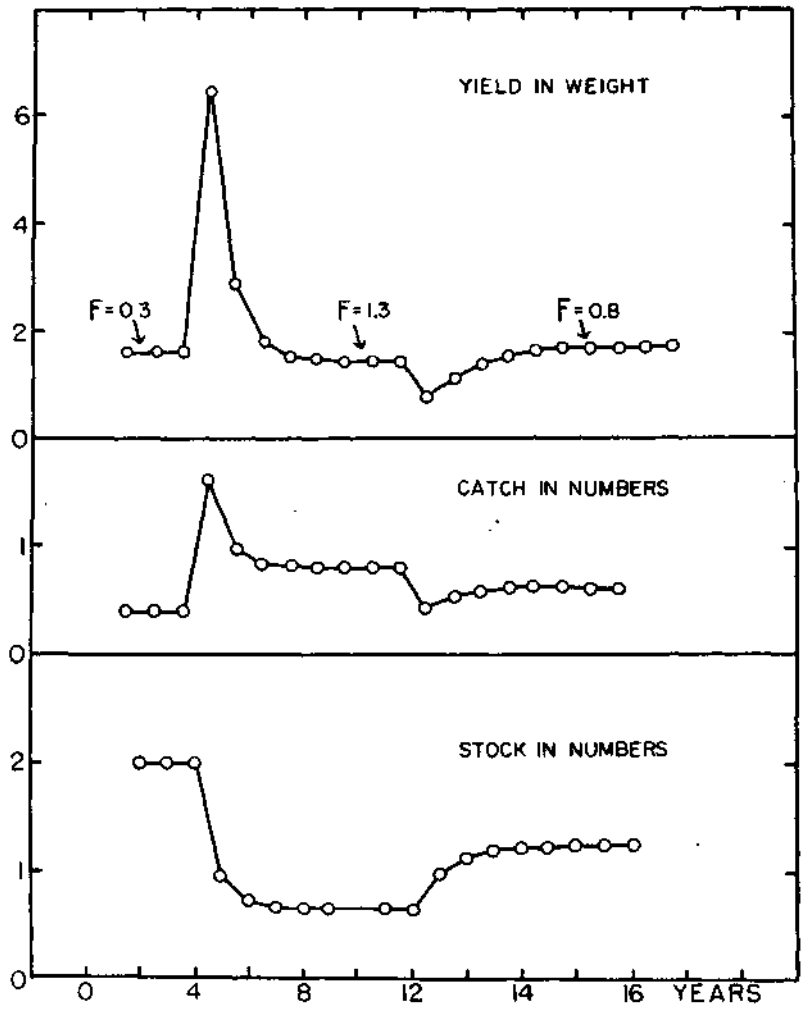

FIG. 10.5. Trends of yield in weight, catch in numbers, and stock size in numbers, for a stock in which natural mortality (M) is 0.2 throughout, and rate of fishing (F) changes from 0.3 to 1.3, and then to 0.8. The first year of each change is marked by the high peak and low trough, respectively, on the yield curve. Values were computed using a model of the type of Table 10.1, with an appropriate age–weight distribution, the same for all years.

Rejected Options for Action 3:

Rejected Option 1. Overfishing for golden crab is defined as follows:

(i) A golden crab stock is overfished when it is below the level of 30% of the spawning potential ratio (SPR) which would occur in the absence of fishing.

(ii) When the golden crab stock is overfished, overfishing is defined as harvesting at a rate that is not consistent with a program that has been established to rebuild the stock to the 30% spawning potential ratio (SPR) level.

(iii) When a golden crab stock is not overfished, overfishing is defined as a harvesting rate that, if continued, would lead to a state of the stock that would not at least allow a harvest of OY on a continuing basis.

Biological Impacts

There is not sufficient information available to calculate the spawning potential ratio. There would be no way to measure whether or not overfishing was occurring.

Economic Impacts

Lack of data precludes determination of economic impacts.

Social Impacts

See Social Impacts under Action 3.

Conclusion

The Council rejected this option because there is not sufficient information available to calculate the spawning potential ratio and there would be no way to measure whether or not overfishing was occurring. Detailed catch, effort, size, and age data are not yet available for golden crab.

Rejected Option 2. Overfishing is defined as a fishing mortality rate in excess of $F_{0.1}$ or F_{max}.

Biological Impacts

There is not sufficient information available to calculate the fishing mortality rate. There would be no way to measure whether or not overfishing was occurring.

Economic Impacts

Lack of data precludes determination of economic impacts.

Social Impacts

See Social Impacts under Action 3.

Conclusion

The Council rejected this option because there is not sufficient information available to calculate the spawning potential ratio and there would be no way to measure whether or not overfishing was occurring. Detailed catch, effort, size, and age data are not yet available for golden crab.

Rejected Option 3. Overfishing exists when the annual catch and CPUE decline for three consecutive fishing years.

Biological Impacts

This would delay action because time would be necessary for the data series to be generated. During the interim, overfishing could occur.

Economic Impacts

This could result in dissipation of economic benefits and possible overcapitalization in the fishery.

Social Impacts

See Social Impacts under Action 3.

Conclusion

The Council concluded this option would delay being able to measure overfishing and would not provide sufficient biological protection. Also, a longer time series of data would be required (on the order of 10 years) before trends in CPUE could be reasonably interpreted. The Council also concluded that market forces have a very large impact on when vessels fish for golden crab, hence, CPUE may not be a valid reflection of true population abundance. Therefore, this option was rejected.

Rejected Option 4. No action.

Biological Impacts

This option would not provide a measure to determine whether or not golden crab are overfished which would increase the possibility of overfishing the golden crab resource.

Economic Impacts

This could result in dissipation of economic benefits and possible overcapitalization in the fishery.

Social Impacts

Every fishery management plan must define overfishing and the no action option would preclude development of a plan. Without such a definition, no plan would be approved for it is required by the Magnuson Act. Therefore, the social impacts for this option relate to the previous discussion under Action 1 social impacts which address the impacts of the Council's inability to act with regard to fishermen's concern over the biological, economic, and social problems they have identified within this fishery.

Conclusion

The Council rejected this option because defining overfishing is necessary to regulate the fishery and to prevent overfishing. Also, defining overfishing is a required part of a fishery management plan.

4.2.1.1.4 ACTION 4. Modify crustacean trap definition.

Modify the crustacean trap definition contained in regulations implementing the snapper grouper fishery management plan by adding golden crab. The revised wording is as follows: Crustacean trap means a type of trap historically used in the directed fishery for blue crab, stone crab, golden crab (including Jonah and red crab), or spiny lobster and that contains at any time not more than 25 percent, by number, of fish other than blue crab, stone crab, golden crab (including Jonah and red crab), and spiny lobster. Action 7 specifies traps as the only allowable gear in the directed golden crab fishery and includes

a provision for non-conforming gear and experimental gear. Section 3.5.2 Commercial Fishery contains a description of traps used historically in the golden crab fishery.

Biological Impacts

None. Available data and input from fishermen indicate that there is no bycatch of species in the snapper grouper management unit in golden crab traps.

Economic Impacts

None. Available data and input from fishermen indicate that there is no bycatch of species in the snapper grouper management unit in golden crab traps.

Social Impacts

There would be few if any social impacts with this option. Available data and input from fishermen indicate that there is no bycatch of species in the snapper grouper management unit in golden crab traps.

Conclusion

The Council never intended to include golden crab traps in the fish trap prohibition. Golden crab traps have been used since the early 1980s and have been modified. Including golden crab traps as a crustacean trap is based on the best available information from the Golden Crab Advisory Panel and from the Scientific and Statistical Committee. Available data and input from fishermen indicate there is no bycatch of species in the snapper grouper management unit in golden crab traps. The Council approved this revision to the definition in order to make the traps legal, to allow the golden crab fishery to continue, and has specified additional measures to ensure the golden crab traps are fished in an appropriate manner in order to minimize any potential interaction with the snapper grouper fishery. It is the Council's intent that NMFS use the most effective and least burdensome administrative procedure to implement this action.

Rejected Options for Action 4:

Rejected Option 1. No action.

Biological Impacts

None. Available data and input from fishermen indicate there is no bycatch of species in the snapper grouper management unit in golden crab traps.

Economic Impacts

None. Available data and input from fishermen indicate there is no bycatch of species in the snapper grouper management unit in golden crab traps.

Social Impacts

The social impacts from the no action option would most likely develop if enforcement of the trap definition became a problem and fishermen were unable to fish because of the trap definition within the plan.

Conclusion

The Council rejected no action because the golden crab traps would continue to be technically illegal which was never the Council's intent. Measures specified in this management plan minimize the potential for golden crab traps to be fished as fish traps.

4.2.1.2 BIOLOGICAL PROTECTION

4.2.1.2.1 ACTION 5. Escape gap.

Require at least two escape gaps in each golden crab trap, require they be located on opposite vertical sides of golden crab traps, and require the inside measurement of the escape gap be no smaller than 2 and 3/4 inches by 3 and 3/4 inches. If a ring is used, the inside diameter must not be less than 4 and 1/2 inches.

Biological Impacts

The escape gap specified will let a 1 to 1 and 1/4 pound crab escape. This equates to about 125-130 mm carapace width. Females are mature at sizes equal to or greater than 85 mm and males equal to or larger than 130 mm. Females are smaller than males and the escape gap will result in most females being released on the bottom which will reduce any release mortality. Protecting females will help to protect and preserve the biological integrity of the stock.

If the proposed size was increased to exclude those males smaller than 140-150 mm carapace width, then there would be better assurance that at least some of the males captured would have previously mated (Elizabeth L. Wenner, per. comm.). The concern is not with the size at which males attain physiological sexual maturity but with the size at which males are competent to breed under natural conditions. One must be careful in assuming that smaller males are equally as capable in reproductive output as larger males.

Economic Impacts

This will increase the efficiency of fishermen and not change how the fishery presently operates, with only male crabs being harvested. The proposed escape panel is of a size that will not allow larger male crabs to escape. Thus, the escape panel will not result in any reduction in catch levels. Also, it does not involve any increased cost in the construction of traps. Only a minor adjustment to incorporate the escape gap will be needed. Furthermore, the release of females and immature males should maintain recruitment at a level that will ensure a sustainable fishery in the long-term. If fishing effort is controlled at the optimum level, this should help with market development and stability and could increase long-term economic benefits from the fishery.

Social Impacts

It is unlikely that there would be any social impacts through the implementation of an escape gap requirement. Because some fishermen have requested this option it may provide a sense of security knowing that measures are being implemented to protect the species they fish, therefore ensuring a stable and possibly sustainable fishery. As stated earlier, most fishermen during public hearings said they are presently using escape gaps. Fishermen who indicated they were not presently using escape gaps on their traps did not state they opposed implementation of this option. Therefore, it seems that, overall, industry supports this option.

Conclusion

The Council received a presentation from fishermen on use of escape rings and construction of the escape gaps (See Section 3.4.2 Commercial Fishery for details.). The Council concluded that requiring an escape gap of the specified size would allow for release of most females and sexually immature males and unmarketable crabs. This will provide basic biological protection and improve the economics of the fishery. The Council will monitor the fishery and evaluate the spawning potential of the population as soon as sufficient data becomes available. If data indicate the reproductive output is decreasing, the framework provisions will be used to evaluate increasing the size of the escape gap. However, the Council concluded the specified size is sufficient at this time and any larger size could unnecessarily negatively impact the fishery in the early stages of development.

Rejected Options for Action 5:

Rejected Option 1. Do not require an escape gap or escape ring.

Biological Impacts

Small crabs and more female crabs would be retained in the trap which would negatively impact the biological integrity of the resource by harvesting and removing female and sexually immature crabs.

Economic Impacts

The female crabs are smaller in size and number. If they are not protected, recruitment could be affected in the long-term due to reduction in the female population. There could also be a high fishing mortality of immature male crabs. Such a situation could reduce the long-term overall yield from the fishery and thus the net economic benefit to society.

Social Impact

The social impacts associated with no requirement of an escape gap would most likely affect those fishermen who believe this type of management option is needed to ensure a viable fishery. There are representatives within the industry who believe this option is necessary for a sustainable fishery. By not requiring an escape gap for biological protection there may be some concern for the effects on the stock by fishermen who in general have supported this option.

Conclusion

The Council rejected this option because they concluded an escape gap is necessary to release sexually mature female and immature crabs in order to preserve the reproductive potential of the population, prevent overfishing, and achieve OY.

Rejected Option 2. Require a 4" escape ring.

Biological Impacts

This size ring would retain smaller crabs and would reduce the reproductive potential of the population. This could reduce recruitment and future catches.

Economic Impacts

See discussion under Action 5 for economic impacts.

Social Impacts

See Social Impacts under Action 5.

Conclusion

The Council concluded the 4 and 1/2 inch-escape ring is necessary to release mature female and sexually immature crabs in order to preserve the reproductive potential of the population, prevent overfishing, and achieve OY; therefore, this option was rejected.

4.2.1.2.2 ACTION 6. No retention of females.

Require that all females be released immediately in a manner most likely to ensure survival; no retention of females will be allowed. However, recognizing the need for a small tolerance for human error, the Council is specifying a limit on retention of females up to 0.5% by number but sale of female golden crabs is prohibited.

Biological Impacts

Most smaller crabs will be released with use of escape gaps or rings (see Action 5). Females are generally smaller than males and should be able to escape through the escape gap described above. However, any females caught should be returned immediately in order to maximize the reproductive output from females. Female crabs can be visually identified based on the shape of the abdomen. Tag recaptures and extensive maintenance in aquariums after capture indicate that released crabs will survive. Releasing female crabs will provide further biological protection because it is not known how harvesting females would affect recruitment, although any mortality would reduce the reproductive output.

Further biological benefits were described in a letter to the Council from Dr. Gertrude W. Hinsch dated August 17, 1995: "In the Gulf of Mexico population with which I worked, it is my feeling that there is a molt to maturity in the females and that they do not continue to molt and reproduce repeatedly.....The

presence of empty egg cases indicates that such females did not molt and then mate but rather mated in the hardened condition. This condition occurs in other brachyurans on a regular basis and I feel should also be considered for Chaceon.....I think it is a mistake to consider that C. fenneri mates only in the soft condition after a molt and that the females must molt in order to mate. If they do live as long as the management suggests I find it difficult to understand why none of the persons working with C. fenneri has reported females larger than 140-150 mm. carapace size. If a hardened female of maturity were to mate at the time of zoeae each season, it would be a practical way of conserving energy.....When it comes to fishery management of such a species as C. fenneri, terminal molts to maturity are of some significance. Of importance to the fishery would be the continued practice of harvesting males and returning the females to the sea for additional broods. A female who can mate in the hardened condition can continue to reproduce annually for many years."

Economic Impacts

A 0.5% retention in number of female golden crabs would allow for human error during the harvesting process and is not likely to affect the female crab population. This will increase the long-term economic viability by maximizing yield. Females are not marketed now because they are smaller and have less meat in them. Thus, there will be no short-term losses. The increase in long-term economic benefits cannot be assessed at this time because of lack of data. The magnitude of such increase would depend on harvesting methods and market situation. Assuming that female crabs have a reproductive life of 5-10 years, releasing females could enhance recruitment significantly thereby increasing the long-term economic benefits.

Social Impacts

This option has the support of industry so there should be no social impacts other than the assurance the Council is taking action to address industry concerns. A large majority of fishermen during public hearings stated that they do not retain females at this time. The Golden Crab Advisory Panel strongly supports this option.

Conclusion

The Council concluded that requiring release of females will provide additional biological protection by increasing spawning and subsequent recruitment. Females are smaller and are more valuable to the fishery as producers of larvae than they would be in terms of meat yield. This measure will contribute to preventing overfishing, achieving the objectives and OY, and increase net benefits from the fishery in the long-term. At the same time, a small tolerance as discussed below will allow for human error.

Fishermen and members of the Council's Golden Crab Advisory Panel expressed concern about how violations would be viewed for permit sanctions and/or harsh penalties if one inadvertently had one or two female crabs in their catch. Fishermen attempt to release all females immediately but due to human error there are instances when two or three females might be retained in one's catch. The Golden Crab Advisory Panel strongly recommended some tolerance to address such instances. The Council discussed basing the

tolerance on pounds or numbers and concluded that a percentage based on numbers was the best approach. A level of 1% was considered too high and the Council concluded 0.5% would allow for the likely levels of inadvertent retention. The Golden Crab Advisory Panel strongly supported this measure.

The Council is also prohibiting sale of female golden crabs to increase enforceability of the prohibition on retention of female crabs and to remove any incentives for fishermen to retain and land up to the tolerance limit. The Council considered allowing no possession by dealers but recognized the catch would be sorted at the dealer level and if there were any female crabs in the catch, the dealer would then be "in possession". The Council concluded preventing sale of female crabs would provide sufficient deterrent to encourage fishermen to release all female crabs and not attempt to land up to the tolerance limit.

Rejected Option for Action 6:

Rejected Option 1. Allow possession of females.

Biological Impacts

This would negatively impact the biological integrity of the golden crab resource by decreasing the number of females available for spawning. As described above, females released would be able to reproduce annually and thereby prevent overfishing.

Economic Impacts

This would likely reduce yield from the fishery in the long-term. If this should happen, a decrease in economic benefits could result. It could also lead to overcapitalization in the long-term depending on the rate at which the fishery expands. This situation would occur if the decrease in female population as a result of catching females leads to a decline in stock biomass. There would then be excess capacity to harvest the fishable biomass.

Social Impacts

Because allowing possession of females could potentially have a negative impact on golden crab stocks and industry supports the non-retention of females, this option may not be well received and could have detrimental effects upon the sustainability of the fishery.

Conclusion

The Council rejected this option because they concluded that requiring release of females will provide additional biological protection by increasing spawning and subsequent recruitment. Females are smaller and are more valuable to the fishery as producers of larvae than they would be in terms of meat yield. This measure will contribute to preventing overfishing and achieving the objectives and OY. Female crabs are presently not retained by fishermen.

4.2.1.3 GEAR REGULATIONS

4.2.1.3.1 ACTION 7. Allowable gear, non-conforming gear, experimental gear, and requirement that crabs be landed whole.

Allowable Gear. Specify traps as the only gear allowable in the directed golden crab fishery. Rope is the only allowable gear for mainlines in the golden crab fishery, however, cable mainlines and buoy lines will be allowed in the golden crab fishery for 18 months after publication of the final rule to allow for an evaluation and transition period.

Non-Conforming Gear. Vessels using non-conforming gear will be allowed zero retention of golden crabs.

Experimental Gear. The NMFS Southeast Regional Director may issue permits for experimental gear on provided that a process is implemented to collect data on the use of the particular gear concurrently with issuance of the permit. It is the Council's intent to allow sale of the catch from experimental gear. The data collected would be reviewed by the assessment group as soon as possible after the gear has been in use for 12 months or some other specified period of time. The Council would review the data and the group's report and determine whether the gear should be allowed. Any changes would be made by plan amendment. (Note: this procedure tracks regulations implementing Snapper Grouper Amendment 7.)

Landed Whole. Require that all golden crabs be landed whole.

Biological Impacts

This will protect the biological integrity of the fishery by preventing use of other types of gear that could result in increased harvest of females and/or small crabs. The use of appropriate traps should result in virtually no bycatch and since the majority of areas currently fished with traps are soft bottoms, potential habitat damage will be minimized. Habitat damage from other types of gear (e.g., trawls, entangling gear, nets) and from use of cable for the mainline is a concern. Use of rope for mainline can also potentially result in habitat damage. Habitat is limited in the areas fished and the Council intends to minimize any habitat damage. Specifying crabs be landed whole will prevent processing at sea, making the regulations protecting females and small crabs more effective and result in increased biological protection.

Economic Impacts

There should be no impacts because only traps are currently used in the fishery. Various types of trap construction have been experimented with and industry representatives testified that traps are the most efficient gear for the fishery. The requirement for traps only in this fishery should prevent gear conflict, eliminate bycatch, increase efficiency, and likely result in increased economic benefits in the long-term.

Presently, most fishermen in the golden crab fishery use rope as their mainline. However, there are a few golden crab fishermen, particularly in the Keys that use cable as their mainline. The provision to allow use of cable as mainlines and buoy lines for 18 months will enable golden crab fishermen presently using cable to continue to participate in the fishery. At the public hearing in Marathon, Florida during August 1995, only two fishermen indicated they are using cable as their mainline and they did not know of

others using cable. The Monroe County Commercial Fishermen, Inc. indicated to the Council, the need for the continued use of cable as mainline since it is an integral component of the fishery, particularly in the Key West area. The 18-month period will enable the Council to determine whether any significant gear conflict will develop in the fishery without affecting the operations of those presently using cable. If gear loss results from cable cutting through mainlines and buoy lines made of rope, those using rope would incur some loss.

Also, the provision for experimental gear will allow those who want to test gear that may be more efficient the opportunity to do so.

Social Impacts

Although the majority of fishermen use rope for mainline and buoy lines, there is one distinct group that use cable. Testimony during public hearings indicated that one Caucasian fisherman and several Hispanic fishermen in the Florida Keys were using cable for mainline rather than rope. The reason for using cable for mainline seems to be reduced gearing up costs. Cable is used in other fisheries by certain fishermen and is easily adapted to their golden crab fishing operation. Rope may also present a storage problem, especially with smaller boats which do not have the added room for storage space. Without the proper storage facilities, rope coiled on the deck presents a safety risk that some fishermen are not willing to take. Allowing cable for at least 18 months after the fishery management plan takes effect will provide sufficient time to assess the viability of this gear in the golden crab fishery. Some fishermen requested that cable not be allowed stating it would reduce the opportunity for conflict. Cable when laid over rope can result in lost traps as it cuts the line while the rope mainline is being hauled up. Fishermen have indicated some attempts to resolve this conflict through informal agreements regarding territory. It is worth noting the informal use of territoriality may be illustrative of a possible infrastructure for future co-management of this fishery

Conclusion

The Council concluded defining allowable gear is the best approach to prevent gear conflict and habitat degradation. Fishermen stated the loop of rope mainline between traps shows up on their fathometers which reduces the potential for trap loss. The Council's intent is that the use of cable will automatically be prohibited after 18 months unless no conflicts occur during the evaluation period. The 18-month period will allow for an evaluation and transition period thereby minimizing impacts on affected fishermen. If there is no conflict and fishermen work out any problems, the Council could use the framework procedure to allow use of cable. Requiring golden crab be landed whole will reduce potential violations of the measures designed to protect the biological integrity of the golden crab fishery which can result if at-sea processing were allowed. These measures are necessary to promote orderly utilization of the resource and promote management regimes that minimize gear and area conflict among fishermen.

Rejected Options for Action 7:

Rejected Option 1. Do not specify allowable gear.

Biological Impacts

Gear that could have negative biological impacts (e.g., entangling gear, nets, cable) would be allowed and management would have to react after the fact.

Economic Impacts

Allowing use of different gear types in this fishery could lead to potential gear conflict resulting in crowding and gear loss. This could reduce economic benefits from the fishery. It will also allow the introduction of unknown factors (e.g., bycatch) which would require restrictive management measures. This could create inefficiency and lead to dissipation of economic rent.

Social Impacts

There would be few if any social impacts associated with the option of not specifying allowable gear, unless gear conflicts develop or a potentially destructive gear were introduced. At this time, these problems do not exist to any great extent. Gear conflicts have occurred, but may have been resolved by industry itself.

Conclusion

The Council rejected this option because not specifying allowable gear would result in gear conflict and habitat damage.

4.2.1.3.2 ACTION 8. Escape panel (degradable).

Require an escape panel or door on at least one of the vertical sides with an opening or area of at least 12" by 12". The hinges or fasteners of each panel or door must be made of one of the following degradable materials:

A. Ungalvanized or uncoated wire no larger than 19 gauge or 0.041 inches diameter.

B. Untreated cotton 3/16-inch diameter or smaller.

C. Traps made of webbing must have at least a 1-foot slit relaced with untreated cotton of 3/16-inch diameter or smaller.

Biological Impacts

Escape panels will allow golden crabs to escape lost traps and reduce any mortality from lost traps continuing to fish. This will allow crabs that would be lost to reproduce and/or be harvested thereby protecting the biological integrity of the resource.

Economic Impacts

If lost gear does not degrade but continue to fish, there could be significant loss due to crabs not being able to escape from the traps. Public testimony indicated that some fishermen deploy traps for two to

three days, and others deploy them for one or two weeks. Thus, an appropriate time frame for traps or some part of the trap to degrade should be about two weeks or less than 30 days. Uncoated wire currently used in the black seabass pot fishery may not be suitable in this fishery because it does not degrade quickly due to the depths involved, the levels of dissolved oxygen, and low temperatures. This means that fishermen would incur some extra cost in using material that will degrade within the time period. Since there is the potential for significant trap loss due to the depths at which they are fished, the gains from using degradable material would likely exceed the extra cost that fishermen will incur.

Social Impacts

Because of the conservation effect of this action, any social impacts would be minimal and likely beneficial to both fishermen and the fishery. Public hearing testimony suggests the majority of fishermen are already using some type of panel or wire fasteners, therefore, this option should be acceptable to most if not all fishermen. Most fishermen included in the earlier profile (72%) were using some type of degradable panel.

Conclusion

The Council concluded escape panels are necessary to protect the biological integrity of the golden crab resource by removing mortality from lost or ghost traps. The material specified are expected to degrade within one to two months based on experience with a larger gauge wire in the black seabass pot fishery and input from fishermen. The Council is requesting research be conducted in this area and will modify the regulations as necessary in the future.

Rejected Options for Action 8:

Rejected Option 1. Require an escape panel or door on the front or back of each trap with an opening equal to or larger than the interior end of the trap's throat (funnel). The hinges and fasteners of each panel or door must be made of one of the following degradable materials: (a) magnesium alloy, timed float releases (pop-up devices) or similar magnesium alloy fasteners, or (b) ungalvanized or uncoated iron wire of 0.062-inch (1.6-millimeters) diameter or smaller. (Source: snapper grouper regulations.)

Biological Impacts

Escape panels will allow golden crabs to escape lost traps and reduce any mortality from lost traps. This will allow crabs that would be lost to reproduce and/or be harvested thereby protecting the biological integrity of the resource.

Economic Impacts

See discussion under the proposed action. There would likely be no cost saving. This option could increase the cost of traps because more degradable material is required.

Social Impacts

Because of the conservation effect of this action, any social impacts would be minimal and likely beneficial to both fishermen and the fishery.

Conclusion

The Council concluded escape panels as specified in the proposed action are necessary to protect the biological integrity of the golden crab resource by removing mortality from lost or ghost traps. The materials specified in the proposed action are better suited to the deep water golden crab fishery. Thus the Council rejected this option.

Rejected Option 2. Traps covered with biodegradable mesh or webbing are allowed without an escape panel as the trap itself is biodegradable.

Biological Impacts

Degradable traps will allow golden crabs to escape lost traps and reduce any mortality from lost or ghost traps.

Economic Impacts

See discussion under the proposed action.

Social Impacts

Because of the conservation effect of this action, any social impacts would be minimal and likely beneficial to both fishermen and the fishery.

Conclusion

The Council concluded escape panels as specified in the proposed action are necessary to protect the biological integrity of the golden crab resource by removing mortality from lost or ghost traps. The materials specified in the proposed action are better suited to the deep water golden crab fishery. Therefore, the Council rejected this option.

Rejected Option 3. Require the appropriate escape mechanism so that the material degrades rendering the trap unfishable in approximately 14 to 30 days. Acceptable materials include:

A. A door on one end, hinged on top and closed with 19 gauge wire measuring 0.041-inch diameter or smaller;

B. Escape panel of cotton mesh of at least 36 square"; and

C. Traps made of mesh must have at least a 1-foot slit relaced with cotton of 3/16-inch diameter or smaller.

Biological Impacts

Escape panels will allow golden crabs to escape lost traps and reduce any mortality from lost or ghost traps. This will allow crabs that would be lost to reproduce and/or be harvested thereby protecting the biological integrity of the resource.

Economic Impacts

If lost gear does not degrade but continue to fish, there could be significant loss due to crabs not being able to escape from the traps. Public testimony indicated that some fishermen deploy traps for two to three days, and others deploy them for one or two weeks. Thus, an appropriate time frame for traps or some part of the trap to degrade should be about two weeks or less than 30 days. Uncoated wire currently

used in the black seabass pot fishery may not be suitable in this fishery because it does not degrade quickly due to the depths involved, the levels of dissolved oxygen, and low temperatures. This means that fishermen would incur some extra cost in using material that will degrade within the time period. Since there is the potential for significant trap loss due to the depths at which they are fished, the gains from using degradable material would likely exceed the extra cost that fishermen will incur.

Social Impacts

See Social Impacts under Action 8.

Conclusion

The Council concluded escape panels as specified in the proposed action are necessary to protect the biological integrity of the golden crab resource by removing mortality from lost or ghost traps. The materials specified in the proposed action are better suited to the deep water golden crab fishery. Therefore, the Council rejected this option.

Rejected Option 4. Do not require an escape panel or door.

Biological Impacts

Ghost fishing would result in negative biological impacts from unaccounted fishing mortality.

Economic Impacts

This option could result in significant economic loss due to ghost fishing.

Social Impacts

Not requiring escape panels or doors on traps would be looked upon unfavorably by those individuals who feel that lost traps are a nuisance and detrimental to the environment. Because lost traps have the potential to continue trapping indefinitely, they certainly can have a detrimental effect upon the fishery.

Conclusion

The Council concluded escape panels as specified in the proposed action are necessary to protect the biological integrity of the golden crab resource by removing mortality from lost or ghost traps. The materials specified in the proposed action are better suited to the deep water golden crab fishery. Therefore, the Council rejected this option.

4.2.1.3.3 ACTION 9. Tending traps.

A golden crab trap may be pulled or tended only by a person (other than an authorized officer) aboard the vessel permitted to fish such trap, or aboard another vessel if such vessel has on board written consent of the vessel permit holder and possesses a valid golden crab permit. Pulling traps at night is allowed because the potential of someone else pulling a fisherman's traps is low given the gear necessary.

Biological Impacts

None.

Economic Impacts

This action will help prevent conflict and pilfering. It should not impose any extra burden on fishermen.

Social Impacts

Requiring traps be tended only by those who are authorized would provide some assurance to fishermen that unauthorized tending of traps would not be allowed and punishable by law. This action would act as a deterrent to those fishermen who illegally take crabs from another fisherman's traps without permission. This action could introduce some inconvenience to fishermen if for some reason they were unable to provide written consent for another to tend their traps.

Conclusion

The Council concluded that this measure is necessary to prevent possible trap loss and conflict among fishermen. This measure is necessary to promote orderly utilization of the resource.

Rejected Options for Action 9:

Rejected Option 1. Do not specify tending requirements.

Biological Impacts

None.

Economic Impacts

This option would not help prevent conflict and pilfering of traps.

Social Impacts

The option of not specifying tending requirements would most likely have few social impacts other than placing the burden of monitoring illicit trap tending upon fishermen themselves.

Conclusion

The Council rejected not specifying tending requirements because they concluded such requirements are necessary to prevent possible trap loss and conflict among fishermen, and to promote orderly utilization of the resource.

4.2.1.3.4 ACTION 10. Gear identification.

Require that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. If buoys are used, the permit number or other assigned number must be marked on the buoy. It is the Council's intent that fishermen be allowed to identity traps and buoys in the manner they feel is most appropriate and cost effective and that the numbering system be as few digits as possible in order to minimize costs/impacts on fishermen.

Biological Impacts

None.

Economic Impacts

The cost of plastic identification tags used in the black seabass pot fishery in the South Atlantic is $1.10 each (Source: Edward Burgess, NMFS SERO, pers. comm.). Assuming that similar tags are used in the golden crab fishery, fishermen will incur an additional cost depending on the number of traps fished. For a fisherman using 300 traps, the initial cost will be about $330. There could be a replacement cost if tags break and are lost. However, use of identification tags will aid enforcement significantly. Also, individual fishermen will be able to identify their traps and those of others if any conflict arises. Members of the Golden Crab Advisory Panel supported marking traps as a valuable means of enforcing regulations but were concerned over tag loss. The minimal cost to fishermen is not expected to impose any financial burden.

Social Impacts

There would be few social impacts from the requirement of trap identification and fishermen support identification to help monitor illegal use of traps. The Golden Crab Advisory Panel expressed concern about requiring trap tags because they break easily. Recent advances in tag-making technology should resolve the breakage problem. Allowing fishermen to choose how they identify their traps will minimize any social impacts.

Conclusion

The Council is requiring traps be identified, but is not requiring trap tags at this time primarily on the advice of fishermen. Fishermen stated that the tags break easily and represent an unnecessary expense. The Council is requiring that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. Allowing fishermen to choose how they identify their traps will minimize impacts while promoting enforcement, promoting orderly utilization of the resource, and minimizing conflict.

Rejected Options for Action 10:

Rejected Option 1. A valid identification tag purchased at the expense of the fisherman, available from the NMFS regional director, must be affixed to each golden crab trap used or possessed in the EEZ. Such tag shows the specific tag number, the permit number, and the month and year through which the permit and tag are valid. The permit number shall be displayed on any buoy deployed in conjunction with the use of traps.

Biological Impacts

None.

Economic Impacts

There would be a cost burden on fishermen for the purchase of the tags. The cost per tag is $1.10 (Source: Edward Burgess, NMFS SERO, pers. comm.). The magnitude of the cost burden will depend on the number of tags purchased. For example, if a fisherman requires 300 tags, the cost to that fisherman

would be $330. However, the cost of tags is expected to be a very small fraction of the operating cost to fishermen. Fishermen on the other hand, will be able to identify their traps positively. This should help prevent pilfering and could involve cost savings from having to replace stolen traps in the long-term. It will also aid enforcement.

Social Impacts

There would be few social impacts from requiring trap tags. In fact, the requirement may assist in identifying those fishermen who consistently misuse traps or leave them unattended for long periods of time, especially if other measures regarding trap characteristics were required. Because traps left at sea can continue catching golden crab, tags would offer a means of identifying those fishermen who are violating requirements which may have a detrimental effect on the golden crab and other fisheries. Comments during public scoping indicates support for this measure by fishermen.

Conclusion

The Council is not requiring trap tags at this time primarily on the advice of fishermen. Fishermen stated that the tags break easily and represent an unnecessary expense. However, the Council is requiring that traps be identified with a permanently affixed and legible permit number or other assigned number on each trap. Allowing fishermen to choose how they identify their traps will minimize impacts while promoting enforcement, promoting orderly utilization of the resource, and minimizing conflict.

Rejected Option 2. Do not require identification tags on golden crab traps at this time. If this becomes necessary in the future, the Council will consider requiring identification tags through the framework procedure. If buoys are used, the permit number should be marked on the buoy.

Biological Impacts

None.

Economic Impacts

This would not aid enforcement. If traps cannot be traced to individual fishermen, they could not be held accountable if such traps are being used illegally unless they are caught in the illegal act.

Social Impacts

Although there would be few social impacts from the requirement of trap tags, fishermen may support use of tags to help monitor illegal use of traps. However, the Advisory Panel did not support trap tags because they break easily.

Conclusion

The Council rejected this option because there are enforcement benefits and efficiency benefits associated with identifying traps.

4.2.1.3.5 ACTION 11. Maximum trap size.

Specify a maximum trap volume size of 64 cubic feet in the northern zone and 48 cubic feet in the middle and southern zones. (Note: See Action 19 for a description of the zones.)

Biological Impacts

The relationship of catch to trap size is not known for the golden crab fishery although in other crab fisheries catch rate increases with trap size. There are more vessels in the fishery in the southern and mid-zones, and a smaller trap would help slow the rate of harvest which will lessen the risk of overfishing.

Economic Impacts

Public testimony indicated some fishermen make day trips and fish within 50-60 miles of shore. This group utilizes traps with a maximum inside volume of 48 cubic feet. Their fishing area extends from Cape Canaveral, Florida south to the Florida Keys on the Florida east coast. A trap of 48 cubic feet volume will not impact the fishing operation of this group.

Another group fishes mainly north of Cape Canaveral, Florida utilizing bigger vessels and traps larger than 60 cubic feet in volume. Their fishing area extends up to 150 miles offshore. These vessels fish in much deeper waters and make trips lasting up to 12 days. Because of the depth at which they fish, these fishermen claim they have to use bigger traps to prevent the traps from moving on the bottom. The proposed action would not affect this group if their traps do not exceed 64 cubic feet in volume. However if their traps exceed 64 cubic feet, this action could have some negative impacts on this group. If they can switch to traps of 64 cubic feet, and operate efficiently, the impact on them would be the cost of changing to the 64 cubic feet trap volume. If they cannot operate efficiently with a trap volume of 64 cubic feet, the impact would be the lost harvest due to inefficient trap use.

Specifying maximum trap volumes according to zones could enable all participants to utilize different trap volumes and would likely not impact any fishermen, or cause them to alter their current operating procedures. It should also prevent crowding on fishing grounds and gear conflict as fishing activity would be spread out in different areas in the south Atlantic.

Social Impacts

Requiring a maximum trap size may raise questions of equity among some industry representatives for there is public testimony that those who fish at greater depths and use larger traps may catch larger crabs. This action could, if the maximum trap size is set too low, negatively impact larger vessels by introducing an inefficiency that would make it impractical to fish with smaller traps and larger vessels. Limiting trap size to a maximum could artificially restrict the fishery to small boats. Because there has been exploratory fishing by large vessels, there is obvious interest in developing a sector of the fishery that would harvest at these greater depths using larger traps and possibly catching larger crabs.

Conclusion

The Council approved this action to provide some cap on the maximum size of traps in the southern and mid-zones to slow the rate of harvest which will help prevent overfishing. However, the number of vessels in the northern zone appears to be low and given the depth and distance from shore, larger traps can be allowed. Also, the majority of vessels fishing in the southern and mid-zones use traps less than or equal to 48 cubic feet. Limiting trap size in the southern and middle zones will also help reduce conflict from larger versus smaller vessels.

Rejected Options for Action 11:

Rejected Option 1. Rectangular traps constructed of wire are limited to a maximum volume of 48 cubic feet.

Biological Impacts

The relationship of catch to trap size is not known for the golden crab fishery although in other crab fisheries catch rate increases with trap size.

Economic Impacts

Based on testimony by those participating in the fishery the traps currently employed in some areas are larger than the one in this proposed option. This would impact some of the participants. Those that are currently utilizing traps slightly larger than 48 cubic feet volume would be impacted less (if they can fish efficiently with the smaller traps) than those that are currently fishing much larger traps. The issue is whether the latter group can operate profitably with this size trap and whether they could switch to depths where the traps can fish efficiently. Lack of necessary data precludes a quantitative assessment of the impact of this option.

Social Impacts

The social impacts of specifying a particular trap with a maximum size would depend upon the types of traps that may be excluded from use. Public scoping suggests that a wide variety of traps are being used experimentally. Some small boat fishermen have refined their trap design and may be satisfied with this size limit. Larger vessels, however, have only recently begun to fish experimentally and have not had the opportunity to narrow the choice of trap to any specified design or size. A large part of that decision will depend upon the ability of captain and crew to adapt present designs to the specific conditions of the fishing environment (i.e., currents, depths, etc.) as they explore new grounds.

Conclusion

The Council rejected this option in order to provide more opportunity for fishermen in the northern zone to fish larger traps.

Rejected Option 2. Non-rectangular traps constructed of material other than wire are limited to a maximum volume of 64 cubic feet.

Biological Impacts

The relationship of catch to trap size is not known for the golden crab fishery although in other crab fisheries catch rate increases with trap size.

Economic Impacts

The issue concerning the shape of the trap could be critical because of the depth of water fished. If it turns out that rectangular traps are more efficient, this option could reduce the profitability of individual fishing units. The magnitude of such reduction in profit cannot be determined because of the lack of data. Also, the maximum volume requirement could constrain some fishermen and prevent them from fishing at certain depths. (Refer to the discussion under the proposed Action) The requirement that traps be constructed of material other than wire could increase the cost of traps depending on the cost of the material relative to the cost of wire. Conversely, it could reduce the cost if it turns out that the material is cheaper than wire.

Social Impacts

See Social Impacts discussed in Rejected Option 1 above.

Conclusion

The Council rejected this option in order to slow the rate of harvest (which will help prevent overfishing) in the southern and mid-zones where there are more fishermen.

Rejected Option 3. Specify maximum dimensions (e.g., 4' by 4' by 4' or 6' by 4' by 2').

Biological Impacts

The relationship of catch to trap size is not known for the golden crab fishery although in other crab fisheries catch increases with trap size.

Economic Impacts

A 4' by 4' by 4' dimension will result in a trap of 64 cubic feet. A 6' by 4' by 2' dimension will result in a trap of 48 cubic feet. The first size would likely affect one group of participants in the fishery. The latter size would likely affect more participants in the fishery. There is also the issue concerning the shapes of the traps. Some shapes may not be efficient at certain depths of water. The extent of the impact cannot be determined at this time. The level of impact would depend on the loss in harvest to fishermen as a result of this action and whether some fishermen would have to cease fishing for golden crab.

Social Impacts

See rejected Option 1 above.

Conclusion

The Council rejected this option because it would not slow the rate of harvest (which will help prevent overfishing) in the southern and middle zones while allowing more flexibility in the northern zone.

Rejected Option 4. Specify a maximum trap volume of 64 cubic feet regardless of shape or material. The Council requested public input on material for trap construction (e.g., wire, plastic, etc.) and on where such limits should apply (e.g., different regulations north and south of Cape Canaveral).

Biological Impacts

The relationship of catch to trap size is not known for the golden crab fishery although in other crab fisheries catch rate increases with trap size.

Economic Impacts

See Rejected Option 2 above.

Social Impacts

At this time, a trap volume requirement of 64 cubic feet may accommodate the entire fishery. It is not known whether there are any vessels using a trap larger than this size. Information presented during public hearings suggests that most traps presently in use would fall below this size requirement.

Conclusion

The Council rejected this option because it would not slow the rate of harvest (which will help prevent overfishing) in the southern and middle zones while allowing more flexibility in the northern zone.

Rejected Option 5. Do not specify a maximum trap volume.

Biological Impacts

This could result in fishermen using larger traps in the southern and middle zones which would increase the catch rate. Such an increase in trap size could result in overfishing and increase the level of conflict between small and large vessels.

Economic Impacts

This option would allow participants to utilize any size trap. If catch rate is not related to trap size, this option will have no impact on the fishery. It would benefit those who require large volume traps to fish in deeper water. However, if catch rate increases with increasing trap volume, the possibility exist for overfishing to occur which would result in net economic losses.

Social Impacts

This option would have some support among those fishermen who are still experimenting and have not decided upon the size trap. Those most likely to support this option are fishing larger vessels. This group would like the opportunity to experiment with the largest volume size feasible.

Conclusion

The Council rejected this option because it would not slow the rate of harvest (which will help prevent overfishing) in the southern and middle zones while allowing more flexibility in the northern zone.

4.2.1.4 LAW ENFORCEMENT CONSIDERATIONS

4.2.1.4.1 ACTION 12. Depth limitations.

In the northern zone golden crab traps can only be deployed in waters deeper than 900 feet; in the middle and southern zones traps can only be deployed in waters deeper than 700 feet. (Note: See Action 19 for a description of the zones.)

Biological Impacts

Establishing depth limitations may protect some of the female crabs in shallower water and will provide some additional habitat protection. Additional biological input was provided by Elizabeth Wenner (letter dated August 15, 1995: "In the South Atlantic Bight, females were found at depths > 367 m. At depths of 367-550 m, greatest catch rates were recorded for male crabs. It is unlikely then that restricting trapping to depths greater than 900 ft would provide much protection for females. Bycatch of Jonah crab has also been documented at depths between 293-567 m with greatest catches from 294 to 366 m. Fishing much beyond 500 m off SC and Georgia becomes a hazard due to coral mounds and low rock outcrops. To avoid gear loss and habitat damage to deep water coral banks, it is suggested that minimum and maximum depth limits be set. The distribution of females and preferred habitat appears to change with latitude so some consideration of allowable fishing depths and sensitive habitats within the SAB needs to be considered. It appears that deep water coral banks occur deeper off southern Florida than they do off SC, so a maximum depth at 500 m should protect this habitat."

In addition, the depth limitation specified will provide some separation between golden crab traps and snapper grouper/tilefish species. This is supported in a letter from Glenn Ulrich (dated August 15, 1995): "Large male crabs are sometimes available between 600 and 900 feet off the Georgia coast (Drew Kendall, GA MAREX, pers. comm.). From a crab fishery perspective, setting a minimum depth doesn't make much sense although I can envision possible gear conflicts with tilefish longliners in certain areas. Setting the near shore limit at 800 feet would be a reasonable compromise. No maximum depth limit should be considered at this time."

Economic Impacts

Public testimony indicated that the majority, if not all of the present participants in the fishery operate at depths of 700 feet and more in the middle and southern zones. Larger vessels in the northern zone operate at depths greater than 1,500 feet. This action will have little or no impact on fishermen. It could provide protection to female crabs and minimize interaction with other fisheries.

Social Impacts

Much of the testimony at scoping and public hearings indicates that this depth limitation would be acceptable to most fishermen, since they are primarily fishing at this depth or greater. However, other sources indicate that productive fishing has been undertaken at depths under 900 ft (Lindberg and Wenner, 1990). If fishermen need to move from one depth strata to another over time to have a stable harvest, then this limitation may not be acceptable to those who would want to fish in shallower waters at some point in time. Working in shallower waters means less time to reach fishing grounds and less fuel expended. This allows participation of many more vessels than would otherwise be restricted due to their smaller size. The types of constraints that come with such a depth limitation may restrict the fishery to only those vessels large enough to withstand the environmental conditions that accompany fishing at greater depths and further from shore.

Conclusion

The Council concluded, based on the depth distribution of species in the snapper grouper management unit, these depth limitations were appropriate to provide adequate separation from snapper grouper species. This measure will also provide some habitat protection. As better habitat distribution and fishery data become available, the Council will examine this issue and implement necessary changes through the framework procedure.

Rejected Options for Action 12:

Rejected Option 1. Golden crab traps are only allowed in waters deeper than 600 feet.

Biological Impacts

This may protect some of the female crabs in shallower water and will provide some additional habitat protection.

Economic Impacts

This option could cause interaction between this fishery and other fisheries, particularly the snapper grouper fishery. It could lead to a bycatch problem. This could reduce the economic benefits from these fisheries. There is no indication present participants fish for golden crab at this depth.

Social Impacts

See Action 12, Social Impacts.

Conclusion

The Council concluded that the proposed action best separated the golden crab fishery from the snapper grouper fishery and best provides habitat protection. Therefore, this option was rejected by the Council.

Rejected Option 2. Golden crab traps are only allowed in waters deeper than 700 feet.

Biological Impacts

This may protect some of the female crabs in shallower water and will provide some additional habitat protection.

Economic Impacts

One participant indicated during testimony to the Council that his vessel used to fish at 700 feet depth. He now operates at depths of 1,000 feet and deeper. It is likely that one or two other participants fish at this depth. Others fish at greater depths. Given that the smaller size vessel (about 45 feet) can fish at depths of 1,000 feet, this option would have no impact on the participants.

Social Impacts

See Action 12, Social Impacts.

Conclusion

The Council concluded that the proposed action best separated the golden crab fishery from the snapper grouper fishery and best provides habitat protection. Therefore, this option was rejected by the Council.

Rejected Option 3. Golden crab traps are only allowed in waters deeper than 800 feet.

Biological Impacts

This may protect some of the female crabs in shallower water and will provide some additional habitat protection.

Economic Impacts

A few participants who operate at depths less than 800 feet would be affected. If they can move to depths of over 800 feet and fish efficiently, the impact on them would be the cost of traveling the extra distance. Also, there could be some crowding externality. On the other hand, if these vessels are not capable of fishing at depths greater than 800 feet, they will have to exit the fishery. This could cause total economic loss or varying degrees of loss depending on how well they perform in their next best alternative.

Social Impacts

See Action 12, Social Impacts.

Conclusion

The Council concluded that the proposed action best separated the golden crab fishery from the snapper grouper fishery and best provides habitat protection. Therefore, this option was rejected by the Council.

Rejected Option 4. No area or depth limitation for golden crab traps. Golden crab traps could be deployed at any depth of water.

Biological Impacts

This option would not protect female crabs in shallower water and would not provide any additional habitat protection. Also, it would result in the bycatch of snapper grouper species which would represent additional fishing mortality for already overfished species.

Economic Impacts

During public testimony, no one indicated fishing for golden crabs at depths less than 650 feet. Thus, no depth limitation would not affect fisheries that occur at depths less than 650 feet. It is likely that some snapper grouper species could be encountered in some areas at depths between 650 and 750 feet. If golden crab traps are deployed at these depths, there could be gear conflict between them and fishermen fishing for snapper grouper species. Crowding could also be a possibility. Bycatch could also become a problem if golden crab traps are fished in areas where they capture snapper grouper species.

Social Impacts

See Action 12, Social Impacts.

Conclusion

The Council concluded that the proposed action best separated the golden crab fishery from the snapper grouper fishery and best provides habitat protection. Therefore, this option was rejected by the Council. This option would result in conflict with snapper grouper fishermen, potential interaction with snapper grouper species, and potential habitat damage.

4.2.1.4.2 ACTION 13. Possession of snapper grouper species.

Prohibit possession of whole or gutted fish or fillets of species in the snapper grouper management unit while fishing for, or possessing, golden crabs.

Biological Impacts

None.

Economic Impacts

Presently, the fishery does not have any bycatch of species in the snapper grouper complex. Participants have testified they do not want to retain any snapper grouper species. Thus, this action will not impact participants in the fishery. As a safeguard, it will protect the snapper grouper species which for some species are already overfished.

Social Impacts

Because golden crab fishermen are presently using heads and frames from snapper/grouper species as bait, some type of provision that would allow them to continue this practice needs consideration. This action will assist law enforcement problems for fishermen using carcasses for bait.

Conclusion

The Council concluded that this measure would provide adequate protection to ensure that golden crab traps were not being used to fish for snapper grouper species while providing for the orderly utilization of the resource for those fishermen using heads and frames as bait.

Rejected Options for Action 13:

Rejected Option 1. No possession of species in the snapper grouper management unit is allowed while fishing for golden crabs, including use of fish frames/heads for bait.

Biological Impacts

None.

Economic Impacts

This option could affect participants in the fishery. Public testimony indicated that most fishermen utilize fish frames/heads of snapper grouper species as bait. If they are prohibited from possessing them while fishing for golden crabs, they will have to find alternative material for bait. The extent to which it will impact their activities depends on the availability and cost of substitute material for bait. If the cost of substitute material is higher than the cost of the fish frames/heads of snapper grouper species, their operating costs could increase significantly. One participant fishing full time for golden crab indicated that he utilized over 65 tons of bait per year. Also, limiting the choices they could use as bait could increase the cost of the bait material in demand depending on the market situation.

Social Impacts

Fishermen are presently using snapper grouper heads and frames for bait and would likely disapprove of this option. Sources for bait may be limited especially in Florida since entanglement nets have been banned in state waters.

Conclusion

The Council concluded that the proposed action provided sufficient protection without negatively impacting fishermen. The Council rejected this option because of the potentially large negative impact on fishermen.

Rejected Option 2. Allow use of fish heads/frames obtained from fish processing facilities to be used as bait provided written documentation from the facility where fish frames/heads were obtained is onboard the vessel.

Biological Impacts

None.

Economic Impacts

Action 13 would allow use of fish heads/frames. Thus, this option would have no economic impact. It could create some logistical problems since fishermen testified that fish houses are reluctant to provide documentation on fish heads/frames.

Social Impacts

This option may introduce some enforcement difficulties with verification of written documentation. Fishermen would likely have few objections to obtaining this type of documentation, but it may be hard to obtain from fish houses according to the Golden Crab Advisory Panel.

Conclusion

The Council rejected this option because the proposed action provides sufficient protection without negatively impacting fishermen and because it would increase the paperwork burden on fishermen and dealers.

Rejected Option 3. No action. Species in the snapper grouper management unit could be possessed while fishing for golden crab if the vessel has a snapper grouper permit.

Biological Impacts

None unless snapper grouper species are targeted with golden crab traps.

Economic Impacts

Although this option could encourage directed effort at snapper grouper species, it would make fishing operations for those who have a snapper grouper permit more efficient because of the distance offshore that these vessels have to go. There is some evidence that some wreckfish vessels have caught golden crabs using traps during the same trip that they fished for wreckfish. If this continuation of fishing for golden crabs and snapper grouper species during a single trip is successful, operating costs could be reduced leading to increased profits to fishermen, or at least higher revenues.

Social Impacts

Allowing possession of snapper grouper species aboard golden crab vessels would make enforcement of the prohibition on fish traps much more difficult. Information from wreckfish fishermen indicated a desire to combine fishing trips for both wreckfish and golden crab. Because of the distance traveled to either fishing ground, fishermen who might be in both fisheries could save time and money by combining trips. However, as stated earlier, the enforcement problems make this alternative undesirable as it would be impossible to determine whether snapper/grouper had been caught in traps or by hook and line. Fish traps were prohibited in 1991 and caused animosity among some fishermen toward fishery management. The Council would like to avoid enforcement complications regarding such a contentious issue.

Conclusion

The Council concluded that the proposed action provided sufficient protection without negatively impacting fishermen. This option would result in enforcement problems with the fish trap prohibition and could cause conflict between golden crab fishermen and other fishermen. Therefore the Council rejected this option.

4.2.1.5 PERMITS

4.2.1.5.1 ACTION 14. Vessel permit.

For a person aboard a fishing vessel to fish for golden crab in the exclusive economic zone (EEZ), possess golden crab in or from the EEZ, off-load golden crab from the EEZ, or sell golden crab in or from the EEZ, a vessel permit for golden crab must be issued to the vessel and be on board.

A fee will be charged to cover the administrative costs of issuing federal vessel permits. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

Biological Impacts

Determination of the number of vessels in the fishery will improve our understanding of the fishery and will improve stock assessments. This will reduce the risk of overfishing

Economic Impacts

Vessel permits will enable the universe of participants in the fishery to be known. It will also aid collection of data necessary for management. A fee will be charged to cover administrative costs of issuing the permits. Any inconvenience caused to vessel owners by this requirement would be compensated for by the benefits from increased incentives for regulatory compliance.

Annual vessel permits will be issued to those who qualify. The applicants will be charged the administrative costs for issuing the permits. Presently, the cost of issuing vessel permit is $40 and the opportunity cost (time spent completing the application) to the fishermen is $5 per application. Assuming that about 30 vessels initially qualify and are issued permits, the annual cost to the industry is estimated at $1,350 ($1,200 plus $150). However, this does not take into consideration vessels that have permits for other fisheries. If a vessel already possesses a permit for one fishery, that vessel would only be charged an additional $10 to obtain an endorsement for the golden crab fishery. The total cost to the industry could be much less depending on the number of vessels that already have permits for other fisheries. It should be noted that most of the vessels that qualify according to the Florida trip ticket data are either in the mackerel, lobster, or stone crab fishery.

Vessel permits are already required in other fisheries in the South Atlantic Region. This action will yield dividends if it is successful in discouraging non–reporting and other forms of cheating which could reduce expected benefits from other management actions.

Social Impacts

Permits have become an established part of many fisheries. It is unlikely that fishermen would object to having to apply for permits to fish for golden crab. However, if the permitting process was perceived as unnecessarily burdensome for any reason then there may be opposition. Permitting does allow the Council to identify and access crucial information regarding the fishery and its participants. With golden crab this type of information may be critical to the determination of a sustainable fishery. Permitting has become an almost necessary part of fishery management and therefore may outweigh some of the burden on the public.

Conclusion

The Council concluded requiring permits is necessary to meet the objective of collecting data necessary to monitor and assess the fishery. This data is necessary for the long-term productivity and sustainability of the golden crab resource and for the Council to increase enforcement compliance and achieve optimum yield. Requiring fishermen only sell to Federally permitted dealers is appropriate because all catches occur in the EEZ; golden crabs are not harvested in state waters.

Rejected Options for Action 14:

Rejected Option 1. Do not require a vessel permit.

Biological Impacts

Not knowing the number of vessels in the fishery will negatively impact our understanding of the fishery and will result in less accurate stock assessments which increases the risk of overfishing.

Economic Impacts

If vessel permits are not required, it would be difficult to identify the universe of participants in the harvesting sector. Also, the incentive for compliance among participants would decrease and a weak link in the compliance chain could result. The small cost to fishermen by requiring permits and reporting is more than compensated for by benefits from increased incentives for regulatory compliance.

Social Impacts

This option would certainly curtail the Council's ability to identify and have access to information critical for management of fisheries today. Although there would be less of a public burden, the long-term inability to access data on the fishery may create severe problems in managing the resource in a sustainable manner.

Conclusion

The Council concluded requiring permits is necessary to meet the objective of collecting data necessary to monitor and assess the fishery. This data is necessary for the long-term productivity and

sustainability of the golden crab resource and for the Council to increase enforcement compliance and achieve optimum yield. Therefore, the Council rejected this option.

4.2.1.5.2 ACTION 15. Dealer permit.

A dealer who receives golden crab must obtain an annual dealer permit for golden crab. To be eligible for such permit, an applicant must have a valid state wholesaler's license in the state where he or she operates and must have a physical facility for the receipt of fish/shellfish at a fixed location in that state.

A fee will be charged to cover the administrative costs of issuing federal dealer permits. To purchase golden crab harvested in the exclusive economic zone (EEZ) from a fisherman, a person or business (including a restaurant) must have a federal dealer permit. Golden crabs taken from the EEZ may only be sold to Federally permitted dealers, and Federally permitted dealers may only purchase golden crab from Federally permitted fishermen. Because all catches occur in the EEZ (golden crabs are not harvested in state waters), it is a rebuttable presumption that a vessel with golden crab aboard harvested the crabs from the EEZ.

Biological Impacts

Determination of the number of dealers in the fishery will improve our understanding of the fishery and will improve stock assessments. This will reduce the risk of overfishing.

Economic Impacts

Dealers who want to handle golden crab must obtain a federal dealer permit. Dealers who handle golden crab must fill out monthly golden crab reports listing their golden crab purchases. Requirements for a federal golden crab permit are that the applicant possesses a state dealer's license and that the applicant must have a physical facility at a fixed location in the state where the dealer has a state license. A fee will be charged to cover the administrative costs of issuing the federal golden crab permit. It should be noted that dealers who already have federal dealer's permits for other species in the south Atlantic will not have to obtain separate permits. They will only be required to include golden crab in the list of species in their permits.

Dealer permits will increase incentives for dealers to report golden crab purchases accurately. The small inconvenience to fish houses by requiring permits and monthly reporting is more than compensated for by the benefits from increased incentives for regulatory compliance. The estimated annual cost of dealer permits to the industry is unknown at this time because there is no available count on the number of golden crab dealers. Unofficial reports indicate that there are less than five dealers presently.

The public cost of dealer reporting is estimated at $12.50 per hour for processing monthly reports. Processing time per report is estimated at 15 minutes. Requiring that dealers have physical facilities at

fixed locations should not impose any large cost on legitimate dealers because from a practical standpoint, physical facilities are required to offload golden crab. This proposed action should yield dividends if it is successful in discouraging non–reporting and other forms of cheating which could significantly reduce the expected benefits from other management measures.

Social Impacts

The requirement for dealer permits allows for clear identification of those involved in the intermediate sector of the fishery. Having this type of information will facilitate other data collection by providing the universe of those involved in the fishery. Dealers are often the best source for up-to-date landings information in a timely manner, therefore being able to identify those individuals is important to data collection. Permitting of dealers can be viewed as burdensome by the public if there is too much redundancy perceived by those required to be permitted. Avoiding duplication when possible reduces some opposition to this type of requirement.

Conclusion

The Council concluded requiring permits is necessary to meet the objective of collecting data necessary to monitor and assess the fishery. This data is necessary for assessing and ensuring the long-term productivity and sustainability of the golden crab resource and for the Council to increase enforcement compliance and achieve optimum yield. Requiring dealers purchase only from Federally permitted fishermen is appropriate because all catches occur in the EEZ; golden crabs are not harvested in state waters.

Rejected Options for Action 15:

Rejected Option 1. Do not require a dealer permit.

Biological Impacts

This option would not allow determination of the number of dealers in the fishery, would not improve our understanding of the fishery, and would not improve stock assessments which increases the risk of overfishing.

Economic Impacts

If a dealer permit is not required, the incentive for compliance among dealers and fishermen would decrease and a weak link in the compliance chain could result. The small inconvenience to fish houses by requiring permits and reporting is more than compensated for by benefits from increased incentives for regulatory compliance.

Social Impacts

Not requiring dealer permits would make it difficult to identify the universe of those involved in the intermediate sector of the golden crab fishery. That information is important when data collection becomes necessary to manage a fishery.

Conclusion

The Council concluded requiring permits is necessary to meet the objective of collecting data necessary to monitor and assess the fishery. This data is necessary for the long-term productivity and sustainability of the golden crab resource and for the Council to increase enforcement compliance and achieve optimum yield.

4.2.1.6 DATA COLLECTION

4.2.1.6.1 ACTION 16. Vessel/fishermen reporting.

The owner or operator of a vessel for which a permit for golden crab has been issued must maintain a daily logbook form for each fishing trip on a form available from the NMFS Science and Research Director. Among other things, the logbook forms provide a record of fishing locations, time fished, fishing gear used, and numbers of each bycatch species discarded. The forms should also provide for the recording of economic data such as variable costs and prices paid. Logbook forms must be submitted to the NMFS Science and Research Director postmarked not later than the 30th day after sale of the golden crabs off-loaded from a trip. If no fishing occurred during a month, a report so stating must be submitted in accordance with instructions provided with the forms.

If selected, the owner or operator of a vessel must provide data and must comply with any requirements regarding landing golden crab and any associated bycatch. The Council is specifying 100% logbook coverage given the severe lack of data and extreme importance of this data. Also, if selected, the owner or operator of a vessel must make their catch available for biological sampling and if required, must carry an observer.

The industry has indicated they would be more than willing to provide data voluntarily as well as under the fishery management plan. The South Atlantic Council requested (September 1995) NMFS to immediately begin a voluntary logbook program so that valuable data and time are not lost.

Biological Impacts

Reporting from vessels in the fishery will improve our understanding of the fishery and will improve stock assessments. Biological sampling and data that would be collected through the logbook and by observers is critical to stock assessments. This information is critical for refinement of the golden crab management program and in preventing overfishing. Ongoing data collection and stock assessments will allow the Council to implement needed modifications through the framework procedure. Given the extremely limited data available, 100% coverage would provide the most data and is necessary at this time. This information is crucial to determining OY and overfishing.

Scientific review comments indicate support for reporting:

1. Dr. Elizabeth L. Wenner, Associate Marine Scientist, SCDNR (letter dated August 15, 1995) - "Vessel/fishermen reporting with the components listed should be required. It is very important that catches be identified by vessel and the actual time spent fishing noted. The size and soak time of pots should be noted. Economic data such as crew size, fuel consumption and cost per standardized unit of effort would also be helpful in determining the cost of fishing by vessel size."
2. Mr. Glenn F. Ulrich, Marine Resources Division, SCDNR (letter dated August 15, 1995) - "The required filing of logbook reports should be an integral part of the FMP but should be accompanied by a firm commitment to revoke and not re-issue permits in cases of non-compliance."

Economic Impacts

A mandatory logbook reporting system will enable collection of more accurate and complete data for the golden crab fishery. It will also increase incentives for regulatory compliance and aid enforcement. Estimated cost of logbook reporting to the industry is $12.50 per hour per vessel. This represents the opportunity cost for filling out vessel logbooks. Approximately 30 minutes is required to complete the monthly reporting.

The public burden costs associated with vessel logbook include: (a) the cost of logbooks at $8.00 per logbook, (b) mailing cost estimated at $3.00 per logbook, and (c) processing cost estimated at $100 per vessel annually. Any inconvenience to harvesters from requiring mandatory logbook reporting would be more than compensated for by the benefits from increased incentives for regulatory compliance.

Social Impacts

Data collection is becoming an important part of fisheries management as the number of participants within many fisheries increases. Reduction in governmental data collection capabilities has placed greater importance upon required industry reporting to provide necessary data to manage fisheries. Logbooks are required in a growing number of fisheries to resolve many of the deficiencies in data collection. Most objections to this type of requirement center upon the duplication of reporting and different destinations for each report. NMFS may wish to incorporate measures to reduce redundancy in order to make this option more acceptable to fishermen.

Conclusion

The Council concluded mandatory reporting, making the catch available and carrying observers is all necessary to meet the objective of collecting data necessary to monitor and assess the fishery. The required information is necessary to develop an estimate of MSY, determine the optimal number of fishermen, and to prevent overfishing. Without this information, the Council will not be able to ensure a long-term, stable fishery. The Council concluded given such limited data, 100% coverage is appropriate at this time. This will maximize the data collected and reduce the time required before better information becomes available. The Council specified logbook forms be submitted not later than the 30th day after sale in order to allow fishermen sufficient time to comply. Fishermen stated submitting the logbook forms sooner than the 30th day is sometimes difficult given the short time between the end of one trip and the beginning of another trip.

Rejected Options for Action 16:

Rejected Option 1. Do not require logbooks.

Biological Impacts

This option would not improve our understanding of the fishery and would not improve stock assessments which would increase the risk of overfishing.

Economic Impacts

If mandatory logbook reporting is not required the incentive for compliance among golden crab vessels' captains, owners, and dealers would decrease and a weak link in the compliance chain could result. The small cost to vessels' captains and owners due to the mandatory logbook reporting requirement would be compensated for by benefits from increased incentives for regulatory compliance.

Social Impacts

Not requiring logbooks could curtail collection of necessary data for managing the fishery. If data are not available to the Council in a timely manner, critical decisions regarding management of the resource could be negatively affected.

Conclusion

The Council rejected this option because requiring reporting is necessary to meet the objective of collecting data necessary to monitor and assess the fishery. The required information is necessary to estimate MSY, determine the optimal number of fishermen, and to prevent overfishing. Without this information, the Council will not be able to ensure a long-term, stable fishery.

4.2.1.6.2 ACTION 17. Dealer reporting.

A dealer who has been issued an annual dealer permit for golden crab must, if selected by the NMFS Science and Research Director, provide information on receipts of such crab and prices paid, to the NMFS Science and Research Director through existing state/federal cooperative agreements at monthly intervals, or more frequently if requested. Additional information must be provided as requested by the NMFS Science and Research Director. The NMFS Science and Research Director is not expected to select dealers in states where satisfactory data are being provided through existing cooperative agreements.

Biological Impacts

Dealer reporting will improve our understanding of the fishery and will improve stock assessments.

Economic Impacts

A dealer reporting system will enable collection of more reliable and complete data for the golden crab fishery. It will also increase incentives for regulatory compliance and aid enforcement. Estimated cost of dealer reporting to the industry is approximately $12.50 per hour. About 30 minutes is required to fill out the monthly report. The public burden cost for processing monthly reports is estimated at $12.50

per hour. Approximately 15 minutes is required to process one monthly report. Any inconvenience to dealers from requiring dealer reporting would be more than compensated for by benefits from increased incentive for regulatory compliance.

Social Impacts

Dealer reports can often provide timely information concerning landings of product. This information is vital to fishery management, especially when quotas or other forms of effort limitation are implemented. While some states do require dealer reports, others do not. By requiring dealer reports in this action, consistent data collection would be facilitated, thereby enhancing management of the fishery.

Conclusion

The Council concluded requiring reporting is necessary to meet the objective of collecting the data necessary to monitor and assess the fishery. The required information is necessary to estimate MSY, OY, to determine the optimal number of fishermen, and to prevent overfishing. Without this information, the Council will not be able to ensure a long-term, stable fishery. This will not impose any additional burden on dealers in states like Florida that have a trip ticket system that currently collects the necessary information. However, in states without such a system, dealer reporting is required to prevent overfishing.

Rejected Options for Action 17:

Rejected Option 1. Do not require dealer reporting.

Biological Impacts

This option would not improve our understanding of the fishery and would not improve stock assessments which would increase the risk of overfishing.

Economic Impacts

If dealer reporting is not required incentives for compliance among golden crab vessel captains, owners, and dealers would decrease and a weak link in the compliance chain could result. The small cost to dealers by requiring dealer reporting would be compensated for by benefits from increased incentives for regulatory compliance.

Social Impacts

This option may hamper timely and informed action by the Council due to the limitations on reliable and valid data.

Conclusion

The Council rejected this option because the required information is necessary to estimate MSY, OY, to determine the optimal number of fishermen, and to prevent overfishing. Without this information, the Council will not be able to ensure a long-term, stable fishery. Data necessary for preventing overfishing would not be collected in states without a trip ticket (or similar) system.

4.2.1.7 FRAMEWORK PROCEDURE & ACTIVITIES AUTHORIZED BY SECRETARY

4.2.1.7.1 ACTION 18. Mechanism for Determination of Framework Adjustments.

Establish an assessment group and procedure for adjustments including in-season adjustments:

1. The Council will appoint an assessment panel (Panel) that will assess the condition of golden crab (including periodic economic and sociological assessments as needed) on an annually planned basis. The panel will present a report of its assessment and recommendations to the Council.

2. The Council may take action based on the assessment panel report or may take action based on issues/problems/information that surface separate from the assessment group. The steps are as follows:

A. Assessment panel report — The Council will consider the report and recommendations of the Panel and hold public hearings at a time and place of the Council's choosing to discuss the Panel's report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

B. Information separate from assessment panel report — The Council will consider information that surfaces separate from the assessment panel. Council staff will compile the information and analyze the impacts of likely alternatives to address the particular situation. The Council staff report will be presented to the Council. A public hearing will be held at the time and place where the Council considers the Council staff report. The Council will consult the Advisory Panel and the Scientific and Statistical Committee to review the staff report and provide advice prior to taking final action. After receiving public input, the Council will make findings on the need for changes.

3. If changes are needed in the maximum sustainable yield (MSY), total allowable catch (TAC), quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year, the Council will advise the Regional Director in writing of their recommendations accompanied by the Panel's or Staff's report, relevant background material, draft regulations, regulatory impact review, social impact review, and public comments. This report will be submitted at least 60 days prior to the desired effective date of regulations.

4. The Regional Director will review the Council's recommendations, supporting rationale, public comments, and other relevant information. If the Regional Director concurs that the Council's recommendations are consistent with the goals and objectives of the fishery management plan, the national standards, and other applicable law, the Regional Director will recommend that the Secretary publish proposed and final rules in the Federal Register of any changes. The public comment period on the proposed rule will be not less than 15 days.

5. Should the Regional Director reject the recommendations, he will provide written reasons to the Council for the rejection, and existing regulations will remain in effect until the issue is resolved.

6. Appropriate adjustments that may be implemented by the Secretary by proposed and final rules in the Federal Register are:

A. Initial specification of MSY and subsequent adjustment of the best estimate of MSY when this information is available.

B. Initial specification of acceptable biological catch (ABC) and subsequent adjustment of the ABC range and/or best estimate when and where this information is available.

C. Setting TAC.

D. Modifying (or implementing) TAC, quotas (including zero quotas), trip limits, minimum sizes, gear regulations and/or restrictions, permit requirements, season/area closures (including spawning closures), time frame for recovery of golden crab should they become overfished or fishing year.
E. The fishing year (calendar year) may not be adjusted by more than two months.
F. Authority is granted to the Regional Director to close the fishery once a quota has been established through the procedure described above and such quota has been reached or projected to be reached. Authority is also granted to reopen a fishery once a new fishing year begins. When such action is necessary, the Regional Director will recommend that the Secretary publish a notice in the Federal Register as soon as possible.
G. Requiring onboard observers.

The procedure described above will allow for regular stock assessments and provide for timely adjustments to the management program to prevent overfishing and/or rebuild the stock if overfished. It is the Council's intent that golden crab receive periodic assessments. Initially, assessments would be annual and as sufficient data becomes available such that the Scientific and Statistical Committee, the Assessment Panel, and the Council feel confident in the results, assessments will be completed every 2-5 years. Council staff and NMFS will specify such assessment in the annual NMFS/Council planning process (called operations plans).

It is the Council's intent that once MSY is estimated, TAC be limited by the upper end of an Acceptable Biological Catch (ABC) range when and if one is provided; however, no limits should be placed on the lower limit of TAC so that a zero TAC could be specified if deemed necessary to protect the resource.

Biological Impacts

This procedure allows for rapid modification of the management program based on updated stock assessments as well as information separate from the assessment. Providing a mechanism for such modification will allow the Council to better protect the biological integrity of the golden crab resource and prevent overfishing.

Economic Impacts

Assessments and annual adjustments are described above. This action will require some expenditures of public funds for meetings and staff work. However, an estimate of these costs is not available at this time. Although specific actions may have some economic impacts on fishery participants, the consequences cannot be assessed until such time as the actions are implemented. In principle, this action should allow for additional flexibility in management. To the extent that flexibility is increased, positive net benefits to user groups can be expected at some future time.

Social Impacts

By specifying a mechanism for modifying the management program, a more rapid response to changes in the fishery would be facilitated, thereby enhancing management of the fishery.

Conclusion

The Council concluded this procedure, which allows for rapid modification of the management program, is necessary to allow the Council to better protect the biological integrity of the golden crab resource by preventing overfishing. The objective of providing a flexible management system that minimizes regulatory delays while retaining substantial Council and public involvement in management decisions, and rapidly adapts to changes in resource abundance, new scientific information, and changes in fishing pattern among user groups will be achieved.

Rejected Options for Action 18:

Rejected Option 1. Do not include a framework for future adjustments.

Biological Impacts

This option would not allow for rapid modification of the management program based on updated stock assessments. Not providing a mechanism for such modification would not allow the Council to protect the biological integrity of the golden crab resource and would increase the risk of overfishing.

Economic Impacts

This option would not allow the Council to take timely action if and when needed. To the extent that delays in taking action to address problems in the fishery lead to stock depletion, negative economic impacts could result.

Social Impacts

This option would not allow for timely and informed action by the Council due to the time required for an amendment to the plan to be implemented.

Conclusion

The Council rejected this option because a procedure, which allows for rapid modification of the management program, is necessary to allow the Council to better protect the biological integrity of the golden crab resource by preventing overfishing and by meeting the objective of providing a flexible management system that minimizes regulatory delays while retaining substantial Council and public involvement in management decisions, and rapidly adapts to changes in resource abundance, new scientific information, and changes in fishing pattern among user groups.

Rejected Option 2. Include adjusting the number of vessels and areas in the framework for future adjustments.

Biological Impacts

This option would allow for timely modification of the number of vessels based on updated stock assessments. Not providing a mechanism for such modification would require a plan amendment which would take longer.

Economic Impacts

This option would allow the Council to take timely action if and when needed to limit the number of vessels. To the extent that delays in taking action under plan amendment to address problems in the fishery lead to stock depletion, negative economic impacts could result.

Social Impacts

This option would allow for timely and informed action by the Council. However, fishermen prefer there be more public input through the plan amendment process before adjustments to the number of vessels in the fishery is undertaken.

Conclusion

The Council concluded that the preferred option, which allows for rapid modification of the management program, is necessary to allow the Council to better protect the biological integrity by preventing overfishing of the golden crab resource and that adjusting the number of vessels by plan amendment would provide more public input and not result in significant negative impacts. The Council rejected this option because of concern on the fishermen's part that changes to the number of vessels and areas should be done through plan amendment to allow more public input.

4.2.1.8 CONTROLLED ACCESS

4.2.1.8.1 ACTION 19. Controlled access program.

A. Zones. Because all catches occur in the exclusive economic zone (EEZ) (golden crabs are not harvested in state waters), the following zones are established from the seaward boundary of the EEZ to shore (Figure 2):

(1) Northern zone - north of the 28°N. latitude to the North Carolina/Virginia border;
(2) Middle zone - 28°N. latitude to 25°N. latitude; and
(3) Southern zone - south of 25°N. latitude to the border between the South Atlantic and Gulf of Mexico Fishery Management Councils.

B. Initial Eligibility. To be eligible for a permit, golden crabs must have been harvested within the South Atlantic Council's area of jurisdiction. For vessels which qualify, the applicant must indicate which zone the vessel will fish within, and fishing for golden crab will only be allowed within that zone. Initial eligibility is limited to owners of boats/vessels that meet the following two criteria:

(1) Catches equal to or greater than 600 pounds (whole live weight) by April 7, 1995 (control date); or
(2) Total catches (including pre-April 7, 1995 catches) equal to or greater than 2,500 pounds (whole live weight) by September 1, 1995.

C. Appeals. The Council will establish an ad hoc committee (comprised of Council members) to assist the NMFS Southeast Regional Director (by providing individual recommendations) in handling disputes over eligibility. Any appeal must be submitted within 30 days after the permit is rejected by NMFS. All appeals must be accompanied by written documentation and individuals will be allowed to testify before the appeals ad hoc committee. The appeals ad hoc committee will only meet once. The charge to the appeals ad hoc committee is to make sure the criteria pertaining to eligibility were applied to an individual's application in a correct manner.

D. Permits. Applications for permits must be made within 30 days after publication of the final rule in the Federal Register. Permits are to be implemented 90 days after implementation of the final rule. It is the Council's intent that the permit year be the 12 month period following issuance of the permits. Permits will be issued to the vessel. The possession of golden crab aboard a vessel within a zone for which you do not have a permit is prohibited except that vessels may transit zones provided they do not stop to fish and they notify the NMFS Office of Law Enforcement of the pending transit. It is the Council's intent that a message left on a NMFS Law Enforcement answering machine constitute notice.

The Council retains the right to issue additional permits depending on the status of the resource. Adding permits should dilute the value of existing permits. Any changes to the number of permits will be by plan amendment.

E. Transferability. Permits are transferable within a zone or to the northern zone. To permit a new vessel or enter the fishery, the owner of the new vessel must acquire a permit or permits for vessels currently in the fishery equal to at least 90% of the length of the new vessel (length to be determined from documentation or state registration information).

F. Renewals. Permits may be renewed if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that owner's vessel(s) during one out of the two previous years. It is anticipated that permits will be issued in April 1996. The first time permits may be renewed will be April 1997 and the two years under consideration will be retroactively to April'95-March'96 and the first permit year of April'96-March'97.

G. Assignment of Initial Permits. The initial assignment of permits will be to vessel owners.

H. Tracking/Monitoring Permit Transfers. Tracking transfers of permits will be done by requiring the buyer and seller to sign and date the appropriate lines on the reverse side of the permits that transfer. Fees to cover the administrative costs of processing transfers will be charged.

I. Increasing Enforceability. Because the benefits obtained from controlled access depend, in large measure, on regulatory compliance by fishermen, the Council maintains that gross violations (such as failure to report; fishing traps without escape gaps, identification numbers, or biodegradable panels; retaining female crabs in excess of the tolerance specified; and fishing in an unauthorized zone) warrant strict penalties such as permit sanctions. The Council's intent is that fishermen submit logbooks by the 30th day after sale. It is not the Council's intent that strict penalties such as permit sanctions be applied if the logbook reports are late once or twice. However, it is the Council's intent that repeated lateness warrant strict penalties. It is also the Council's intent that fishermen not be allowed to supply missing logbook reports at the time of permit renewal.

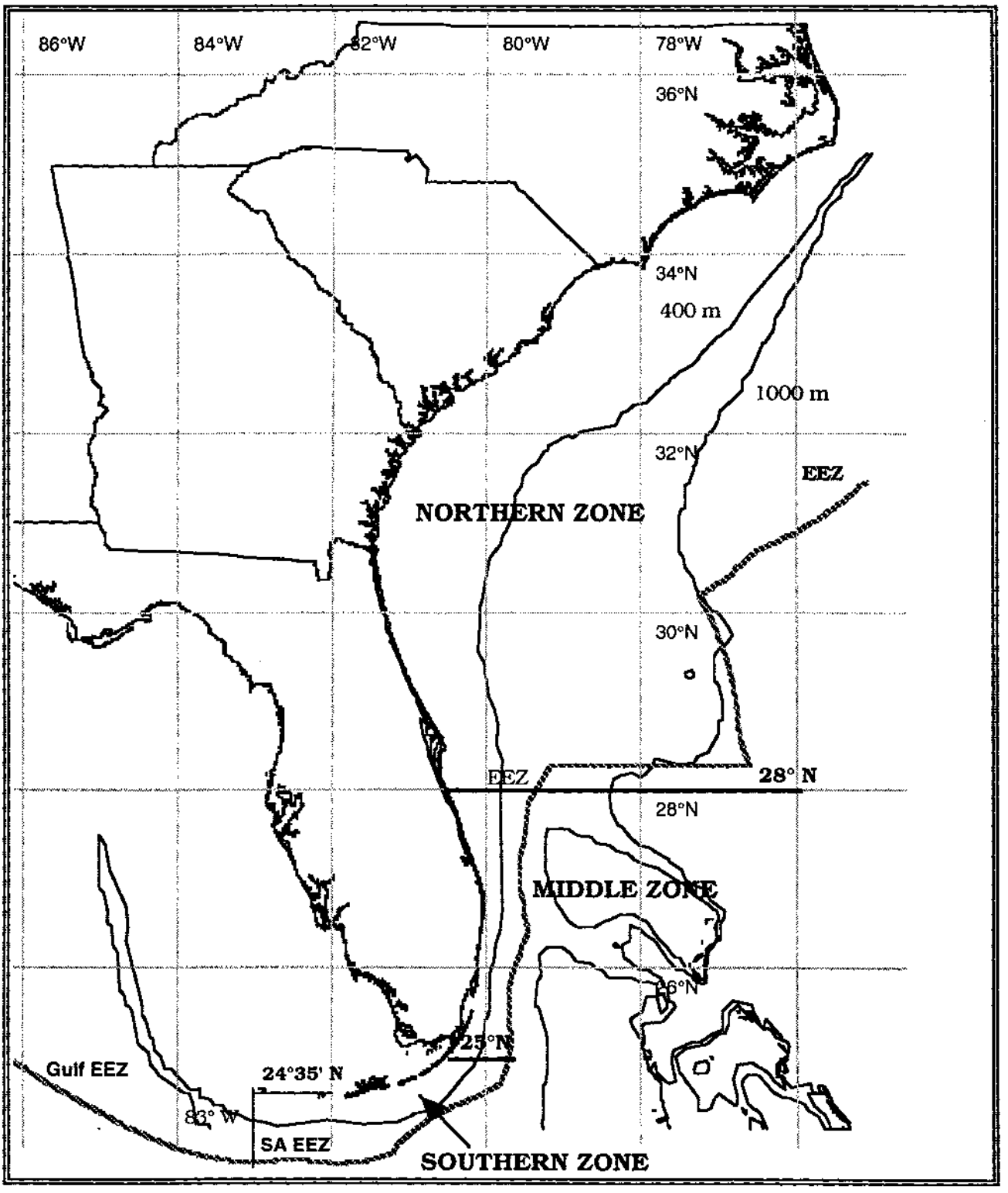

Figure 2. Map of the South Atlantic Council's area of jurisdiction with the proposed zones.

It is the Council's intent to initially limit the number of permitted vessels for several years and evaluate the fishery. A plan amendment will be used to either increase or decrease the number of vessels allowed in the fishery based on data collected and stock assessment results. The Magnuson Act, as amended, provides that any fishery management plan which is prepared by any Council with respect to any fishery, may establish a system for limiting access to the fishery in order to achieve optimum yield if, in developing such system, the Council takes into account: (a) present participation in the fishery; (b) historical fishing practices in, and dependence on, the fishery; (c) the economics of the fishery; (d) the capability of fishing vessels used in the fishery to engage in other fisheries; (e) the cultural and social framework relevant to the fishery; and (f) any other relevant considerations.

Although not an explicit objective at this time, the Council believes that portions or all of management and administrative costs should be recovered from those who hold individual permits in the golden crab fishery, should the Council approve such an approach and should recovery of those costs become permissible under future Magnuson Act (MFCMA) revisions. Those costs, or portions of them, would be recovered through such means as transfer fees or ad valorem taxes or other means available.

It is expected that NMFS will evaluate permit applications using information provided by applicants. This information may include, but is not limited to, the following: (1) official state landings records (e.g., Florida trip ticket data or recorded landings by trip in South Carolina, Georgia, and North Carolina), (2) dealer records, (3) sales receipts, and (4) notarized affidavits. NMFS will be publishing notice of the application process and requirements which will include more specifics on the types of acceptable information. A vessel's catch history stays with the vessel owner unless specifically addressed in any sales agreement. If a vessel is lost/sunk, the vessel owner retains the vessel's catch history. Rejected applicants may appeal their rejection to the ad hoc committee in writing within 30 days after the application is rejected by NMFS. The appeals ad hoc committee will make sure the criteria pertaining to eligibility were applied to an individual's application in a correct manner. Written documentation should include information to support the level of landings claimed (e.g., trip ticket receipts, trip receipts, weigh-out sheets, sales receipts, signed affidavits, etc.). The appeals ad hoc committee will only meet once to resolve all cases.

Table 8. Number of individuals qualifying with catches equal to or greater than 600 pounds by April 7, 1995 (control date) and catches equal to or greater than 2,500 pounds by September 1, 1995. Source: Based on Florida trip ticket data. An additional 3-7 vessels could qualify for the northern zone with data outside of the Florida trip ticket data base.

Vessels with landings greater than or equal to 600 lb by 4/7/95	Individuals with landings greater than or equal to 600 lb by 4/7/95	Vessels with landings greater than or equal to 2,500 lb by 9/1/95	Individuals With Landings greater than or equal to 2,500 lb by 9/1/95
11	6	4	3

Biological Impacts

To the extent limiting effort (Table 8) limits fishing mortality, biological protection will be provided and overfishing prevented. Limiting the number of vessels will result in a cap on harvest in lieu of a quota at this time; due to extremely limited data MSY cannot be estimated and hence knowledge about a level of total harvest is very limited. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

Establishing zones will enable a diverse number of vessels in terms of size to participate in the fishery while at the same time using a conservative approach in managing the fishery. Historically, smaller sized vessels have fished for golden crab in the EEZ off south Florida including areas off the Florida Keys. It is practicable and safe for these vessels to fish in the EEZ because of the narrow continental shelf which enables them to reach deep waters (600 feet and over) within six miles from the coastline. There is evidence that a number of vessels have fished for golden crab in this area since the 1980s on a sporadic basis. (It is also possible that some of these vessels landed golden crab as bycatch.) Since 1994 golden crab landings have increased in this area. The Florida trip ticket data shows that landings of golden crabs increased during the first seven months of 1995. In Monroe County, Florida landings from May to July 1995 exceeded landings from January to May 1995. Reports from official sources in North Carolina, South Carolina, and Georgia do not indicate any landings of golden crab in those states for the first half of 1995.

Records of participation in the golden crab fishery in the proposed northern zone is very limited. However, public input indicate that this area is more suited for larger vessels that are capable of fishing up to and beyond 150 miles offshore. This zonation will also minimize crowding on the fishing grounds since larger vessels that may be fishing with large numbers of traps would likely be further offshore away from other fisheries.

The 600 pounds qualifier by April 7, 1995 and the 2,500 pounds qualifier by September 1, 1995 will determine the number of vessels that will receive initial permits to participate in the golden crab fishery. For Florida where most of the landings have occurred, the trip ticket data provides the most reliable information on the number of vessels that would qualify. Based on information compiled from the Florida trip ticket system, 11 vessels each landed 600 pounds and over of golden crabs in Florida by April 7, 1995. Also, six individuals each landed 600 pounds and over in Florida by April 7, 1995 that were not associated with vessels. These six individuals with Florida SPLs would qualify if they can provide evidence of the vessels (other than the previous 11 vessels) that made those landings. In addition, four vessels each landed 2,500 pounds and over in Florida by September 1, 1995. Three individuals each landed 2,500 pounds and over in Florida by September 1, 1995 that were not associated with vessels. These individuals would also qualify if they can provide evidence of the vessels (other than the previous 11 and 4 vessels) that made those landings. This means that 15-24 vessels will qualify initially for vessel permits. However, those who

landed golden crab outside Florida prior to these dates are not included in this number. Some fishermen landed golden crab in South Carolina in the 1980s and could provide records through official dealer records. Given the initial eligibility requirements, it is likely that not more than 30 vessels would qualify.

Because of inadequate knowledge of the fishery, biology, and status of the stock of golden crab in the South Atlantic area, it is impossible to estimate the number of vessels or the optimum level of effort this fishery can sustain. Thus, it cannot be determined a priori, whether optimum harvest levels could be achieved with the initial number of qualified vessels whatever that number may be. This is one of the areas that research efforts will be directed. As such, it is not possible to assess the economic benefits that could accrue from limiting the initial number of vessels using the two dates. However, it is evident that limiting the number of vessels will prevent uncontrolled expansion of the fishery until data are available to assess the potential and hence the optimum level of effort for this fishery. Given the nature of the fishery, controlling access would prevent over–exploitation and over–capitalization in this fishery. It will also provide market stability which is very important for a market that is only in its early stage of development.

The eligibility criteria will eliminate a number of fishermen from the fishery. Based on Florida's trip ticket information, thirty–six fishermen who landed golden crab by April 7 and September 1, 1995 respectively would not be able to obtain vessel permits to continue in the fishery. Six of them made a total of eight trips between 1986 and 1994 and landed a total of 1,886 pounds of golden crab. One of these six fishermen made one trip post–April 7, 1995 and landed 47 pounds of golden crab. Of the remaining thirty fishermen, one of them made three trips prior to April 7, 1995 and landed a total of 563 pounds. The same fisherman made one trip after that date and landed 202 pounds. Four fishermen made two trips each prior to April 7, 1995 and landed an average of 514 pounds each. Two of these fishermen did not make any trips after April 7, 1995. The other two fishermen made two trips each after April 7, 1995 and landed an average of 1,216 pounds each. Twenty–five fishermen made one trip each prior to April 7, 1995 and landed and average of 230 pounds each. Sixteen of the 25 did not make any trips after April 7, 1995. Seven made one trip each after April 7, 1995 and landed an average of 651 pounds each. Two made two trips each and landed an average of 232 pounds each. From the above analysis, it can be seen that all 35 fishermen earned very minimal revenue from the golden crab fishery between 1986 and 1994, and in 1995. On average, none of these fishermen earned more than $150 on a monthly basis. Thus, earnings from the golden crab fishery could not have accounted for any significant portion of their total income, and eliminating them from the fishery at this time would not cause any significant economic hardship to them. It should be noted that these fishermen were also engaged full-time in other fisheries.

Estimates of maximum sustainable yield (MSY) are not available due to lack of data and cannot be used to compute the annual value of the fishery. Since 1995 is the first year that the golden crab fishery has been exploited on a consistent basis (a number of vessels have landed golden crab regularly), the projected total landings for 1995 is used as a proxy to compute the annual value of the fishery, at least for 1995. This should provide a rough valuation of this fishery compared to other fisheries. So far, all the landings in 1995

have been reported in Florida. These were harvested in the EEZ off the mid and southern zones. No significant landings have been reported for the northern zone in 1995, although fishermen have indicated some landings were made prior to September 1. (These landings were made by fishermen who wanted to qualify by landing any volume of golden crab by September 1.) A number of fishermen claimed that golden crabs are more abundant in the northern zone than in the other two zones. The computation for estimating the value of the fishery assumes that similar yields could be obtained from the northern zone.

Data from Florida trip tickets indicate that from January through September 1995, approximately 670,800 pounds of golden crabs were landed. Using an average monthly figure of 74,533 pounds, the projected landings for January through December 1995 would be 894,400 pounds. This poundage would be from the mid and southern zones. Based on the assumption made for the northern zone, a similar volume could be landed. Thus, if golden crabs are harvested from all three zones, it is possible to achieve total landings of 1,788,800 pounds from the South Atlantic EEZ. The annual value of this fishery would then be approximately $1.8 million, assuming exvessel price is $1.00 per pound. This does not include value added through processing.

This value has to be compared to the cost of managing the fishery in determining the economic benefits that could accrue from this fishery. The estimated annual value seems low compared to other fisheries, but it should be noted that this is a new fishery which offers opportunities to those who have been displaced from other fisheries due to Council regulations the chance to make a living. Thus, even at such a low value, a management program which ensures harvest on a sustainable basis in the long–term will provide income to support a number of fishermen and their families. Conversely, if this fishery is allowed to expand rapidly to the point where it collapses because of heavy fishing pressure, fishermen will have to turn to other heavily exploited fisheries to make a living. In addition, there would be idle capital in the event the fishery collapses because investment in gearing up for this fishery is fairly high and the gear is not easily adaptable for use in other fisheries.

It is worth noting the parallels between the golden crab and wreckfish fisheries. Both fisheries were discovered relatively recently compared to other fisheries. Their exploitation started with few vessels, was sporadic and suddenly expanded partly as a result of market development. Both fisheries occur in deep waters away from most other fisheries. Their exploitation require certain navigational and technical skills, and significant investment in gear and other equipment. There is little or no bycatch in both fisheries. The annual value of the wreckfish fishery is $3.72 million. This is based on a 2.0 million pound TAC and an average exvessel price of $1.86. However, since the inception of the program (April 1992), the TAC has never been taken. For the 1994/95 season, the fishery was valued at $2.2 million. The cost of administering the wreckfish individual transferable quota (ITQ) program is estimated at $31,000 annually (Ed Burgess, NMFS SERO, pers. comm.). This includes issuing permits, administering and tracking ITQs, issuing and tracking coupons, analyzing coupon utilization, and analyzing ITQ transfers. It does not include enforcement costs. Even though the value of this fishery is low compared to other fisheries, it does

provide a regular source of income for shareholders in this fishery. The program is partly responsible for the stable market situation, the steady but marginal annual increase in exvessel price, and steady supply of product throughout the season. Above all, it allows shareholders to operate in the most efficient way given their fishing capacities.

Depending on the status of the stock, the market price, and the level of exploitation, the estimated annual value of $1.8 million for the golden crab fishery could be much higher. There is also the possibility that with a steady supply and predictable market there would be increasing consumer acceptance. Although no individual transferable quota (ITQ) system is proposed for the golden crab fishery at this time, administering and tracking the sale of vessel permits would be similar to the wreckfish program. Thus, the cost is expected to be less for the golden crab fishery since shares and coupons are not involved. Enforcement cost should be similar to that for wreckfish. However, this cost is not expected to increase in the same proportional since enforcement cost is spread out between fisheries. Given the above discussion, it is evident that controlling access to the golden crab fishery would protect the biological integrity of the fishery and possibly result in long–term economic benefits to the participants. Consumers will also benefit by having a steady supply of the product.

Annual vessel permits will be issued to those vessels which qualify. The applicants will be charged the administrative costs for issuing the permits. Presently, the cost of issuing vessel permit is $40 and the opportunity cost (time spent filing the application) to the fishermen is $5 per application. Assuming that about 30 vessels initially qualify and are issued permits, the annual cost to the industry is estimated at $1,350 ($1,200 plus $150). However, this does not take into consideration vessels that have permits for other fisheries. If a vessel already possesses a permit for one fishery, that vessel would only be charged an additional $10 to obtain an endorsement for the golden crab fishery. The total cost to the industry could be much less than $1,200 depending on the number of vessels that already have permits for other fisheries. It should be noted that most of the vessels that qualify according to the Florida trip ticket data are either in the mackerel, lobster or stone crab fishery.

The provision that permits are issued for a one–year period and are renewable only if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that vessel during one out of the two previous years, will eliminate those who are not active in the fishery after the first year. Also, it will not affect those who may encounter operational problems in one year and could not participate in the fishery as a result.

Allowing the transfer of vessel permits within a zone or to the northern zone should provide some flexibility and a chance for some fishermen to enter the fishery. However, it would likely encourage more fishermen to apply for initial vessel permits because of the value created by making permits transferable. This would be true for those fishermen who qualify for initial vessel permits but do not want to participate actively in the fishery. They will obtain permits and sell them to those wanting to enter the fishery. If this transferability provision results in only active fishermen remaining in the fishery and harvesting on a regular

basis, it could aid market development. However, with little knowledge of the biological status of the fishery, it is impossible to assess how this provision will affect the fishery.

At present there is no record of the average number of trips that an active golden crab fisherman could make in one year. Based on catch data provided from Florida trip tickets as of September 1995, the four to seven vessels that would qualify with the September 1, 1995 date landed an average of 1,821 pounds each of golden crabs per trip. These vessels would have to make only three trips in one of two years to qualify for permit renewal. The 11-17 vessels that would qualify by the April 7, 1995 date landed an average of 1,081 pounds each per trip. These vessels would have to make five trips in one of two years to qualify for permit renewal. It could be seen that the number of trips that vessels need to make to meet the 5,000 pounds requirement is minimal. Thus, it is unlikely that this requirement will eliminate anyone who fishes for golden crab part of the year and who depends on the income from this fishery as a substantial part of his/her total annual income. This is particularly true for some of the fishermen in south Florida.

Social Impacts

Controlled access has support within certain sectors of the fishing industry, however, there is apprehension among some within the industry because of the obvious implications for free enterprise. Overall, limited access has received mixed reviews by the commercial fishing industry. Those who oppose limiting access are often concerned with the specific structure of the limited access system and its resultant impacts. They see this form of management as too restrictive and not allowing the essential flow of participants in and out of the fishery with the ease they consider necessary. Others within the industry see limited access as a necessary management tool to avoid overcapitalization and depletion of stocks.

Within the golden crab fishery there is notable support for controlled access by fishermen who have fished golden crab for many years. This support parallels suggestions from the scientific community who also see limited access as essential for this fishery because of the many unknowns concerning the life history of this crab (Lindberg and Wenner, 1990). It is difficult to know which type of controlled access would most likely address both the concerns over stock status while at the same time allow fishermen to develop the fishery so they may have a sustainable harvest to meet market demands given the uncertainty regarding the resource and the lack of information about the industry.

Fishermen in general have been supportive of the biological measures proposed for this fishery. There has also been a great deal of support for the options to limit entry. Fishermen have recognized the need for a conservative approach toward this fishery and realized their efforts will provide much of the data for the golden crab fishery. At the same time there are areas where data needs are crucial and presently very few fishermen are fishing in those areas, especially to the north of Cape Canaveral. With the control date of April 7, 1995, few vessels would qualify in the area north of the Cape. For that reason, certain fishermen requested provisions that would allow entry into this fishery after the control date. Such a provision would ensure data would be collected throughout the range of the South Atlantic Council's jurisdiction by allowing entry into the northern zone. However, others expressed misgivings about the

use of another date of entry, for they see this as expansion of the fishery when the Council's primary concern is to limit effort.

As mentioned earlier, there is widespread support for the biological protection measures proposed. What little data do exist on the life history of this crab suggests a conservative approach, therefore fishermen see limited entry as one avenue to regulate harvest, yet allow for some expansion of the fishery which will increase data collection and provide stable markets. Many fishermen fear that an open access system will negatively impact this fishery and the markets they have tried to build and maintain. Given these concerns the Council has attempted to accommodate industry's concerns and still provide the necessary protection to the resource.

The initial eligibility requirements of a boat with landings of at least 600 pounds by April 7, 1995 or 2,500 pounds by September 1, 1995 will effectively limit the number of vessels fishing in the South Atlantic to between 15 and 24. This range does not incorporate all those who may qualify outside of Florida with landings that have not been accounted for (some individuals have documented landings outside of Florida and are included in this range). The reason for a numerical range of vessels is because some individuals who qualify for the fishery landed golden crab in Florida under an individual SPL number and did not indicate a vessel number. Permits will be issued to vessel owners, therefore an individual without a vessel would be excluded from the fishery. Information from the Florida Trip Ticket system indicates there were six fishermen who qualified using individual SPLs not associated with a vessel. Overall, there would be no more than 30 vessels in the fishery given the criteria selected by the Council.

Using the above mentioned criteria for initial eligibility there would be a minimum of 36 individuals who would not qualify for permits in the fishery, but did establish landings of golden crab according to the Florida trip ticket system and other information provided. Most of the individuals in this category had limited landings prior to the control date (April 7, 1995) and many had no landings after the control date (see discussion under Economic Impacts). It was the Council's intent to limit entry to those fishermen who intend to actively participate in the golden crab fishery and established that intent by their harvesting pattern. There will likely be fishermen who are actively participating in the golden crab fishery and are excluded from qualifying for entry into the fishery initially. The appeals process will be one avenue to address their grievances and possible entry into the golden crab fishery.

The concept of zones within the golden crab fishery was initiated through discussions with fishermen to address two characteristics of the fishery: 1) the limited life history information on golden crab and 2) the disparate vessel characteristics within the fishery. Limited information on the life history of this crab suggested that harvesting pressure, in order to be sustainable over time, should be limited and widely separated. Limiting entry by zones may assist in spreading effort throughout the range. In addition, public testimony and details provided by the Golden Crab Advisory Panel established a vessel size distinction and differing levels of participation among individuals in the fishery. The Southern Zone

(Figure 2) has a large number of vessels, but participation is primarily by fishermen who intend to fish golden crab part of the year. The Middle Zone is fished by individuals who are full-time, year round golden crab fishermen. The largest is the Northern Zone which has few participating vessels at this time but, may have more large vessels because of the distance from shore and fishing conditions.

By establishing zones and requiring an individual to choose a zone in which to fish, the Council can monitor the number of vessels fishing in a particular zone. The pulse like nature of the fishery in the Gulf of Mexico suggests that an area may be depleted over time with an open access system. By using zones, the Council will be able to monitor landings within zones and take action if catches appear to be declining within a particular area. Such action may entail limiting the number of vessels within an area or other modifications to restrict effort. This may reduce the opportunity for conflict between the different size class of vessels and the chances of overfishing a particular zone.

The transfer of permits will allow movement in and out of the fishery thereby alleviating some fears fishermen have about limited access programs. By limiting the size of new vessels entering the fishery, the Council may be able to slow expansion of effort through the increasing scale of vessels and gear. On the other hand, by allowing transferability, the Council has added value to the permit which would not exist were it not transferable. The added value of permits could initiate greater interest in the fishery and speculation as to their possible worth. Some fishermen will be interested in obtaining a permit solely for the windfall profit that would come from selling it. The idea that individuals can profit by merely qualifying for permits is a contentious issue, and has been a detractor of many limited access programs. In addition, when those who are only interested in profits sell their permits (or shares as in the case of wreckfish), it often looks as if the fishery is being concentrated in the hands of a few individuals with greater financial resources, when in reality they are the serious fishermen actively working within a fishery while those who sold out were not.

The Council's intent with regard to renewals was to ensure those with permits would be actively engaged in fishing golden crab. The requirement for landings of at least 5,000 pounds in one of two years on renewal of permits will limit the fishery to those individuals who intend to actively participate. At the same time, the criteria should allow for unforeseen consequences which might prevent an individual from participating fully during a fishing season, i.e., major breakdown, injury, etc., yet still qualify for renewal.

Overall, the controlled access system outlined above has support within the industry. There will obviously be fishermen who are not supportive of the criteria since they will not qualify for permits to fish golden crab, but established landings prior to the control date. However, some criteria must be used when limiting access. With participation from the industry, the Council developed criteria that would encompass most if not all active participants in the fishery to date. The appeals process will address the concerns of those who may be actively fishing golden crab but were excluded from qualifying. Furthermore, the Council's intent in limiting access was to take a conservative approach to regulating the golden crab fishery

until sufficient biological data could be gathered. This program will provide that information and facilitate monitoring the status of the fishery.

Conclusion

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of any anticipated MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants because the amount of gear will be limited and fishermen will not be forced to fish areas of hard bottom due to crowding on the more preferred fishing grounds.

Zones were created to address the different fishing patterns, fishing conditions, socio-economic conditions, and apparent resource abundance within the golden crab fishery. The fishery in the middle zone is comprised of fishermen fishing for golden crabs all year; alternative fishing opportunities are very limited due to Council regulations and resource status. There are currently four vessels fishing this area. Information from fishermen fishing the middle zone indicates a steady supply of golden crabs and the potential for high catches; information on the abundance of golden crab in the middle zone is very limited. There are currently about 25 vessels fishing in the southern zone. While the number of fishermen is much greater than the middle zone, fishermen in the southern zone participate in more fisheries (e.g., spiny lobster, stone crab, and mackerel). Their participation in the golden crab fishery will be more seasonal which allows for more participation within the southern zone. Information from fishermen fishing the southern zone indicates a steady supply and potential for high catches; information on the abundance of golden crab in the southern zone is very limited. The northern zone includes the area with some information on abundance of golden crab. While the information is not sufficient to estimate MSY, the abundance data indicates golden crabs are sparsely distributed over a larger area as compared to the middle and southern zones. There are currently 2-4 vessels fishing within the northern zone. The Council concluded the zones are necessary to address the biological and socio-economic differences in the fishery. The boundary between the northern and middle zones was moved south of Cape Canaveral (compare with Rejected Option 8) to prevent vessels fishing out of Pt. Canaveral having to transit a zone to get to the fishing grounds.

The Council chose the initial eligibility criteria based on their intent to allow about 30 vessels in the fishery. The Council is limiting the number of vessels to minimize the risk of overfishing which is consistent with the "NMFS Policy of Risk Aversion in Face of Uncertainty" (Appendix B). Limiting the number of vessels to about 30 should include the serious vessels currently fishing in the southern and middle zones, while also including the vessels currently fishing in the northern zone. The Council was

concerned that there might not be sufficient effort in the northern zone and chose to allow transfer of permits within zones or to the northern zone. In this way vessels not included under the initial eligibility criteria would have the opportunity to try and purchase a permit to fish in the northern zone. The Council concluded additional effort is necessary in the northern zone due to the large area and need for fishery dependent data on the abundance of golden crab within the northern zone.

In establishing this controlled access program, the Council addressed: (a) present participation in the fishery by including the 2,500 pound landing requirement by September 1, 1995; (b) historical fishing practices in, and dependence on, the fishery by using the 600 pound landing requirement by April 7, 1995 to include the pioneers in the fishery, and by establishing the zones; (c) the economics of the fishery by choosing eligibility criteria which included all vessels with sufficient landings to demonstrate some economic dependence on the golden crab fishery, by using the September 1, 1995 date to include vessels which expended money gearing up and landing significant catches after April 7, and by establishing the zones; (d) the capability of fishing vessels used in the golden crab fishery to engage in other fishery by establishing the zones and limiting the number of vessels fishing within each of the zones with particular attention to the fact that alternative fishing opportunities are very limited within the middle zone; and (e) the cultural and social framework relevant to the fishery by establishing the zones. The Council recognized the need for vessels to transit an area to reach port. A process for notifying NMFS Law Enforcement allows fishermen to transit zones when necessary. The Council also recognized the need to allow sufficient fishing effort to provide product for the market and has structured the controlled access program to provide sufficient vessels while minimizing the risk of overfishing. The Council concluded they fully evaluated the criteria for limiting effort as specified in the Magnuson Act.

Rejected Options for Action 19:

Rejected Option 1. Limit the number of vessels by area as shown below:

(a) North Carolina (1, 2 or 3 areas), South Carolina (1 area) and Georgia (1 area) — one vessel per area or one vessel for these areas combined.

(b) Florida with three areas — Cape Canaveral north with 1 to 3 vessel; Cape Canaveral to Molasses Reef with 2 vessels; and Molasses Reef south with 4 to 20 vessels.

Biological Impacts

To the extent limiting effort limits fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it make take some trial and error to come to the optimal effort level.

Economic Impacts

Considering the number of individuals who now appear to have qualified for initial permits, this option may be restrictive and would take away the flexibility for fishermen to explore other areas that could be more productive. This option could cause unnecessary economic hardship to those who can participate in the fishery. So far only an estimated eight vessels have fished for golden crab north of Cape Canaveral or have indicated the desire to do so. If this situation holds, it may not be problematic to decide who gets initial

permits to fish in the northern zone. However, it could be difficult to determine who to assign to what area. To date, there is no official record of historical participation in the golden crab fishery in the northern zone. Thus, whatever method is used may be deemed as unfair by some individuals.

Social Impacts

See Social Impacts for Action 19.

Conclusion

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants are not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants because the amount of gear will be limited and fishermen will not be forced to fish areas of hard bottom due to crowding on the more preferred fishing grounds. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within.

Rejected Option 2. The following areas are established _____

_____

_____

_____

(committee and Council would need to specify based on public hearing input) and the number and size of vessels are limited as follows:_____

_____

_____

_____

(committee and Council would need to specify based on public hearing input).

Biological Impacts

To the extent limiting effort limits fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

See discussion under Economic Impacts for Action 19.

Social Impacts

See Social Impacts for Action 19.

Conclusion

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within.

Rejected Option 3. Area apportionment and/or area licensing.

Biological Impacts

To the extent area apportionment and/or area licensing limits fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

This option would divide the South Atlantic area into a number of sub–areas. Individuals would be assigned specific areas to fish for golden crab. This is more like carving out a piece of the ocean for each individual to fish for golden crab. Two problems are evident with this option. The first is how to decide who should be assigned a particular piece of the ocean. The second is how to enforce this assigned property right to the exclusion of others. As stated earlier, the only official record of participation by area in this fishery is from the Florida trip ticket program. This data does not go back far enough to provide a record of historical participation by area. In south Florida including the Florida Keys, the assignment of areas to individuals could interfere with other fisheries and create obstacles for other fishermen. This could lead to conflicts and to lost benefits not only from the golden crab fishery, but from other fisheries.

Social Impacts

Assignment of individual areas and/or use rights would be difficult to implement due to the lack of information concerning Catch Per Unit of Effort for the fishery and density or abundance of the crab. It is not known at this time how large an area may be needed to support a particular fishing operation in order to have a sustainable harvest over time. It is possible that the population distribution and density for this crab may be such that fishermen will find fishing grounds crowded and have to compete for fishing areas. Conflicts may develop in the future which may necessitate some type of area apportionment, but at this time there is not enough information upon which to base such a decision.

Conclusions

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within and also because this option would not limit the number of vessels.

Rejected Option 4. Territorial use rights in fisheries (TURFs).

TURFs are usually harvest rights assigned to an individual based upon some type of historical tie to an institution or organization, i.e., kinship group, communal group, village or territory. TURFs often carry informal rules regarding harvesting and resource use that are not always apparent to outsiders until violations occur and sanctions are carried out. Sanctions can be severe and are often carried out by other members of the group. Many examples of TURFs can be found in Asian fisheries and some do exist in the Americas (see Acheson's description of the Maine lobster fishery). The essential component of any TURF is the ability of members to form an allegiance to the group assigned use rights and the ability of that group to impose sanctions on members who violate rules and regulations.

Biological Impacts

To the extent TURFs limit fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

Territorial use rights (TURFs) system of managing a fishery is more appropriate to coastal fisheries. This system of management is also through local authorities who are present to observe day to day activities in the fishery. The golden crab fishery being a deep sea fishery does not lend itself to this type of management regime. Furthermore, the Magnuson Act does not provide for management of federal fisheries by local authorities. It is hardly possible for any economic benefits to accrue from this form of management given that local authorities would not be able to monitor and enforce regulations at sea. It could be argued that such a system could enforce some of the regulations by forming a market structure such that all golden

crabs harvested should be channeled through. However, this could lead to a monopsonistic[1] situation and would be against the principles of free enterprise.

Social Impacts

TURFs are usually harvest rights assigned to an individual based upon some type of historical tie to an institution or organization, i.e., kinship group, communal group, village, or territory. TURFs often carry informal rules regarding harvesting and resource use that are not always apparent to outsiders until violations occur and sanctions are carried out. Sanctions can be severe and are often carried out by other members of the group. Many examples of TURFs can be found in Asian fisheries and some do exist in the Americas (see Acheson's description of the Maine lobster fishery). The essential component of any TURF is the ability of members to form an allegiance to the group assigned use rights and the ability of that group to impose sanctions on members who violate rules and regulations.

Although golden crab fishermen have not formed organized groups with historical ties to the resource, public testimony and anecdotal evidence indicate a form of territoriality may exist to resolve gear conflicts. In south Florida, fishermen have informally agreed to divide territory among themselves to avoid setting gear on top of one another. At this time it is not known how many fishermen participate in these informal agreements or the effectiveness of these territorial arrangements. Fishermen seem to have resolved conflicts regarding gear placement, but whether this territoriality will endure and be applicable to other issues related to the fishery remains to be seen. With little information on density of crab or the impact of harvesting over time on abundance, the concept of territoriality and its efficacy need to be examined. If fishermen are willing to enter into territorial use rights agreements on their own, the Council may want to consider some type of co-management of this fishery.

Conclusions

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within and because this option would not limit the number of vessels

[1]Monopsony is a market situation in which there is only one buyer.

Rejected Option 5. Communal management.

Communal management is much like TURFs described above. There is usually some historical tie to the resource based upon membership in some communal organization, i.e., village, community, territory, etc. Communal management of present-day fisheries has been established by ensuring fishermen have the ability to affect the management of the resource. Communal management can take many forms like one where fishermen have an advisory role to one where they have full authority to create, implement and enforce regulations governing the resource. Like TURFs some historical tie to the resource is often a prerequisite as is having some allegiance to the communal group. The ability to effect some aspect of managing the resource seems to be a key to successful communal management.

Biological Impacts

To the extent communal management limits fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

See Economic Impacts under Action 19, Rejected Option 4.

Social Impacts

Communal management is similar to TURFs described above. There is usually some historical tie to the resource based upon membership in some communal organization, i.e., village, community, territory, etc. Communal management of present-day fisheries has been established by ensuring fishermen have the ability to affect the management of the resource. Communal management can take many forms like one where fishermen have an advisory role to one where they have full authority to create, implement and enforce regulations governing the resource. Like TURFs some historical tie to the resource is often a prerequisite as is having some allegiance to the communal group. The ability to effect some aspect of managing the resource seems to be a key to successful communal management.

Because the golden crab fishery is small and fishermen have shown a willingness to resolve conflicts on their own, communal management may be a viable management tool in the future. The discussion under social impacts for Action 24 Option 4 indicates a willingness by fishermen to solve problems within the fishery through their own devices. Fishermens' willingness to cooperate among themselves and their extensive participation during the development of the FMP signal an opportunity for a more comprehensive form of communal management. The Golden Crab Advisory Panel provided considerable guidance regarding management options and seemed to suggested that compliance with many regulations would be assured. Future assessments of the golden crab fishery should review communal management as an option

Conclusions

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within and because this option would not limit the number of vessels.

Rejected Option 6. Limit the number of participants to those that can document landings as of the control date (April 7, 1995).

Biological Impacts

To the extent limiting the number of participants limits fishing mortality, biological protection will be provided and overfishing prevented. This option would not provide the same level of biological protection as the preferred option. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

This option would result in approximately 60 individuals qualifying for initial permits without the 600 pounds requirement. If landings of 600 pounds are required by that date, 17 individuals would qualify. It will eliminate all those who qualify for the September 1, 1995 date but did not make landings by April 7, 1995. This means that seven individuals would not qualify. These individuals include owners of vessels ranging from 80 feet to 180 feet in length who have invested thousands of dollars in refitting those vessels and gearing up for the fishery. Such an option would impose significant economic losses on those individuals. Conversely, it could be argued that the Council did put the public on notice through publication of the control date. The critical factor is to decide whether the number that would qualify under the April 7, 1995 control date is already larger than the number needed to sustain the fishery.

Social Impacts

This option has some support among fishermen who feel that this date accomplishes what the Council intended when the control date was established. However, evidence from public hearing and scoping suggests that few fishermen qualify by the April control date intend to fish in the northern zone. Four fishermen from South Carolina have indicated they have documented landings, but whether they intend to fish golden crab full-time is not clear. This would leave the primary fishery in the southern and mid-zones and limit the data collected through fishing effort in the northern zone.

Conclusions

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants because the amount of gear will be limited and fishermen will not be forced to fish areas of hard bottom due to crowding on the more preferred fishing grounds. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within and because this option would not produce the data necessary (due to very limited number of vessels in the northern zone) to properly manage the golden crab fishery.

Rejected Option 7. Limit the number of participants to those that can document at least 5,000, 10,000, 15,000, or 20,000 thousand pounds of golden crab landings as of the control date (April 7, 1995).

Biological Impacts

To the extent limiting the number of participants limits fishing mortality, biological protection will be provided and overfishing prevented. This option could provide more biological protection. The stock assessment will provide information which may require further adjustments to the level of effort and it make take some trial and error to come to the optimal effort level.

Economic Impacts

This option is even more restrictive than Rejected Option 6. Based on the Florida trip ticket data, only five individuals could demonstrate landings of over 5,000 pounds as of April 7, 1995. This means that 55 individuals that made landings by April 7, 1995 will not qualify for initial permits. Also, those that landed golden crab post–April 7, 1995 and by September 1, 1995 will not qualify for initial permits. This option will likely impose the most severe economic hardship on fishermen.

Social Impacts

This option would be the most restrictive and may impact the ability of those within the fishery to continue if the markets which have been established cannot continue with a limited supply. Because this option would allow only five or fewer individuals into the fishery, it would most likely be opposed by the greatest number of fishermen.

Conclusions

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of

the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants is not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because they concluded it was more fair to allow fishermen to choose which area they wanted to fish within and because the impacts from this option would be overly restrictive. Also, this option would not allow enough fishermen to participate in the fishery to supply the markets necessary to maintain the fishery.

Rejected Option 8. Establish the following controlled access program (Note: This was the Council's preferred option for the second round of public hearings. The Council's current position changes a number of these provisions. The impacts of Rejected Option 8 are presented below directly as they were presented in the second public hearing draft dated September 1995. More recent information has been used to analyze the impacts of the proposed action.)

A. Zones. Establish the following zones (Figure 3):
(1) Northern zone - north of the Flagler/Volusia County line (Florida; 29°25'N. latitude) to the North Carolina/Virginia border;
(2) Mid-zone - 29°25'N. latitude to 25°N. latitude; and
(3) Southern zone - south of 25°N. latitude to the border between the South Atlantic and Gulf of Mexico Fishery Management Councils.

B. Initial Eligibility. Apply April 7, 1995 (control date) to limit access in the southern and mid-zones and apply September 1, 1995 for access in the northern zone. Criteria will be landings by the dates specified from the South Atlantic Council's area of jurisdiction.

C. Appeals. The Council will delegate to its Golden Crab Committee the authority to serve as the applications appeals committee to assist the NMFS RD in handling disputes over eligibility. The charge to the committee is to make sure the criteria pertaining to eligibility were applied to an individual's application in a correct manner.

D. Permits. Applications for permits must be made within 60 days after publication of the final rule in the Federal Register. The possession of golden crab aboard a vessel within a zone for which you do not have a permit is prohibited. The Council will consider establishing a transit zone for fishermen fishing in the Gulf of Mexico to land golden crabs in Key West. The Council is requesting input on how to structure such a transit zone and whether one is actually necessary. (**NOTE:** There is some concern about the timing of the permit requirements and the Council may specify a shorter time period. The public is requested to comment on the time necessary for applying for permits.)

E. Transferability. A permit may not be transferred except that the NMFS RD shall have the authority to transfer a permit:
(1) Between members of the immediate family (spouses, children, siblings or parents);
(2) In the event of death or disability of a permitholder, to a person specified by the permitholder, his legal guardian, or the estate;
(3) To a vessel no greater than 110% of the original vessel's length (applies to 1, 2 & 4);
(4) To the original permitholder for a new vessel if the vessel is lost or sold.

F. **Renewals.** Permits may be renewed if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that vessel during the last permit year.

The Council did not have a preferred position on the following items. Members of the public were invited to offer their suggestions for the Council to consider. The Council will decide on each of these items prior to final approval for formal Secretarial review.

G. **Assignment of Initial Permits.**
(1) The initial assignment of permits will be to vessel owners; OR
(2) The initial assignment of permits will be to persons documenting landings.
The public is requested to comment on the initial assignment of permits.

H. **Tracking/Monitoring Permit Transfers.** Tracking transfers of permits will be done by requiring the buyer and seller to sign and date the appropriate lines on the reverse side of the permits that transfer. The system to track transaction will involve a NMFS single point transfer agent similar to the way wreckfish transactions are recorded. Fees to cover the administrative costs of processing transfers will be charged.

I. **Increasing Enforceability.** Because the benefits obtained from controlled access depend, in large measure, on regulatory compliance by fishermen, the Council maintains that gross violations (such as failure to report, fishing traps without escape gaps or biodegradable panels, retaining female crabs) warrant strict penalties such as permit sanctions.

The Council has established April 7, 1995 as a control date. If the Council develops a controlled access program, participation could be limited to those fishermen able to document landings from the South Atlantic Council's area of jurisdiction as of the April 7, 1995 control date. Fishermen with documented landings after the April 7, 1995 control date are not guaranteed participation in a controlled access program.

It is the Council's intent to initially limit the number of permitted vessels for several years and evaluate the fishery. The controlled access program will be included within the fishery management plan which is scheduled for final approval at the October 1995 meeting. The fishery management plan procedure will be used to either increase or decrease the number of vessels allowed in the fishery based on data collected and stock assessment results.

The Magnuson Act, as amended, provides that any fishery management plan which is prepared by any Council with respect to any fishery, may establish a system for limiting access to the fishery in order to achieve optimum yield if, in developing such system, the Council takes into account (a) present participation in the fishery; (b) historical fishing practices in, and dependence on, the fishery; (c) the economics of the fishery; (d) the capability of fishing vessels used in the fishery to engage in other fisheries; (e) the cultural and social framework relevant to the fishery; and (f) any other relevant considerations.

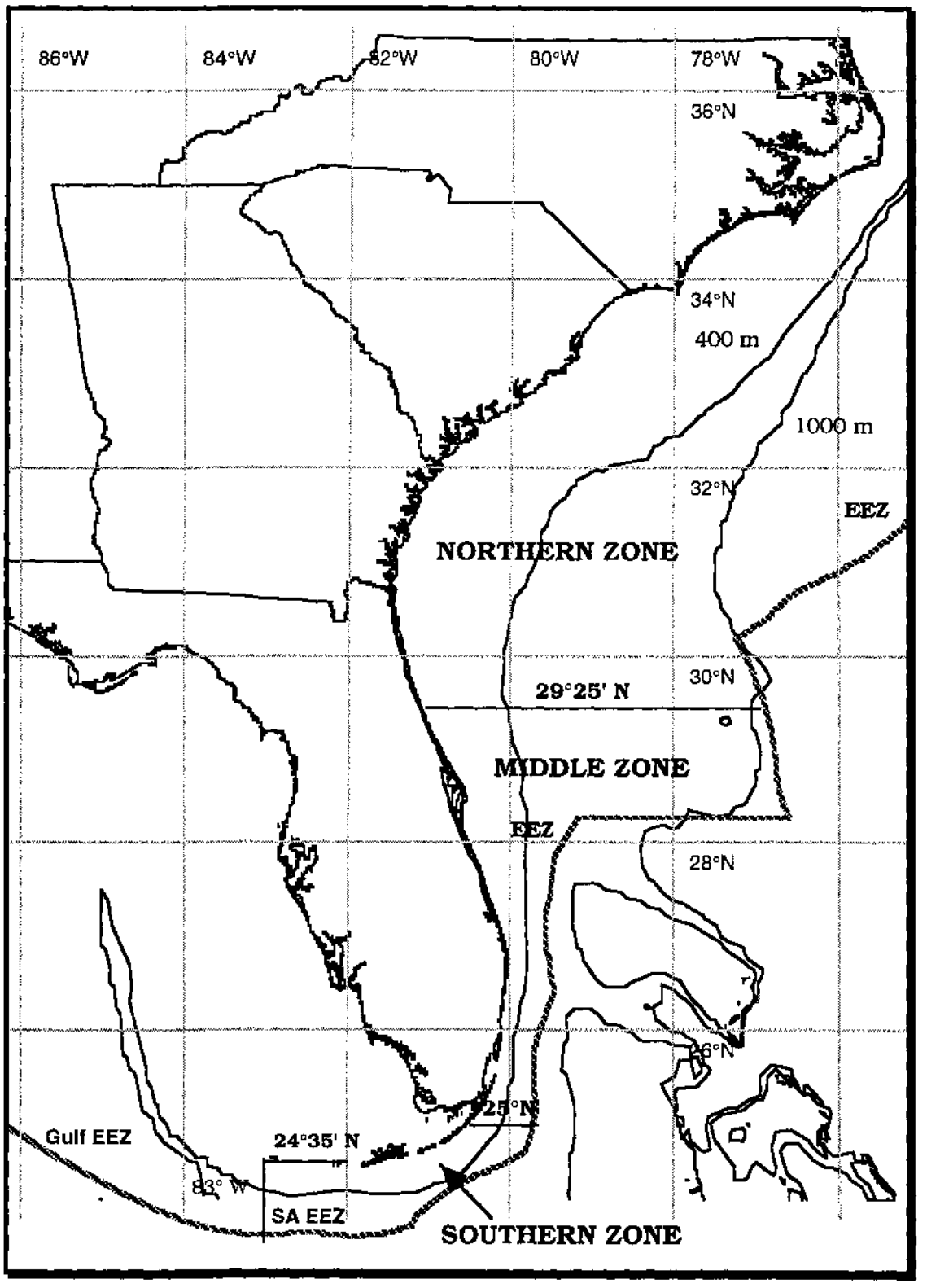

Figure 3. Map of the South Atlantic Council's area of jurisdiction with the proposed zones.

Table 9. Number of individuals qualifying by April 7, 1995 (control date) and by September 1, 1995.

Category (pounds landed)	Number With Landings Prior to April 7, 1995	Number With Landings After April 7 but Prior to September 1, 1995
< 100	19	5
100-199	11	4
200-299	9	0
300-399	8	4
400-499	4	1
500-999	14	5
1000-4999	5	4
> 5000	5	6
Subtotal	75	29
Other Documentation	5	4
Total	80	33

Although not an explicit objective at this time, the Council believes that portions or all of management and administrative costs should be recovered from those who hold individual shares in the golden crab fishery, should the Council approve such an approach and should recovery of those costs become permissible under future Magnuson Act (MFCMA) revisions. Those costs, or portions of them, would be recovered through such means as transfer fees or ad valorem taxes or other means available.

Biological Impacts

To the extent limiting effort limits fishing mortality, biological protection will be provided and overfishing prevented. The stock assessment will provide information which may require further adjustments to the level of effort and it may take some trial and error to come to the optimal effort level.

Economic Impacts

This rejected option was taken to the second round of public hearings as the Council's preferred option for controlling access to the golden crab fishery. The data used in the following analysis have not been updated and revised. Thus, the figures are different from the ones in Action 19 of this document, particularly on the number of vessels and/or individuals that landed golden crabs by April 7, 1995 and September 1, 1995. It should be noted that the following analysis was done based on number of individuals. Since that time, effort was made to link golden crab landings with vessels. It was discovered that in some cases more than on SPL was associated with one vessel. Thus, the figures in Action 19, which incorporates vessels, are less than those in this rejected option which only considers individuals.

Establishing zones will enable a diverse number of vessels in terms of size to participate in the fishery while at the same time using a conservative approach in managing the fishery. Historically, smaller sized vessels have fished for golden crabs in the EEZ off south Florida including areas off the Florida Keys. It is practicable and safe for these vessels to fish in the EEZ because of the narrow

continental shelf which enables them to reach deep waters (600 feet and over) approximately six miles from the coastline. There is evidence that a number of vessels have fished for golden crabs in this area since the 1980s on a sporadic basis. (It is also possible that some of these vessels landed golden crabs as bycatch.) Since 1994 golden crab landings have increased in this area. The Florida trip ticket data shows that landings of golden crabs increased during the first seven months of 1995. In Monroe County, Florida landings between May and July 1995 exceeded landings from January to May 1995. Reports from official sources in North Carolina, South Carolina and Georgia do not indicate any landings of golden crabs in those states for the first half of 1995.

Records of participation in the golden crab fishery in the proposed northern zone is very limited. However, public input indicated that this area is more suited for larger vessels that are capable of fishing up to and beyond 150 miles offshore. This zonation will also minimize crowding on the fishing grounds since larger vessels that may be fishing with large numbers of traps would likely be further offshore away from other fisheries.

The control date of April 7, 1995 and the other qualifying date of September 1, 1995 will determine the number of individuals that will receive initial permits to participate in the golden crab fishery. For the State of Florida where most of the landings have occurred, the trip ticket data provides the most reliable information on the number of individuals that would qualify (Table 9). Based on information compiled from the Florida trip ticket system, 75 individuals would qualify for initial vessel permits based on the April 7, 1995 control date. Five other individuals have also indicated they can provide documentation to show they landed golden crabs prior to the control date. This means 80 individuals would qualify for the initial permits. These individuals would qualify to fish in the entire South Atlantic area irrespective of the size of their vessels. However, only four of them have indicated a preference to fish in the northern zone. The other 76 would likely fish in the mid– and southern zones if they obtain permits.

Preliminary data as of July 1995 from the Florida trip tickets also indicate that an additional 29 individuals would qualify for permits based on the September 1, 1995 date. (The trip ticket data compiled as of September 12, 1995 includes golden crab landings up to July 1995. The actual total as of September 1, 1995 may be higher.) Four other individuals/companies have indicated that they can provide documentation of landings as of September 1, 1995. This means an additional 33 individuals/companies would qualify for the initial permits. However, these individuals would only qualify to fish for golden crabs in the northern zone. It should be noted that the 29 individuals with documented landings from the Florida trip ticket system have fished for golden crabs in south Florida and the Keys only. The four individuals/companies with other documentation indicated their catches came from the northern zone, with one indicating catches from the northern zone and the Keys.

Based on these figures, 113 individuals would qualify for the initial permits. All of them (113) would qualify to fish in the northern zone. Eighty of the 113 individuals would qualify to fish in all three

zones. Seventy–six of them have fished in the mid– and southern zones only and would likely continue to do so if they stay in the fishery. The remaining four would likely fish in the northern zone, but would have the option to fish in the mid– and southern zones. Of the 33 that would qualify to fish in the northern zone only, four of them indicated having fished in the northern zone. Assuming that only those that indicated that they have fished in the northern zone would continue to do so, a total of eight individuals would fish in the northern zone if they obtain permits. The other 29 individuals would essentially not be in the fishery unless they can fish in the northern zone.

It should be noted that these 29 individuals made their first landings of golden crabs after the April 7, 1995 control date. It is possible that their interest in the golden crab fishery was sparked by publication of the control date. It is common knowledge that fishermen who have not been active in a fishery may attempt to establish their participation in that fishery if they perceive some form of entry limitation down the line.

Based on Florida trip tickets, four of the 29 individuals made landings on the east coast of Florida. Their catches of golden crabs per trip ranged from 25 pounds to 259 pounds; with an average catch per trip of 129 pounds. Three of the individuals only made one trip each during the period post–April 7, 1995 to July 1995. The fourth individual made three trips for the same period. Total landings of the four individuals was 1,034 pounds. The remaining 25 individuals landed golden crabs in Monroe County that were harvested from the east coast of Florida. Their catches of golden crabs per trip ranged from 31 pounds to 8,954 pounds. Eight individuals recorded catches per trip between 1,691 pounds and 8,954 pounds. The rest recorded catches per trip under 600 pounds. Sixteen of these individuals made one trip each, five made two trips each, three made three trips each, and one made five trips during the period post–April 7, 1995 to July 1995. Total landings of the 25 individuals was 108,662 pounds. All 29 individuals landed 109,696 pounds of golden crab during the period post– April 7, 1995 to July 1995.

Of the 75 individuals with landings by April 7, 1995 (based on Florida trip tickets), 19 had total landings of less than 100 pounds each, 11 had total landings of 100–199 pounds each, nine had total landings of 200–299 pounds each , eight had total landings of 300–399 pounds each, four had total landings of 400–499 pounds each, 14 had total landings of 500–999 pounds each, five had total landings of 1,000–4,999 pounds each, and five had total landings of over 5,000 pounds each (Table 8). Also, of these 75 individuals, one landed golden crabs in 1994, two in 1993 and 1992, three in 1991, four in 1990, 11 in 1989, five in 1988, six in 1987 and three in 1986. Total landings of golden crabs by the 75 individuals from 1986 to April 7, 1995 was 235,965 pounds. For 1995 (pre–April 7) their total landings was 79,919 pounds; post–April 7 to July 1995 (preliminary data), total landings was 334,150 pounds.

It is possible that more fishermen would qualify for the September 1995 date because Florida's trip ticket data provides landings up to July 1995; July's data is preliminary. More fishermen may have made landings between July and September 1, 1995. Also, there could be other fishermen who can document landings of golden crab by these two dates but are not included in the Florida trip ticket system and have

not yet indicated this to the Council. There is some evidence that golden crab was landed in South Carolina during the 1980s. At least one dealer in South Carolina reported handling golden crabs during the 1980s. Given that some landings were made and reported through licensed dealers in the 1980s, it is likely that more than 113 individuals could qualify for the initial permits based on the two dates.

The number of initial permits that could be issued based on initial eligibility cannot be determined with any certainty at this time because in some cases, landings by two individuals are associated with one vessel. It is not known whether such individuals will apply for joint permits for the vessels they are associated with or whether they will apply for individual permits for separate vessels. The provisions for assignment of initial permits stipulate that initial permits will be to vessel owners or to persons documenting landings. Given that there are cases where two individuals' landings are associated with one vessel, assignment of initial permits should be based on whatever approach is practicable and equitable. It could be argued that initial permits should be given to vessel owners because they are the ones who shouldered the financial risks in pioneering the fishery. However, the nature of the fishery, the way it has been exploited and the contractual relationship between vessel owners, captains and crew should be considered in determining the assignment of initial vessel permits.

Because of inadequate knowledge of the biology and status of the stock of golden crabs in the South Atlantic area, it is impossible to estimate the number of vessels or level of effort this fishery can sustain at an optimal level. Thus, it cannot be determined a priori, whether optimal harvest levels could be achieved with the initial number of qualified participants whatever that number may be. This is one of the areas that research efforts should target. As such, it is not possible to assess the economic benefits that could accrue from limiting the initial number of participants/vessels using the two dates. It is evident though that limiting the number of participants will prevent uncontrolled expansion of the fishery until data are available to assess the potential and hence the optimum level of effort for this fishery. Given the nature of the fishery, controlling access would prevent over–exploitation and over–capitalization in this fishery. It will also provide market stability which is very important for a market that is only in its early stage of development.

Preliminary estimates of maximum sustainable yield (MSY) indicate the golden crab fishery in the south Atlantic could sustain an annual harvest of 1.4 million pounds. If these estimates hold true, the annual value of this fishery would be $1.4 million based on an average exvessel price of $1.00 per pound. This value has to be compared to the cost of managing the fishery in determining the economic benefits that could accrue from the fishery. This estimated value seems low compared to other fisheries, but it should be noted that this is a new fishery which offers opportunities to those who have been displaced from other fisheries the chance to make a living. Thus, even at such a low value, a management program which ensures harvest on a sustainable basis in the long– term will provide income to support a number of fishermen and their families. Conversely, if this fishery is allowed to expand rapidly to the point where it collapses because of heavy fishing pressure, fishermen will have to turn to other heavily exploited

fisheries to make a living. In addition, there would be idle capital in the event the fishery collapses because investment in gearing up for this fishery is fairly high and the gear is not easily adaptable for use in other fisheries.

It is worth noting the parallels between the golden crab and wreckfish fisheries. Both fisheries were discovered relatively recently compared to other fisheries. Their exploitation started with few vessels, was sporadic and suddenly expanded partly as a result of market development. Both fisheries occur in deep waters away from most other fisheries. Their exploitation require certain navigational and technical skills, and significant investment in gear and other equipment. There is little or no bycatch in both fisheries. The annual value of the wreckfish fishery is $3.72 million. This is based on a 2.0 million pound TAC and an average exvessel price of $1.86. However, since the inception of the program (April 1992), the TAC has never been taken. For the 1994/95 season, the fishery was valued at $2.2 million. The cost of administering the wreckfish individual transferable quota (ITQ) program is estimated at $31, 000 annually (Ed Burgess, NMFS, pers. comm.). This includes issuing of permits, administering and tracking ITQs, issuing and tracking coupons, analyzing coupon utilization, and analyzing ITQ transfers. It does not include enforcement cost. Even though the value of this fishery is low compared to other fisheries, it does provide a regular source of income for shareholders in the fishery. The program is partly responsible for the stability in the market, the steady but marginal annual increases in exvessel price and steady supply of the product throughout the season. Above all, it allows shareholders to operate in the most efficient way given their fishing capabilities.

Based on the preliminary estimate of MSY included in the public hearing draft document, the estimated annual value of the golden crab fishery is $1.4 million. It is possible that this value could increase with a steady supply, predictable market and increasing consumer acceptance. Although no ITQ is proposed for the golden crab fishery at this time, administering and tracking vessel permits would be similar to the wreckfish program. Thus, the cost is expected to be less for the golden crab fishery since shares and coupons are not involved. Enforcement cost should be similar to that for wreckfish. However, this cost is not expected to increase in the same proportion since enforcement cost is spread out between fisheries. Given the above discussion, it is evident that controlling access to the golden crab fishery would protect the biological integrity of the fishery and possibly result in long–term economic benefits to the participants. Consumers will also benefit by having a steady supply of the product.

Annual vessel permits will be issued to those who qualify. The applicants will be charged the administrative costs for issuing the permits. Presently, the cost of issuing vessel permits is $40. Assuming that about 120 individuals/companies qualify and apply for permits, the annual cost to the industry is estimated at $4,800. However, this does not take into consideration those who have permits for other fisheries. If an applicant already possesses a permit for one fishery, that applicant would only be charged an additional $10 to obtain a second permit for the golden crab fishery. The total cost to the industry could be much less than $4,800 depending on the number of individuals who already have

permits for other fisheries. It should be noted that most of the individuals who qualify according to the Florida trip ticket data are either in the mackerel, lobster or stone crab fishery.

The provision that vessel permits are non–transferable except under certain conditions stipulated in the measures will prevent individuals from speculating and having any vested interest in the fishery. Thus, vessel permits will not accrue any value that will enable owners to make windfall profits in the event research shows higher stock levels which could withstand fishing pressure higher than the initial fishing effort resulting from issuing initial permits. The provision that permits are issued for a one–year period and are renewable only if at least 5,000 pounds of golden crab landings from the South Atlantic Council's area of jurisdiction have been attributed to that vessel during the last permit year, will eliminate those who are not active in the fishery after the first year.

At present there is no record of the average number of trips that an active golden crab fisherman could make in one year. Based on catch data provided from Florida trip tickets, the four individuals who made landings post–April 7, 1995 had an average catch of 129 pounds per trip. Those individuals would have to make approximately 40 trips in one year to meet the 5,000 pounds requirement. (These vessels make one–day trips.) The 25 individuals that made landings in Monroe County had an average catch per trip of 1,880 pounds. Those individuals would have to make only three trips per year to qualify for permit renewal. For those who landed golden crabs pre–April 7, 1995, the categories in terms of total pounds landed (less than 100 pounds to over 5,000 pounds) are provided earlier in the discussion. It could be seen that the number of trips individuals need to make to meet the 5,000 pounds requirement varies significantly. However, it is unlikely this requirement will eliminate anyone who fishes for golden crab part of the year and who depends on the income from this fishery as a substantial part of his/her total annual income. This is particularly true for some of the fishermen in south Florida.

Since there is no provision for transferring permits except under certain conditions, it is not expected that there will be a lot of permit transfers. Such transfers will likely be within immediate families (as defined); in the event of deaths, disabilities, etc.; and to new vessels owned by the same individuals issued the permits. Thus, there should be no significant cost to the National Marine Fisheries Service (NMFS) in tracking any permit transfer. There could be an increase in at sea enforcement depending on the level on enforcement directed toward this fishery. It is however, difficult to determine the dollar amount for enforcement since this cost would also be shared with other fisheries.

Social Impacts

Controlled access has some support within the golden crab fishery, however, there is apprehension among certain industry representatives because of the obvious implications for free enterprise. Overall, controlled access has received mixed reviews by the commercial fishing industry. Some within the industry see controlled access as a necessary management tool to avoid overcapitalization and depletion of stocks. Others see this form of management as too restrictive and not allowing the essential flow of participants in and out of the fishery with the ease they consider necessary. Within the golden crab fishery there is support

for controlled access by fishermen who have fished golden crab in the past. This support parallels suggestions from the scientific community who also see this management tool as a possibility for this fishery because of the many unknowns concerning the life history of this crab. With the uncertainty regarding the resource and limited knowledge about the structure of the industry, it has been difficult to assess which type of controlled access would most likely address the concerns over status of the stock, while at the same time allow fishermen to develop the fishery so that they may have a sustainable harvest to meet market demands. The Council's preferred option utilizing zones and a control date may accommodate both concerns about the resource and expansion within the fishery.

Fishermen in general have been supportive of the biological measures proposed for this fishery as discussed earlier. There has also been a great deal of support for the options to limit entry. Fishermen recognize the need for a conservative approach toward this fishery and realize their effort will provide much of the data for the fishery. At the same time there are areas where data needs are crucial and presently very few fishermen are in those areas, especially to the north of Cape Canaveral. With the control date of April 7, 1995, few vessels would qualify in the area north of the Cape. For that reason, some fishermen would like to see provisions which would allow entry into this fishery after the control date. This would ensure that data would be collected throughout the range of South Atlantic Council's jurisdiction. Other fishermen, however, have expressed misgivings about another control date, for they see this as an opening for expansion of the fishery when the Council's primary concern is to limit entry. Some fishermen favor limiting entry as long as they are in, while those who are out do not favor limiting entry.

This is not to say that fishermen are not concerned with the state of the resource. As mentioned earlier, there is widespread support for the biological protection measures proposed as shown in Table 7. What little data do exist on the life history of this crab suggest a conservative approach, therefore fishermen see limited entry as one avenue to regulate harvest, yet allow for some expansion of the fishery which will increase data collection and provide stable markets. Most fishermen fear that an open access fishery will negatively impact this fishery and the markets they have tried to build and maintain. Given these concerns the Council has attempted to accommodate industry's concerns and still provide the necessary protection to the resource.

The Council's rationale for using the April 7th control date for the southern and mid-zones was to prevent overcapitalization in areas that have seen a rapid expansion in the number of individuals who have or may enter the fishery. Evidence from the Florida trip ticket system indicates there are 75 individuals who have demonstrated landings as of the April control date. This does not mean that there are 75 vessels in the fishery; fishermen have indicated that landings from one vessel may have been divided and placed under different SPLs. Therefore, the number of vessels presently fishing may be much lower. If the Council's intention is to document landings in relation to a vessel for initial qualification, then the number of vessels will be considerably lower than that indicated by the SPL numbers. Five other vessels not included in the

Florida trip ticket system have indicated they can demonstrate landings as of the April control date. Four of those are fishing in the northern zone, while one is in the Florida Keys. The total number of individuals who may qualify by the April control date has risen to 80; a considerable increase from the 2-4 vessels thought to be fishing in February.

Limiting access to the northern zone if landings are established by September 1, 1995 will allow for larger vessels that were outfitted and/or fishing, but for some reason had not landed golden crab by the April 7, 1995 date. These vessels were known to be gearing up for the fishery as early as February. As discussed earlier, industry representatives informed the Council of their intentions to use these larger vessels in the northern area of the South Atlantic Council's jurisdiction. They indicated that they would most likely fish deeper water and make longer trips than the day boat fishery located further south. The Council's intent was to allow this large boat fishery to develop, thereby ensuring that data needs for the entire South Atlantic region would be met.

A major concern expressed throughout has been the ability of the stock to withstand fishing pressure from large vessels. Therefore, limiting the northern area to a small number of large vessels has been the intent. Unfortunately, by establishing this later control date a number of other individuals will qualify to fish in the northern zone. Most of those fishermen, however, have documented landings in the southern and mid-zones, yet would only be allowed to fish the northern zone. How many would choose to do so is uncertain at this time. According to Florida trip ticket data 29 fishermen have established landings as of the September date. Including the four larger boats fishing deeper waters, the total number of individuals who qualify for the northern zone is 33.

The Council's intent has always been to limit the number of vessels in this fishery because of the nature of the very limited information concerning this biology of this crab. Unfortunately, the number of individuals participating within this fishery has grown at an almost exponential rate. Part of that comes from the establishment of a control date and the time allowed before it takes effect. Once word is spread that a fishery will have a control date, fishermen look for ways to establish documented landings. In effect, this initiates the exact behavior fishery managers often wish to avoid. This type of behavior is not peculiar to this fishery, but the multi-species approach to fishing in Southeastern Florida and the Keys does contribute to these developments. Because of increasing regulation on other species, the abolishment of inshore net fishing in Florida and the implementation of limited access in other fisheries, fishermen are constantly searching for other fisheries to add to their yearly round of fishing activity. Certain individuals during public hearings stated that they intend to fish golden crab only part of the year, while continuing their participation in other fisheries like mackerel, spiny lobster, stone crab and snapper grouper. This multi-species approach has been a tradition in the Keys and southeast Florida. While each individual species or fishery may not be crucial to the overall income, the loss of one or more could make or break the fishing operation and have severe repercussions for the total household income. Many fishermen from southeast Florida and the Keys were displaced when fish trapping was banned by the South Atlantic Council in 1991.

They eventually sought other fisheries to supplement their yearly fishing round and golden crab seems to be one of them.

Participating in a variety of fisheries may also mean a considerable investment in different gear types. Information provided during public hearings and scoping suggests that gearing up for golden crab is an expensive proposition. That expense in itself may be a limiting factor, however, other testimony indicates that some fishermen have moved easily into the golden crab fishery and could do quite well on a part-time basis. These individuals tend to be highliners from the lobster and other fisheries. Their participation could mean substantial landings even with limited participation in this fishery.

The Council's preferred option for controlled access is an attempt to balance the biological, economic and social factors identified in this rapidly changing fishery. Although it is difficult to determine many of the impacts associated with this action, it may provide the most practical framework for future actions concerning this fishery.

Conclusion

The Council concluded it is necessary to control access to prevent the problems of overfishing, excess capacity, inefficiency, low conservation and compliance incentives, high regulatory costs, and low marketing incentives. The number of individuals qualifying represents a harvest capacity far in excess of the likely MSY and far in excess of any reasonable level of harvest. A number of scientific reviewers are supportive of limited entry given the life history characteristics of golden crab. The majority of fishermen support the concept and many are supportive of the proposed action. If the number of participants are not limited, conflict will be a significant problem. There are also potential habitat benefits from limiting the number of participants. The Council rejected this option in favor of the proposed action because (1) they concluded it was more fair to allow fishermen to choose which area they wanted to fish within; (2) they wanted to address the public's comments about the boundary of the northern and middle zones by moving the boundary south; (3) they initial eligibility criteria would have allowed too many vessels in the fishery which would have increased the risk of overfishing; (4) they wanted to broaden the composition of the appeals committee; (5) they concluded more transferability of permits was necessary to address changing business arrangements and address sale of vessels; and (6) to clarify the Council's intent about items considered gross violations.

4.2.2 OPTION 2. TRADITIONAL FISHERY MANAGEMENT

Traditional fisheries management includes measures to provide biological protection to the resource (escape gap in traps and no retention of female crabs); regulate gear (define allowable gear, degradable panel, tending requirements, gear identification and maximum trap size by zone); provide for law enforcement (depth limitations and prohibit possession of whole or gutted fish or fillets of snapper grouper species); determine the number of participants (vessel and dealer/processor permits); collect the necessary

data (vessel/fishermen and dealer/processor reporting); and a framework procedure to adjust the management program (framework adjustments and adjustments to activities authorized by the Secretary of Commerce).

Specific Actions included are Actions 1 through 18 (see list in Section 2.0). Specific analysis of impacts associated with each of the actions is included in Section 4.2. Please refer to this section for more detailed information.

Biological Impacts

Use of these traditional management techniques in other fishery management plans has not solved all fisheries management problems. At best, the fishery resource, in this case golden crab, is biologically protected. Ignored or even exacerbated are underlying social and economic problems resulting from open access fisheries. These include excess capacity, inefficiency which increases fishing costs, low conservation and compliance incentives, conflicts, high regulatory costs and low marketing incentives (see Section 1.1 Issues/Problems for more detail).

Economic Impacts

In a new and expanding fishery, traditional fishery management measures are utilized primarily to protect the biological integrity of the fishery. However, as more and more of these measures are implemented, inefficiency is built into the system. For example, a maximum trap size may not be of the size that will allow one group of fishermen to fish efficiently. Public testimony indicated that one group of fishermen operate in waters 150 miles offshore. At such depths, they claimed they need to utilize traps big enough to prevent the traps from being swept away by strong currents. If trap size limitations prevent them from using the size that will work effectively at those depths, significant reduction in harvest could occur.

Area limitations while effective in preventing gear conflict in terms of congestion on fishing grounds and different sizes of gear being used in the same areas, could also be restrictive causing reduction in harvest. This is particularly true if golden crabs exhibit a pattern of movement according to areas or depth stratification. Limiting individuals or groups to certain areas could prevent them from fishing if the golden crabs move away from those areas. Quotas and other forms of limiting harvest without controlling the number of participants could lead to capital stuffing as participants try to increase harvesting capacity to harvest as much of the quota as possible before it is taken. Thus, the proposed controlled access measures with limited restrictions seem to be a more efficient way to manage this fishery.

Social Impacts

Some industry representatives might favor this option because of their unfamiliarity and uncertainty regarding limited access. Fishermen have suggested that traditional management could be implemented until more information regarding the fishery can be gathered allowing for a more informed decision regarding limited entry. However, the rapid increase in the number of participants within this fishery has made the open access alternative seem less desirable. Some type of effort limitation seems to be needed

and, given the nature of this developing fishery, a limited access system may be appropriate. Trip limits and quotas, along with other biological measures, may not accomplish all the social and economic factors the Council wishes to address within this management framework.

Conclusion

Use of a traditional approach to management of this fishery, as described above, would address the biological problems but would not address the social and economic problems. To solve the identified social and economic problems, managers have increasingly turned to various forms of controlled access or effort limitation. The Council concluded that Option 2 (Traditional Fishery Management) by itself would not achieve optimum yield and is not in the best, long-term interest of the fishermen, processors, consumers, and public and rejected this approach. The Council also concluded Option 2 by itself would not be consistent with the "NMFS Policy of Risk Aversion in Face of Uncertainty" (Appendix B).

4.2.3 OPTION 3. NO ACTION

Specific Actions are listed in Section 2.0. Specific analysis of impacts associated with each of the actions is included in Section 4.2. Please refer to this section for more detailed information.

Biological Impacts

The following discussion from Erdman (1990) provides insight into the results of no action:

"The impact of unrestricted fishing of deep-sea crabs can best be seen in data from the *C. maritae* fishery off South west Africa/Namibia. Although the initial fishery expanded rapidly, by 1980 effort had declined to only five vessels (Beyers and Wilke, 1980). Since unrestricted fishing began in 1980, CPUE has decreased from 11.46 kg/trap to 9.29 kg/trap by 1986. However, of greater significance is the drastic change in the composition of the catch observed during the same period. Whole sections, which are from crabs greater than 110 mm CW, have declined from 39 percent of the total catch to only seven percent. Conversely, flake meat produced from crabs less than 110 mm CW, has increased from 61 percent to 93 percent of the total catch during the same period (Melville-Smith, 1988). This change in catch composition illustrates that the unrestricted fishing practices currently utilized have significantly reduced the number of large *C. maritae* in the present fishing grounds. Of greater importance is the unknown effect on future recruitment that may result from the harvest of female crabs.

Although CPUE data (kg/trap) is also available from the *C. quinquedens* fishery, differences in trap designs, soak times and effort preclude any comparison of the present *C. fenneri* fishery data with that previously discussed. However, the gradual decline in CPUE observed during the present study is a reflection of the impact that a small scale fishery may have on stocks in a localized area. As present fishing depths are restricted to depths between 215 and 230 m, the data suggests that the present fishery may deplete the stock of large male crabs within a relatively short period of time. As the data presented herein is from a 3

to 5 mile long, north-south running corridor, the decline in catch is not surprising. Within three months after the completion of this study, fishermen noted the continued decline in catch and moved the gear to a new corridor farther south of the present fishing area. This pattern of trapping in one area and moving all gear when catch rates decline is still in effect (R. Nielsen, commercial fisherman, pers. comm.).

Because *C. fenneri* attains a greater maximum size and weight than other Geryonidae, interest in the further development of a fishery is warranted. However, the slow growth characteristic of many deep-sea crustaceans (Childress and Price, 1978) and *C. maritae* in particular (Melville-Smith, 1989) must be considered by both fisheries management and commercial interests. Unrestricted fishing may lead to rapid depletion of the reproductively active stock, similar to that present in the *C. maritae* fishery. Thus, the current voluntary fishing practice of harvesting only male crabs greater than 130 mm CW may provide sufficient numbers of smaller sexually mature males to permit continued reproductive success. This is further enhanced by the release of all females from the catch. Escape rings may permit undersize crabs to exit traps, however, the impact of their use in the present fishery remains unknown. Although the small southeast Florida fishery for *C. fenneri* has been relatively successful, the longevity of this fishery at increased levels of effort remains unknown."

Economic Impacts

Given the longevity of golden crab, history of exploitation, and recent interest in the fishery partly due to factors affecting other fisheries outside the South Atlantic region, not providing for management of the golden crab fishery could lead to dissipation of long-term economic benefits. No data are available to assess the impact of no action, but information from various sources, including the Florida trip ticket system, indicate that more vessels have entered the fishery and still more are gearing up to enter the fishery. If steps are not taken to manage the fishery, overfishing could result. At worst it could cause a shut down of the fishery. At best it could cause significant reductions in net economic benefits from the fishery.

Social Impacts

The open access option for this fishery would most likely preclude any long-term sustainability. The rapidly growing harvesting sector may have the potential to quickly overfish the golden crab stocks with no management framework in place. This scenario would approach the pulse like nature this fishery has exhibited in other areas like the Gulf of Mexico in the past, but on a much larger scale. Opposition from industry may be conceivable as many fishermen and others have expressed the need for a conservative approach to management and a desire for sustained harvests for this fishery. Given the many unknowns about the life history of golden crab and its ability to withstand fishing pressure, the no action alternative could have a significant impact upon the resource. The developing interest in this fishery, as expressed during public hearing and scoping has spurred a growing concern by the Council, scientific community, and fishermen over the status of golden crab stocks and its ability to withstand increased fishing pressure over time. Therefore, the no action alternative may have little appeal.

Conclusion

Given the life history characteristics (slow growing, long-lived), the golden crab resource if not protected would be overfished resulting in social and economic losses and displacement to participants in the fishery. Once overfished, it would take a long time for the stock to rebuild given their slow growth rate. Consumers would also lose long-term benefits which would result from a sustained fishery. No management would also run the risk of possible effects on habitat due to the unlimited and unrestricted use of cable mainline and the uncontrolled use of golden crab traps. Finally, the fishery has some unique characteristics that make it difficult for everyone to successfully participate; no management would result in the inefficient use of capital.

The Council rejected taking no action because it would result in overfishing and large negative impacts on the fishermen, processors, consumers, and public and because no data would be obtained. The Golden Crab Advisory Panel does not support taking no action. The majority of public comments also did not support taking no action. The Council also concluded taking no action would not be consistent with the "NMFS Policy of Risk Aversion in Face of Uncertainty" (Appendix B).

4.3 Research Needs

The following research needs (Items 1-8 taken from Lindberg and Wenner, 1990) are listed in no particular priority order:

1. Recruitment processes and life history strategy.

2. What are the settlement patterns of juveniles with respect to depth? What are the subsequent development and mortality rates, and how do they vary across depths?

3. Growth rates. Accurate, detailed molt staging should be incorporated into future sampling regimes, while controlled laboratory experiments to test effects of ecological variables are particularly desirable.

4. Reproductive cycle. Age at first reproduction is poorly known. Comparative studies and experimentation are needed to resolve questions of this basic life history trait.

5. Seasonal movements, encounter rates among potential mates and competitors, movement by mated pairs, and takeover attempts all need to be documented to test golden crab mating strategies.

6. Habitat preferences. Basic ecological questions concerning physiological ecology, refuges and foraging habits, trophic dynamics and community relationships remain largely unanswered.

7. Home ranging versus nomadism needs to be examined.

8. Questions of basis physiology of deep-dwelling organisms, biogeography and systematics, or parasitology and symbiosis.

Additional fishery management related items include:

9. Estimate potential yield.

10. Document economic and social information of fishermen and dealers.

11. Document information on market structure, development, and consumer acceptance of product.

12. Determine whether there is any substitutability with other crustaceans.

13. Identification of existing bottom habitat suitable for golden crabs in the South Atlantic Council's area would be useful.

14. Biodegradable panel research - determine the rate at which the specified material degrade and evaluate materials/methods to degrade within 14-30 days.

15. Bioprofile sampling - data on size, molt and reproductive status, etc.

4.4 Unavoidable Adverse Effects

Without management, fishing effort could continue to increase and catches of golden crab would decline. In the absence of management measures limiting fishing mortality rates, such declines would be expected to continue and catches could reach such low levels that the golden crab fishery would no longer be economically feasible. If this situation were allowed to continue, the fishery would ultimately collapse.

Implementation of the proposed traditional management measures will have minimal impacts on fishermen, in part, because many of the measures were recommended by fishermen. The controlled access program will impact those fishermen not included; such individuals may be able to enter the fishery in the future if the stock assessments indicate that additional effort can be sustained by the golden crab resource or by purchasing a permit from someone in the fishery.

4.5 Relationship of Short-term Uses and Long-term Productivity

Short-term uses will be impacted slightly. This level of reduction is necessary to protect the golden crab resource from overfishing and to ensure the long-term productivity of this important species. Without such regulations, the long-term yield would be jeopardized.

The Council weighed the short-term losses to fishermen against the long-term yield and stability of the golden crab resource and concluded that the proposed actions would result in net benefits to society.

4.6 Irreversible and Irretrievable Commitments of Resources

There are no irreversible or irretrievable commitments of resources associated with the proposed action. If the Council had not taken action to prevent overfishing of the golden crab resource and to establish the other regulations, substantial reductions in catches and future net benefits would be expected.

4.7 Effects of the Fishery on the Environment

4.7.1 Damage to Ocean and Coastal Habitats

The proposed actions, and their alternatives, are not expected to have any adverse effect on the ocean and coastal habitats. Identification of sensitive bottom habitat (*Oculina*, *Lophelia*, and *Emallopsamia* coral) will aid fishermen in avoiding damage to these areas.

The fishery, as presently prosecuted, does not substantially impact the bottom habitat that is essential to golden crab under Council management. The Council will continue to monitor the fishery and if it becomes apparent that a particular gear or fishing practice results in habitat damage, action will be proposed through the framework procedures to mitigate or minimize damage.

4.7.2 Public Health and Safety

The proposed actions, and their alternatives, are not expected to have any substantial adverse impact on public health or safety.

4.7.3 Endangered Species and Marine Mammals

The proposed actions, and their alternatives, are not expected to affect adversely any endangered or threatened species or marine mammal population.

4.7.4 Cumulative Effects

The proposed actions, and their alternatives, are not expected to result in cumulative adverse effects that could have a substantial effect on the golden crab resource or any related stocks, including sea turtles. In fact, the proposed measures will maintain the stock status of golden crab and minimize habitat damage because overfishing will be prevented and allowable gear defined.

4.8 Summary of Expected Changes in Net Benefits (Summary of Regulatory Impact Review-RIR)

Specific Actions are listed in Section 2.0. Specific analyses of impacts associated with each of the actions are included in Section 4.2. Please refer to this section for more detailed information.

ACTION	POSITIVE IMPACTS	NEGATIVE IMPACTS	NET IMPACTS
OPTION 1. TRADITIONAL FISHERY MANAGEMENT PLUS CONTROLLED ACCESS.	Provides biological protection for golden crab. Efficient utilization of the resource.	Estimated cost of vessel permits to the industry is $1,200. May exclude some individuals.	Unknown, but likely increase in net economic benefits in the long-term.
OPTION 2. TRADITIONAL FISHERY MANAGEMENT.	Provides biological protection for golden crab.	Does not address economic and social concerns in the fishery.	Probable reduction in economic benefits in the long-term.
OPTION 3. NO ACTION.	None.	Overfishing leading to lost revenues and attendant factors.	Probable decrease in economic benefits.

Given the discussions under economic impacts and the comparison made between the golden crab and wreckfish fisheries, net benefits from the golden crab fishery are likely to exceed management costs.

4.9 Public and Private Costs

Preparation, implementation, enforcement, and monitoring of this and any federal action involves expenditure of public and private resources which can be expressed as costs associated with the regulation. Estimated costs are shown below:

Council costs of document preparation, meetings, public hearings, and information dissemination	$101,000
NMFS administrative costs of document preparation, meetings, and review	$40,000
NMFS law enforcement costs	$33,000
Estimated cost of vessel permits	$1,350
Total	$175,350

4.10 Effects on Small Businesses

4.10.1 Introduction

The purpose of the Regulatory Flexibility Act is to relieve small businesses, small organizations, and small governmental entities from burdensome regulations and record keeping requirements. The category of small entities likely to be affected by the proposed plan is that of commercial golden crab fishermen. The impacts of the proposed action on these entities have been discussed under each action in Section 4. The

following discussion of impacts focuses specifically on the consequences of the proposed actions on the mentioned business entities. A "threshold-type analysis" is done to determine whether the impacts would have a "significant or non-significant economic impact on a substantial number of small entities." If impacts are determined to be significant, then an Initial Regulatory Flexibility Analysis (IRFA) is conducted to analyze impacts of the proposed action and alternatives on individual business entities. In addition to analyses conducted for the Regulatory Impact Review (RIR), the IRFA provides an estimate of the number of small businesses affected, a description of the small businesses affected, and a discussion of the nature and size of the impacts.

4.10.2 Determination of Significant Economic Impact on a Substantial Number of Small Entities

In general, a "substantial number" of small entities is more than 20 percent of those small entities engaged in the fishery (NMFS, 1991). According to data from Florida trip tickets, 60 vessels/individuals landed golden crab in Florida by September 1, 1995. Based on the criteria for initial vessel permit, about 30 vessels would qualify. This means that about half of those that have landed golden crab would not be able to participate in this fishery, although they will be able to gain access by buying vessel permits from those who qualify initially. However, these are fishermen who landed less than 600 pounds by April 7, 1995 or less than 2,500 pounds by September 1, 1995. Income from the sale of golden crabs was an insignificant part of their total income (less than 2% of their annual income, see Section 4.2.1.8.1 for detailed analysis). They are also engaged in other fisheries and would not be put out of business. The Small Business Administration (SBA) defines a small business in the commercial fishing activity as a firm with receipts of up to $2.0 million annually. All golden crab fishermen readily fall within the definition of small business. Since the proposed action will directly and indirectly affect many of these permittees, the "substantial number" criterion will be met.

Economic impacts on small business entities are considered to be "significant" if the proposed action would result in any of the following: a) reduction in annual gross revenues by more than 5%; b) increase in total costs of production by more than 5% as a result of an increase in compliance costs; c) compliance costs as a percent of sales for small entities are at least 10% higher than compliance costs as a percent of sales for large entities; d) capital costs of compliance represent a significant portion of capital available to small entities, considering internal cash flow and external financing capabilities; or e) as a rule of thumb, 2% of small business entities being forced to cease business operations (NMFS, 1991).

Given that for each action (a) any impact would be equivalent to much less than a 5% reduction in annual gross revenues, (b) any increase in compliance costs would be much less than a 5% increase in total costs of production, (c) all entities involved are small entities, (d) capital costs of compliance represent a very small portion of capital, and (e) no entities are expected to be forced to cease business operations, the Council determined that the resulting impacts will not have a significant economic impact on a substantial number of small entities.

4.10.3 Explanation of Why the Action is Being Considered

Refer to Section 1.0, Purpose and Need. Basically, this fishery management plan establishes a management program to prevent overfishing of the golden crab resource and promote long-term stability in the golden crab fishery. This management program will allow the fishery to produce optimum yield on a continuing basis.

4.10.4 Objectives and Legal Basis for the Rule

Refer to Section 1.0 for the Management Objectives. The Magnuson Fishery Conservation and Management Act of 1976 as amended provides the legal basis for the rule.

4.10.5 Demographic Analysis

Refer to the Section 3.0 of this fishery management plan. Data on fishermen are very limited.

4.10.6 Cost Analysis

Refer to the summary of the impacts (Section 4.7 and 4.8) and the summary of government costs (Section 4.9). The Council concluded that the benefits of the preferred alternatives outweigh the costs.

4.10.7 Competitive Effects Analysis

The industry is composed entirely of small businesses (harvesters and fish houses). Since no large businesses are involved, there are no disproportional small versus large business effects.

4.10.8 Identification of Overlapping Regulations

The proposed actions do not create overlapping regulations with any state regulations or other Federal laws.

4.10.9 Conclusion

The proposed measures will not have a significant economic effect on small businesses.

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Atlantic States Marine Fisheries Commission
SAFMC Law Enforcement Advisory Panel
SAFMC Golden Crab Advisory Panel
SAFMC Scientific and Statistical Committee
North Carolina Coastal Zone Management Program
South Carolina Coastal Zone Management Program
Florida Coastal Zone Management Program
Florida Department of Natural Resources
Florida Marine Fisheries Commission
Georgia Department of Natural Resources
South Carolina Department of Natural Resources
Marine Fish Conservation Network
North Carolina Department of Environment, Health, and Natural Resources
National Marine Fisheries Service
- Southeast Region
- Southeast Center

United States Coast Guard
United States Environmental Protection Agency, Region IV
Center for Marine Conservation
Gulf of Mexico & Mid-Atlantic Fishery Management Councils
South Atlantic Fisheries Development Foundation
Marine Advisory Agents
National Coalition for Marine Conservation
North Carolina Fisheries Association, Inc.
Southeastern NC Waterman's Association
Organized Fishermen of Florida
Southeastern Fisheries Association

7.0 APPLICABLE LAW

7.1 VESSEL SAFETY CONSIDERATIONS

PL. 99-659 amended the Magnuson Act to require that a fishery management plan or amendment must consider, and may provide for, temporary adjustments (after consultation with the U.S. 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 safety of the vessels.

No vessel will be forced to participate in the fishery under adverse weather or ocean conditions as a result of the imposition of management regulations set forth in this Fishery Management Plan. Therefore, no management adjustments for fishery access will be provided.

There are no fishery conditions, management measures, or regulations contained in this plan which would result in the loss of harvesting opportunity because of crew and vessel safety effects of adverse weather or ocean conditions. No concerns have been raised by people engaged in the fishery or the Coast Guard that the proposed management measures directly or indirectly pose a hazard to crew or vessel safety under adverse weather or ocean conditions. Therefore, there are no procedures for making management adjustments in this plan due to vessel safety problems because no person will be precluded from a fair or equitable harvesting opportunity by the management measures set forth.

There are no procedures proposed to monitor, evaluate, and report on the effects of management measures on vessel or crew safety under adverse weather or ocean conditions.

7.2 COASTAL ZONE CONSISTENCY

Section 307(c)(1) of the Federal Coastal Zone Management Act of 1972 requires that all federal activities which directly affect the coastal zone be consistent with approved State coastal zone management programs to the maximum extent practicable. While it is the goal of the Council to have complementary management measures with those of the states, federal and state administrative procedures vary and regulatory changes are unlikely to be fully instituted at the same time. Based upon the assessment of this plan's impacts in previous sections, the Council has concluded that this plan is an improvement to the management of golden crab.

The Council concluded that this fishery management plan is consistent with the Coastal Zone Management Plan of the states with approved plans. This determination has been submitted to the responsible state agencies for their review.

7.3 ENDANGERED SPECIES ACT OF 1973

The proposed actions have no anticipated adverse impact on threatened or endangered species or on marine mammals. A Section 7 consultation was conducted with the NMFS Southeast Regional Office.

A biological assessment was prepared which concluded that neither the fishery nor the proposed management plan for the golden crab fishery will adversely affect the recovery of endangered or threatened

species, or their critical habitat. Listed and protected species under the Endangered Species Act (ESA) and governed by the jurisdiction of NMFS include:

Whales:
(1) The northern right whale- *Eubalaena glacialis*(ENDANGERED)
(2) The humpback whale- *Magaptera novaeangliae* (ENDANGERED)
(3) The fin whale- *Balaenoptera physalus* (ENDANGERED)
(4) The sei whale- *Balaenoptera borealis* (ENDANGERED)
(5) The sperm whale- *Physeter macrocephalus* (ENDANGERED)
(6) The blue whale- *Balaenoptera musculus* (ENDANGERED)

Sea Turtles:
(1) The Kemp's ridley turtle- *Lepidochelys kempii* (ENDANGERED)
(2) The leatherback turtle- *Dermochelys coriacea*(ENDANGERED)
(3) The hawksbill turtle- *Eretmochelys imbricata*(ENDANGERED)
(4) The green turtle- *Chelonia mydas* (THREATENED/ENDANGERED)
(5) The loggerhead turtle- *Caretta caretta* (THREATENED)

Other:

(1) The manatee- *Trichechus manatus* (ENDANGERED)

7.4 MARINE MAMMALS PROTECTION ACT AMENDMENTS OF 1988

The Council has determined that the golden crab fishery management plan and its implementing rule will not have a significant adverse impact on marine mammals.

7.5 PAPERWORK REDUCTION ACT

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the federal government. The authority to manage information collection and record keeping requirements is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications.

The Council does propose permit and data collection programs within this fishery management plan. The opportunity cost, the time spent completing the vessel permit application, to the fishermen is $5 per application. The public cost of dealer reporting is estimated at $12.50 per hour for processing monthly reports. Processing time per report is estimated at 15 minutes. The number of golden crab dealers is unknown. Estimated cost of logbook reporting to the industry is $12.50 per hour per vessel. This represents the opportunity cost for filling out vessel logbooks. Approximately 30 minutes is required to complete the monthly reporting. The public burden costs associated with vessel logbooks include: (a) the cost of logbooks at $8.00 per logbook, (b) mailing cost estimated at $3.00 per logbook, and (c) processing cost estimated at $100 per vessel annually. Estimated cost of dealer reporting to the industry is approximately $12.50 per hour. About 30 minutes is required to fill out the monthly report. The public

burden cost for processing monthly reports is estimated at $12.50 per hour. Approximately 15 minutes is required to process on monthly report.

7.6 FEDERALISM

No federalism issues have been identified relative to the actions proposed in this amendment and associated regulations. The affected state have been closely involved in developing the proposed management measures and the principal state officials responsible for fisheries management in their respective states have not expressed federalism related opposition to adoption of this fishery management plan.

7.7 NATIONAL ENVIRONMENTAL POLICY ACT — FINDINGS OF NO SIGNIFICANT IMPACT (FONSI)

The discussion of the need for this fishery management plan, proposed actions and alternatives, and their environmental impacts are contained in Sections 1.0 and 2.0 of this plan/environmental impact statement. A description of the affected environment is contained in Section 3.0.

The proposed fishery management plan is not a major action having significant impact on the quality of the marine or human environment of the South Atlantic. The proposed actions establishes a fishery management plan to protect the golden crab resource from depletion.

Mitigating measures related to proposed actions are unnecessary. No unavoidable adverse impacts on protected species, wetlands, or the marine environment are expected to result from the proposed management measures in this amendment.

7.7.1 Finding of No Significant Environmental Impact (FONSI)

The Council's preferred action is to establish a fishery management program for golden crab. Section 4.0 describes the Council's management measures in detail.

Section 1508.27 of the CEQ Regulations list 10 points to be considered in determining whether or not impacts are significant. Impacts of these actions are relative to the individuals that will be required to forego catches in the short-term and to the individuals, and society, in the long-term, because higher and more stable catches will be maintained. The analyses presented below are based on the detailed information contained in Section 4.0 Environmental Consequences including the Regulatory Impact Review and Regulatory Flexibility Determination.

7.7.1.1 Beneficial and Adverse Impacts

There are beneficial and adverse impacts from the proposed actions. The impacts are described for each action in Section 4.0 (See Section 4.8 Summary of Impacts and 4.10 Effects on Small Businesses) and summarized in Section 2.0.

The beneficial and adverse impacts as analyzed in Section 4.0 are not significant.

7.7.1.2 Public Health or Safety

The proposed actions are not expected to have any significant adverse impact on public health or safety.

7.7.1.3 Unique Characteristics

The proposed actions are not expected to have any significant adverse impact on unique characteristics of the area such as proximity to historic or cultural resources, park lands, wetlands, or ecologically critical areas. Section 3.2 contains information on habitat. The Council's positions on a number of habitat related issues are presented in that section. The Council evaluated the effects of the fishery on the environment (Section 4.7) and concluded that the fishery, as presently prosecuted, does not significantly impact the bottom habitat that is essential to the species under Council management.

7.7.1.4 Controversial Effects

The proposed actions are not expected to have any significant controversial issues. The Council has provided for input by the public through committee and Council meetings that are open to the public, through a meeting with the Golden Crab Advisory Panel, by holding a scoping meeting and public hearings, and by providing the opportunity for interested persons to provide written comments.

7.7.1.5 Uncertainty or Unique/Unknown Risks

The proposed actions are not expected to have any significant effects on the human environment that are highly uncertain or involve unique or unknown risks.

7.7.1.6 Precedent/Principle Setting

The proposed actions are not expected to have any significant effects by establishing precedent and do not include actions which would represent a decision in principle about a future consideration.

7.7.1.7 Relationship/Cumulative Impact

The proposed actions are not expected to have any significant cumulative impacts that could have a substantial effect on the golden crab resource or any related stocks, including sea turtles. (See Section 4.8 Summary of Impacts and Section 4.10 Effects on Small Businesses.)

7.7.1.8 Historical/Cultural Impacts

The proposed actions are not expected to have any significant effects on historical sites listed in the National Register of Historic Places and will not result in any significant impacts on significant scientific, cultural, or historical resources.

7.7.1.9 Endangered/Threatened Impacts

The proposed actions are not expected to adversely affect any endangered or threatened species or marine mammal population. (See Sections 7.3 and 7.4.) A Section 7 consultation was conducted with the NMFS Southeast Regional Office. A biological assessment was prepared which concluded that neither the fishery nor the proposed management plan for the golden crab fishery will adversely affect the recovery of endangered or threatened species or marine mammals.

7.7.1.10 Interaction With Existing Laws for Habitat Protection

The proposed actions are not expected to have any significant interaction which might threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Additional points analyzed by the Council are presented below:

7.7.1.11 Effects of the Fishery on the Environment

Section 3.2 contains information on habitat concerns. The Council's positions on a number of habitat related issues are presented in Section 3.2.6. The Council evaluated the effects of the fishery on the environment (Section 4.7) and concluded that the fishery, as presently prosecuted, does not significantly impact the bottom habitat that is essential to the species under Council management.

7.7.1.12 Bycatch

The golden crab fishery has virtually no bycatch (See Section 3.4.3 for details.) The measures in this fishery management plan will not impact bycatch and do not have bycatch considerations.

Conclusion:

Having reviewed the environmental assessment and the available information relating to the proposed actions, I have determined there will be no significant environmental impact resulting from the proposed actions.

_____

Assistant Administrator for Fisheries Date

8.0 REFERENCES

Acheson, James M. 1975. The Lobster Fiefs: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry. Human Ecology 3(3):183-207.

Annala, J. H. 1980. Mortality estimates for the rock lobster, *Jasus edwardsii* near Gisborne, New Zealand, N. Z. Jl mar. Freshwat. Res. 14(4): 357-371.

Armstrong D.A. 1990. Rapporteurs' Comments. Pages 23-29 In: Lindberg, W.J. and E.L. Wenner (eds.). 1990. Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report. SC Sea Grant Consortium and FL Sea Grant College Program. FL SG Technical Paper 58: 61 pp.

Beddington, J.R. and J.R. Cooke. 1983. The potential yield of previously unexploited stocks. FAO Fish. Tech. Pap. 242.

Bennett, D. B. 1979. Population assessment of the edible crab (*Cancer pagurus* L.) fishery off southwest England. Rapp. P.-v.Reun. Cons. perm. int. Explor. Mer 175: 229-235.

Beyers, C. J. De B., and C. G. Wilke. 1980. Quantitative stock survey and some biological and morphometric characteristics of the deep-sea red crab *Geryon quinquedens* off South West Africa. Fisheries Bulletin of South Africa 13: 9-12

Bullis, H. R. , Jr., and W. F. Rathjen. 1959. Shrimp explorations off southeastern coast of the United States (1956-1958). Comm. Fish. Rev. 21(6):1-20.

Caddy, J.F. and J. Csirke. 1983. Approximation to sustainable yield for exploited and unexploited stocks. Oceanogr. Trp. 18(1):3-15.

CEE. 1987. Plastics in the ocean: More than a litter problem. Center for Environmental Education. 128 pp.

Childress, J. J. and M. H. Price. 1978. Growth rate of the bathypelagic crustacean *Gnathophausia ingens* (Mysidacea: Lophogastridae). I. Dimensional growth and population structure. Marine Biology (Berlin) 50: 47-62.

Cobb, J. S. and D. Wang. 1985. Fisheries biology of lobsters and crayfishes. In the Biology of Crustacea 10. Economic Aspects: Fisheries and Culture. Provenzano, A. J. (Ed.). New York; Academic Press: 167-247.

Department of Commerce. 1987. Marine Environmental Assessment Southeastern United States, 1986 Annual Summary. U.S. DOC, NOAA, National Environmental Satellite, Data, and Information Services Center, Climate Impact Assessment United States, September 1987. 134 pp.

Department of Commerce. 1988a. Aquaculture and Capture Fisheries: Impacts in U.S.. Seafood Markets. April, 1988. Report Prepared Pursuant To The National Aquaculture Improvement Act of 1985 (P.L. 99-198). U.S. DOC, NOAA, NMFS.

Department of Commerce. 1988b. Fisheries Grant-in-Aid 1987 Program Activities. U.S. DOC, October 1988.

Department of Commerce. 1988c. Report of the Interagency Task Force on Persistent Marine Debris. U.S. DOC, May 1988. 170 pp.

Elner, R. W., S. Koshio, and G. V. Hurley. 1987. Mating behavior of the deep-sea red crab *Geryon quinquedens* Smith (Decapoda, Brachyura, Geryonidae). Crustaceana (Leiden) 52: 194-201.

Ennis, G. P. 1979. Estimates of abundance and recruitment to the standing stock for a Newfoundland population of the lobster, *Homarus americanus*, with a method of estimating its natural mortality. Rapp. P.-v Reun. Cons. perm. int. Explor. Mer 175: 225-228.

Erdman, R.B. 1990. Reproductive ecology and distribution of deep-sea crabs (Family Geryonidae) from southeast Florida and the eastern Gulf of Mexico. Ph.D. Dissertation, April 1990. University of South Florida, Tampa, Florida. 147 pp.

FAO. 1993. Reference points for fishery management: their potential application to straddling and highly migratory resources. FAO Fisheries Circular No. 864. 52pp.

Fish and Wildlife Service. 1980. Ecological characterization of the sea island coastal region of South Carolina and Georgia. Volume II: Socioeconomic features of the characterization area. USFWS. FWS/OBS-79/41. 321 pp.

FKNMS. 1995. Florida Keys National Marine Sanctuary. Draft Management Plan/Environmental Impact Statement. USDOC 1995. 323pp.

Garcia, S.M. and L. Le Reste. 1981. Life cycles, dynamics, exploitation and management of coastal penaeid shrimp stocks. FAO fish. Tech. Pap. 203:215p.

Garcia, S.M., P. Sparre, and J. Csirke. 1989. Estimating surplus production and maximum sustainable yield from biomass data when catch and effort time series are not available. Fish. Res. 8:13-23.

George, R. Y., and R. J. Menzies. 1967. Indication of cyclic reproductive activity in abyssal organisms. Nature (London) 215: 878.

George, R. Y., and R. J. Menzies. 1968. Further evidence for seasonal breeding in the deep-ea. Nature (London) 220: 80-81.

Gerrior, P. 1981. The distribution and effects of fishing on the deep sea red crab, *Geryon quinquedens* Smith, off southern New England. M. S. Thesis, Southeastern Massachusetts Univ., North Dartmouth, MA, 130 p.

Giese, A. C. 1959. Comparative physiology: annual reproductive cycles of marine invertebrates. Annual Review of Physiology 21: 547-576.

Giese, A. C., and J. S. Pearse. 1974. Introduction: General principles. In: A. C. Giese and J. S. Pearse, editors, Reproduction of Marine Invertebrates, Volume 1. Pp. 1-49. Academic Press, New York, New York.

Goodyear, C. P. 1987. Status of the red drum stocks of the Gulf of Mexico. SEFC, NMFS. Sept. 30, 1987. CRD 86/87-34.

Grant, A. 1985. Analysis of continuous reproduction in deep-sea seastars. In: P. E. Gibbs, editor, Proceedings of the 19th European Marine Biology Symposium. Pp 213-222. Cambridge University Press, Cambridge, United Kingdom.

Gulland, J.A. and L.K. Boerema. 1973. Scientific advice on catch levels. Fish. Bull. 72(2):92p.

GMFMC and SAFMC. 1982. Fishery Management Plan and Final Environmental Impact Statement for Coral and Coral Reefs of the Gulf of Mexico and South Atlantic. Gulf of Mexico Fishery Management Council, 5401 West Kennedy Boulevard, Suite 881, Tampa, Florida. 316 pp.

Gulf of Mexico Fishery Management Council. 1987. Amendment 1 and Environmental Assessment and Supplemental Regulatory Impact Review and Initial Regulatory Flexibility Analysis to the Secretarial Fishery Management Plan for the Red Drum Fishery of the Gulf of Mexico. GMFMC. May 1987. 25pp.

Haefner, P. A., Jr. 1977. Reproductive biology of the female deep-sea red crab, *Geryon quinquedens*, from the Chesapeake Bight. Fishery Bulletin, United States 75: 91-102.

Haefner, P. A., Jr. 1978. Seasonal aspects of the biology, distribution, and relative abundance of the deep-sea red crab *Geryon quinquedens* Smith, in the vicinity of the Norfolk Canyon, western North Atlantic. Proceedings of the National Shellfisheries Association 69: 49-61.

Haefner, P.A., Jr. 1985. The biology and exploitation of crabs. In: A. J. Provenzano, editor, The Biology of Crustacea, Vol. 10: Economic Aspects: Fisheries and Culture. Pp. 111-166. Academic Press, New York, New York.

Hartnoll, R. G. 1968. Morphology of the genital ducts in female crabs. Journal of the Linnean Society (Zoology) 47: 279-300.

Hartnoll, R. G. 1969. Mating in the Brachyura. Crustaceana (Leiden) 16: 161-181.

Hartnoll, R. G. 1982. Growth. In: L. G. Abele, editor, The Biology of Crustacea, Volume 2: Embryology, Morphology and Genetics. Pp. 111-196. Academic Press, New York, New York.

Hartnoll, R. G. 1985. Growth, sexual maturity and reproductive output. In: A.M. Wenner, editor, Crustacean Issues, Volume 3: Factors in Adult Growth. Pp. 101-128. Balkema Press, Rotterdam, The Netherlands.

Hartnoll, R. G., and A. L. Rice. 1985. Further studies on the biology of the deep-sea spider crab *Dorhynchus thomsoni*: instar sequence and the annual cycle. In: P. E. Gibbs, editor, Proceedings of the 19th European Marine Biology Symposium. Pp. 223-241. Cambridge University Press, Cambridge, United Kingdom.

Hilborn, R. and J. Sibert. 1988. Adaptive management of developing fisheries. Mar. Policy 12:112-21.

Hilborn, R. and C.J. Walters. 1992. Quantitative fisheries stock assessment: choice, dynamics & uncertainty. Chapman and Hall, Routledge, Chapman & Hall, Inc., 29 West 35 Street, NY, NY 10001.

Hines, A. S. 1988. Fecundity and reproductive output in two species of deep-sea crabs, *Geryon fenneri* and *G. quinquedens* (Decapoda: Brachyura). Journal of Crustacean Biology 8: 557-562.

Hines, A.H. 1990. Fecundity and reproductive output in *Chaceon fenneri* and *C. quinquedens*. Pages 12-13 In: Lindberg, W.J. and E.L. Wenner (eds.). 1990. Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report. SC Sea Grant Consortium and FL Sea Grant College Program. FL SG Technical Paper 58: 61 pp.

Hinsch, G.W. 1988. Morphology of the reproductive tract and seasonality of reproduction in the golden crab *Geryon fenneri* from the eastern Gulf of Mexico. J. Crust. Bio. 8(2):254-261.

Hinsch, G.W. 1988. Ultrastructure of the sperm and spermatophores of the golden crab *Geryon fenneri* and a closely related species, the red crab *G. quinquedens*, from the eastern Gulf of Mexico. J. Crust. Bio. 8(3):340-345.

Intes, A., et P. Le Loueff. 1976 Etude du crabe rouge profund *Geryon quinquedens* en Cote D'Ivoire. Documentes Scientifiques, Centre de Recherches Oceanographiques Abidjan 7: 101-112.

Interogranizational Committee on Guidelines and Principles. 1994. Guidelines and principles for social impact assessment. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-16, 29 p.

Kendall, D. 1990. An assessment of the Georgia golden crab fishery. Pages 18-19 In: Lindberg, W.J. and E.L. Wenner (eds.). 1990. Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report. SC Sea Grant Consortium and FL Sea Grant College Program. FL SG Technical Paper 58: 61 pp.

Lightfoot, R. H., P.A. Tyler, and J. D. Gage. 1979. Seasonal reproduction in deep-sea bivalves and brittlestars. Deep-Sea Research 26A: 967-973.

Lindberg, W.J. and E.L. Wenner (eds.). 1990. Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report. SC Sea Grant Consortium and FL Sea Grant College Program. FL SG Technical Paper 58: 61 pp.

Lindberg, W.J. and F.D. Lockhart. 1993. Depth-stratified population structure of Geryonid crabs in the eastern Gulf of Mexico. Journal Crustacean Biology 13(4): 713-732.

Lindberg, W.J., N.J. Blake, H.M. Perry, R.S. Waller, FD. Lockhart, and R.B. Erdman. 1989. Fisheries development of the deep-sea golden crab, *Geryon fenneri*: Geographic and seasonal production potential in the Gulf of Mexico. Final Project Report. Marine Fisheries Initiation Program, National Marine Fisheries Service, 98 pp.

Lockhart, F.D., W. J. Lindberg, N. J. Blake, R. B. Erdman, H. M. Perry and R. S. Waller. 1990. Distributional differences and population similarities for two deep-sea crabs (Family Geryonidae) in the northeastern Gulf of Mexico. Can. J. Fish. Aquat. Sci., 47:2112-2120.

Low, R. N., and G. F. Ulrich. 1983. Deep-water demersal finfish resources and fisheries off South Carolina. S.C. Mar. Resour. Cent. Tech. Rep. No. 57, 24 p.

Luckhurst, B. 1986. Discovery of deep-water crabs (*Geryon* spp.) at Bermuda - A new potential fishery resource. Proceedings of the Gulf and Caribbean Fisheries Institute, 37th Meeting. Pp. 209-211.

Lux, F. E., A. R. Ganz, and W. F. Rathjen. 1982. Marking studies on the red crab *Geryon quinquedens* Smith off southern New England. J. Shellfish Res. 2(1):71-80.

Mager, A., Jr., and G. W. Thayer. 1986. Quantification of National Marine Fisheries Service habitat conservation efforts in the southeast region of the United States from 1981 through 1985. Marine Fisheries Review. 43(3): 1-8

Mager, A., Jr., and L. H. Hardy. 1988. Mitigation of impacts: National Marine Fisheries Service habitat conservation efforts in the southeast region of the United States for 1985 and an analysis of recommendations. Proceedings: National Wetland Symposium, Mitigation of Impacts and Losses, New Orleans, La., October 8-10, 1986.

Mager, A., Jr., and David H. Rackley. 1991. National Marine Fisheries Service habitat conservation efforts in the Southeastern United States for 1990. NOAA Technical Memorandum NMFS-SEFC-293, 15 pp.

Manning, R. B., and L. B. Holthuis. 1984. *Geryon fenneri*, a new deep-water crab from Florida (Crustacea: Decapoda: Geryonidae). Proceedings of the Biological Society of Washington 97: 666-673.

Manning, R. B., and L. B. Holthuis. 1986. Notes on the *Geryon* from Bermuda, with the description of *Geryon inghami*, a new species (Crustacea: Decapoda: Geryonidae). Proceedings of the Biological Society of Washington 99: 366-373.

Melville-Smith, R. 1987a. Tagging study reveals interesting red crab (*Geryon maritae*) movements off Namibia (South West Africa). Journal du Conseil International pour l'Exploration de la Mer 43: 295-296.

Melville-Smith, R. 1987b. Movement of deep-sea red crab (*Geryon maritae*) off South West Africa/Namibia. South African Journal of Marine Science 22: 143-152.

Melville-Smith, R. 1987c. The reproductive biology of *Geryon maritae* off South West Africa/Namibia. Crustaceana (Leiden) 53: 259-275.

Melville-Smith, R. 1988. The commercial fishery for and the population dynamics of red crab *Geryhon maritae* off South West Africa, 1976-1986. South African Journal of Marine Science 6: 79-95.

Melville-Smith, R. 1989. A growth model for the deep-sea red crab (*Geryon maritae*) off South West Africa/Namibia. Crustaceana (Leiden) 56: 279-292.

Moe, M. A., Jr. LOBSTERS: Florida, Bahamas, the Caribbean. ISBN 0-939960-06-0. Green Turtle Publications, P.O. Box 17925, Plantation, Florida 33318. 510 pp.

Mori, M., and G. Rellini. 1982. Mating behavior of *Geryon longipes* A. Milne Edwards, 1881 (Crustacea: Decapoda: Brachyura). Quaderni del Laboratorio di Technologia della Pesca 3: 169-172.

Morgan, G. R. 1977. Aspects of the population dynamics of the western rock lobster and their role in management. Ph.D. thesis, University of Western Australia.

Munro, J.L. 1974. The biology, ecology, exploitation and management of Caribbean reef fishes. Pt. V.I. The biology, ecology and bionomics of Caribbean reef fishes: crustaceans (spiny lobsters and crabs). Res. Dep. Univ. West Indies Zool. Dept., Kingston, Jamaica, 3: 1-57.

National Marine Fisheries Service. 1986. Species Profile: Deep-sea red crab *Geryon quinquedens* Smith, and golden crab, *Geryon fenneri* Manning and Holthuis, 1984 from the Southeastern United States, south of Cape Hatteras, North Carolina. Latent Resources Report. Pascagoula Laboratory. Pascagoula, Mississippi. Pp. 1-20.

National Oceanic and Atmospheric Administration. 1989. National Status and Trends Program for marine environmental quality. Program report. A summary of data on tissue contamination from the first three years (1986-1988) of the mussel watch project. NOAA/NOS. NOSOMA 49. 151 pp.

NMFS. 1991. Operational guidelines: fishery management plan process. October 1992.

National Oceanic and Atmospheric Administration. 1992a. Assessing nonpoint source pollution in coastal areas: NOAA's current and future capabilties. NOAA strategic assessment program. NOAA/NOS. October 1992. 2 pp.

National Oceanic and Atmospheric Administration. 1992b. Agricultural pesticide use in coastal areas: A national summary. Rockville, MD: Strategic Environmental Assessments Division, Office of Ocean Resources Conservation and Assessment. Prepublication Draft. 112pp. USDOC and USFWS. 59 pp.

Office of Technology Assessment. 1987. Wastes in Marine Environments. US Congress, Office of Technology Assessment, U.S. Government Printing Office, Washington, D.C. OTA-0-334.

Otwell, W. S., J. Bellairs, and D. Sweat. 1984. Initial development of a deep sea crab fishery in the Gulf of Mexico. Fla. Sea Grant Coll. Rep. No. 61, 29 p.

Patterson, K. 1992. Fisheries for small pelagic species: an empirical approach to management targets. Rev. Fish. Biol. Fisheries 2:321-338.

Reed, J. K. 1992. Submersible Studies of Deep-Water *Oculina* and *Lophelia* Coral Banks off Southeastern U.S.A. Proc. The American Academy of Underwater Sciences Twelfth Annual Scientific Diving Symposium. Sept. 24-27, 1992. 143-151.

Reed, J. K. 1980. Distribution and structure of deepwater *Oculina varicosa* coral reefs off central eastern Florida. Bull. Mar. Sci. 30(3) 667-677.

Ricker, W. E. 1973. Linear regression in fishery research. J. Fish. Res. Board Can. 30:409-434.

Ricker, W. E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Bd. Can. 191. 382 p.

Roer, R. D., R. M. Dillaman, M. G. Shelton, and R. W. Brauer. 1985. Effects of pressure on growth. In: A. M. Wenner, editor, Crustacean Issues, Volume 3: Factors in Adult Growth. Pp. 251-264. Balkema Press, Rotterdam, The Netherlands.

Rokop, F. J. 1974. Reproductive patterns in the deep-sea benthos. Science 186: 743-745

Rokop, F. J. 1977. Patterns of reproduction in deep-sea benthic crustaceans: a re-evaluation. Deep-Sea Research 24: 683-691.

Rowe, G. T. 1983. Biomass and production of the deep-sea macrobenthos. In: G. T. Rowe, editor, The Sea, Volume 8: Deep Sea Biology. Pp. 97-102. John Wiley and Sons, New York, New York.

Ryan, E. P. 1967. Structure and function of the reproductive system of the crab, *Portunus sanguinolentus*. II: The female system. Proceedings of the Symposia on Crustacea, 1965 Series II, Part 2: 522-544.

Sanders, H. L., and R. R. Hessler. 1969. Ecology of the deep-sea benthos. Science 163: 1419-1424.

Sastry, A. N. 1975. Phsiology and ecology of reproduction in marine invertebrates. In: F. J. Vernberg, editor, Physiological Ecology of Estuarine Organsisms. Pp. 279-299. University of South Carolina Press, Columbia, South Carolina.

Scheltema, R. S. 1972. Reproduction and dispersal of bottom dwelling deep-sea invertebrates: a speculative summary. In: R. W. Brauer, editor, Barobiology and Experimental Biology of the Deep Sea. Pp. 58-68. North Carolina Sea Grant College Program, Chapel Hill, North Carolina.

Schoener, A. 1968. Evidence for reproductive periodicity in the deep sea. Ecology 49: 81-87.

Schroeder, W. C. 1959. The lobster *Homarus americanus*, and the red crab, *Geryon quinquedens*, in the offshore waters of the western North Atlantic. Deep-Sea Research 5: 266-279.

Smith, K. L. Jr., and J. M. Teal. 1973. Deep-sea benthic community respiration: an in situ study at 1,850 meters. Science 179: 282-283.

Sokal, R. R., and F. J. Rohlf. 1983. Biometry. 2d ed. W. H. Freeman and Co., San Francisco, 850 p.

SAFMC. 1983. Fishery Management Plan, Regulatory Impact Review and Final Environmental Impact Statement for the Snapper Grouper Fishery of the South Atlantic Region. South Atlantic Fishery Management Council, 1 Southpark Circle, Suite 306, Charleston, South Carolina, 29407-4699.

SAFMC. 1991. Amendment Number 4, Regulatory Impact Review, Initial Regulatory Flexibility Analysis and Environmental Assessment for the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region.

Thomas, J. C. 1973. An anlaysis of the commercial lobster (*Homarus americanus*) fishery along the coast of Maine, August 1966 through December 1970. NOAA tech. Rep. NMFS SSRF-667: 57 pp.

Thorson, G. 1950. Reproductive and larval ecology of marine bottom invertebrates. Biological Review 25: 1-45.

Torres, J. J., B. W. Belman, and J. J. Childress. 1979. Oxygen consumption rates of midwater fishes as a function of depth of occurrence. Deep-Sea Research 26A: 185-197.

Tyler, P. A., A. Muirhead, and J. Colman. 1985. Observations on continuous reproduction in large deep-sea epibenthos. In: P. E. Gibbs, editor, Proceedings of the 19th European Marine Biology Symposium. Pp. 223-230. Cambridge University Press, Cambridge, United Kingdom.

U.S. Council on Environment Quality. 1986. Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR 1500-1508). Washington: Government Printing Office, Washington, D. C. 20402.

van Heukelem, W. F., M. C. Christman, C. E. Epifano, and S. D. Sulkin. 1983. Growth of *Geryon quinquedens* (Brachyura: Geryonidae) juveniles in the laboratory. Fishery Bulletin, United States 81: 903-905

von Bertalanffy, L. 1938. A quantitative theory of organic growth (inquiries on growth laws II). Human Biology 10: 181-213

Walters, C.J. 1986. Adaptive management of renewable resources. Macmillian, New York.

Walters, C.J. and R. Hilborn. 1976. Adaptive control of fishing systems. J. Fish. Res. Bd. Can. 33:145-159.

Wenner, E.L. 1990. Distribution and abundance of golden crag, *Chaceon fenneri* in the South Atlantic Bight. Pages 6-7 In: Lindberg, W.J. and E.L. Wenner (eds.). 1990. Geryonid Crabs and Associated Continental Slope Fauna: A Research Workshop Report. SC Sea Grant Consortium and FL Sea Grant College Program. FL SG Technical Paper 58: 61 pp.

Wenner, E.L. and C.A. Barans. 1990. In situ estimates of density of golden crab, *Chaceon fenneri,* from habitats on the continental slope, southeastern U.S. Bulletin of Marine Science 46(3): 723-734.

Wenner, E. L., G. F. Ulrich, and J. B. Wise. 1987. Exploration for golden crab, *Geryon fenneri*, in the south Atlantic Bight: distribution, population structure, and gear assessment. Fishery Bulletin, United States 85: 547-560.

Wigley, R. L., R. B. Theroux, and H. E. Murray. 1975. Deep-sea red crab, *Geryon quinquedens*, survey off northeastern United States. Mar. Fish. Rev. 37(8):1-27.

Yeung, C. 1991. The vertical, horizontal, and seasonal distribution and abundance of Palinurid and Scyllarid lobster phyllosoma larvae in the Florida Keys in relation to the circulation, May 1989 - February 1990. Master's Thesis, University of Miami, Coral Gables, Florida, August, 1991, 141 pp.

9.0 APPENDIXES

Appendix A. Notice of Control Date & Comments.

Proposed Rules 4-7-95 60 FR 17770 **Federal Register**

This section of the FEDERAL REGISTER contains notices to the public of the proposed issuance of rules and regulations. The purpose of these notices is to give interested persons an opportunity to participate in the rule making prior to the adoption of the final rules.

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Chapter VI

[Docket No. 950316075–5075–01; I.D. 022895C]

RIN 0648–AH85

Golden Crab Fishery off the Southern Atlantic States; Control Date

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Advance notice of proposed rulemaking; consideration of a control date.

SUMMARY: This notice announces that the South Atlantic Fishery Management Council (Council) is considering whether there is a need to impose management measures in the golden crab fishery in the exclusive economic zone (EEZ) off the southern Atlantic states, and if there is a need, what management measures should be imposed. If it is determined that there is a need to impose management measures, the Council may initiate a rulemaking to do so. Possible measures include the establishment of a limited entry program to control participation or effort in the fishery. If a limited entry program is established, the Council is considering *[Insert date of publication in the Federal Register]*, as a possible control date. Consideration of a control date is intended to discourage new entry into the fishery based on economic speculation during the Council's deliberation on the issues.

DATES: Comments must be submitted by *[Insert date 30 days after date of publication in the Federal Register]*.

ADDRESSES: Comments should be directed to the South Atlantic Fishery Management Council, Southpark Building, Suite 306, 1 Southpark Circle, Charleston, SC 29407–4699.

FOR FURTHER INFORMATION CONTACT: Peter J. Eldridge, 813–570–5305.

SUPPLEMENTARY INFORMATION: The golden crab fishery is not currently managed under a fishery management plan (FMP) prepared under the authority of the Magnuson Fishery Conservation and Management Act. However, there is a small scale trap fishery for golden crabs (*Chaceon fenneri*) in the EEZ off the southern Atlantic states. The fishery is prosecuted primarily in depths of 110 to 220 fathoms (approximately 200 to 400 m) on sand, mud, and clay bottoms. The fishery has operated sporadically off North and South Carolina and off the east coast of Florida. The fishery is currently operating 8 to 10 miles (15 to 19 km) off Miami, FL. Information on the fishery is limited—the number of fishermen, number of traps, and current production are unknown.

In February 1995, the Council held a scoping meeting to solicit input from the industry and public on the need for management of the golden crab fishery. Based on the results of the meeting, the Council began development of management options for the fishery. The range of options the Council will consider include data collection, area restrictions, seasons, size limits, trap escape panel requirements, prohibition on harvest of females, and limited entry or access. Implementation of any management measures for the fishery would require preparation by the Council of a new FMP or amendment to an existing FMP to include golden crab. The Council will discuss these issues at its April 10–14, 1995, meeting in Savannah, GA. In either event, publication of a proposed rule with a public comment period, NMFS' approval of the FMP or amendment, and publication of a final rule would be required.

As the Council considers management options, including limited entry or access-controlled management regimes, some fishermen who do not currently harvest golden crab, and have never di[d] so, may decide to enter the fishery for [the] sole purpose of establishing a reco[rd] of making commercial landings of golde[n] crab. When management authorities begin, [to] consider use of a limited access manageme[nt] regime, this kind of speculative entry ofte[n] is responsible for a rapid increase in fishing [ef]fort in fisheries that are already fully [de]veloped or overdeveloped. The original fi[sh]ery problems, such as overcapitalization or o[ve]rfishing, may be exacerbated by the entry of [n]ew participants. If management m[e]asures to limit participation or effort in the fi[sh]ery are determined to be necessary, th[e] Council is considering *[Insert date of pu[b]lication in the Federal Register]* as the contr[ol] date. After that date, anyone entering the [fi]shery may not be assured of future participat[io]n in the fishery if a management regim[e] is developed and implemented that limits th[e] number of participants in the fishery.

Consideration of a control d[ate] does not commit the Council or NMFS [to] any particular management regime [or] criteria for entry into the golden crab fish[ery]. Fishermen are not guaranteed future parti[cipation] in the golden crab fishery regardless [of] their date of entry or intensity of participat[ion] in the fishery before or after the con[trol] date under consideration. The Council m[ay] subsequently choose a different control date [or] it may choose a management regime [that] does not make use of such a date. The [Co]uncil may choose to give variably weigh[ted] consideration to fishermen in [the] fishery before and after the control da[te]. Other qualifying criteria, such as do[cu]mentation of commercial landings and sales [may] be applied for entry. The Council [may] also to take no further action t[o] control entry or access to the fishery, in wh[ich] case the control date may be rescinded.

Authority: 16 U.S.C. 1801 *et s[eq.]*

Dated: April 3, 1995.

Gary Matlock,

Program Management Officer, Na[tional] Marine Fisheries Service.

[FR Doc. 95–????? Filed 77–77–95; 8:45 am]

BILLING CODE 3510–22–F

R. Nielsen JR

Davie, FL 33325
April 17, 1995

TO: S.A.F.M.C.

RE: Control Date on Golden Crab Fishery

This letter is written in support of establishing and USING April 7, 1995 as the control date for entering the golden crab fishery in the South Atlantic.

In two short months we have gone from two vessels in the fishery, to fifteen to seventeen vessels now gearing up for this fishery. It will take months before the council can establish and implement management measures, hopefully including limited entry. The number of vessels attempting to enter the fishery will increase significantly as these months go by.

There has to be a conservative limit placed on the number of vessels allowed in the fishery, until more is known about the crab.

We do know the golden crab is a slow growing animal. We do not know what the golden crab resource is in the South Atlantic, nor how much fishing pressure they can endure and still be a viable resource. For these reasons, I support USING April 7, 1995 as the control date for entering the golden crab fishery in the South Atlantic.

Sincerely,

Richard Nielsen JR

Howard C. Rau Jr.

Oakland Park, Florida

April 22, I995

South Atlantic Fishery Council
One Southpark Circle
Charleston, South Carolina
29407-4699

I am Writing this letter to the Council in support of the April 7, I995 control date for the golden crab fishery.

I have been involved, on and off, in this fishery since I983. Today,this is the only fishery I participatein.

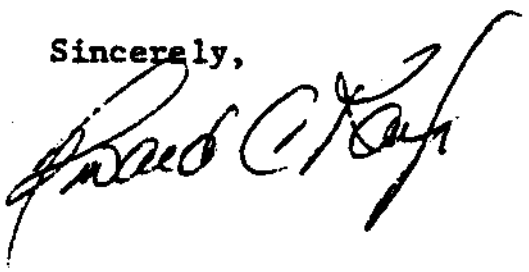
Since this is a new fishery and very little is known about the golden crab, over fishing could possibly take place if to much pressure is put on it. Therefore, I believe research needs to be done in areas of the fishery.

By using April 7, I995 control date, The Council would be able to stop an influx of vessels into the fishery untill the questions of stock assesments, yield, and recruitment can be answered.

With the vessels involved in the fishery now, research could be,gathered, so decisions on the number of boats, trap sizes, minimum crab size, trip limits, limited entry, and fishing areas could be reached before heavy pressure could occur.

I look at this as a unique opportunity for the Council to manage a resource at its infancy rather then at its decline.

Sincerely,



Appendix B. NMFS Policy of Risk Aversion in Face of Uncertainty.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Silver Spring, Maryland 20910

MAY 8 1995

MEMORANDUM FOR: F/SEO - Andrew J. Kemmerer

FROM: F/CM - Richard H. Schaefer

Subject: NMFS Policy of Risk Aversion in Face of Uncertainty

On April 12, 1995, NMFS disapproved the Gulf of Mexico Fishery Management Council's proposed regulatory amendment to reduce the minimum size of red grouper for the commercial sector. This action was to be taken under a framework regulatory adjustment procedure established by the Fishery Management Plan for the Reef Fish Resources of the Gulf of Mexico. In our letter to the Council, we indicated that the primary basis for our decision was the scientific uncertainty about the effects of the proposed measure on the long-term productivity of the red grouper stock. Based on this uncertainty, we indicated that approval of the measure would amount to the unacceptable risk of allowing overfishing, and that it would be inconsistent with the agency policy of risk aversion in the face of uncertainty.

Your staff has requested clarification of the agency's policy of risk-averse decision making. I have provided answers to your staff's specific questions as follows:

1. Question: What is the NMFS definition of risk aversion?

   Answer: There is no formal agency definition of risk-averse decision making. However, this type of decision making is discussed in several NMFS publications. A succinct agency statement regarding the rationale and objectives of this type of decision making was presented publicly in the Strategic Plan of the National Marine Fisheries Service--Goals and Objectives, June 10, 1991. This statement still represents the formal agency position on this issue. Under Goal 2--Maintain Currently Productive Fisheries, there is a discussion of risk-prone and risk-averse decision making. This clearly explains that the agency advocates risk-averse fishery management decisions because they reduce the risk of overfishing and give the benefit of the doubt to conservation, particularly in the face of uncertainty about the effects of management actions on the managed fishery resources.

   Also, in "Our Living Oceans," December 1993, page 24, NMFS indicates that risk-averse decision making is a key elemen

in the development of any improved management system, and that this policy means that managers should err on the side of caution with respect to long-term resource health when making fishery management decisions. Making such decisions based on short-term objectives often places the resource's long-term health at risk.

Attached are copies of these texts.

2. Question: What is the level of uncertainty that triggers the policy of risk-averse decision making ? (e.g., at what point may a council anticipate that the policy will override its decision and substitute for the council's judgment ?).

Answer: There is no specifically fixed or established level of uncertainty, or even risk, that would trigger application of the agency's policy of risk-averse decision making. Each management action proposed by a council will be evaluated by the agency to determine the risk posed to the health of the subject fishery resource. Based on this evaluation, the supporting information provided by the council, and the best scientific information available, the agency will decide what level of risk to the resource is likely to result from the proposed action and whether this risk level warrants disapproval of the action. Clearly, where a proposed action has a reasonable probability of causing or continuing overfishing, the agency's policy would result in disapproval. Where best available scientific information presents significant uncertainty about effects on the resource, the risk-averse policy should result in a decision that reduces or even minimizes adverse effects on the condition of the fishery resource.

NMFS has formally articulated the factors that it expects the councils to consider in developing their proposed management measures under the Guidelines for Fishery Management Plans (50 CRF Part 602). Most relevant to the issue of risk-averse decision making is the agency's guidance regarding the application of the national standards for fishery conservation and management to proposed management actions. In particular, the guideline on National Standard 1 (preventing overfishing while achieving optimum yield) summarizes the agency's expectations regarding how the councils should consider risk and uncertainty in developing proposed measures, with particular emphasis on preventing overfishing and ensuring optimum yield from a healthy resource. This general discussion provides some additional guidance on how the agency views relationships among risk, uncertainty, and fishery management actions.

3. Question: When did NMFS adopt the policy?

Answer: The agency's policy was formally adopted in its Strategic Plan of the National Marine Fisheries Service--Goals and Objectives. The Plan was published June 10, 1991. Also, the policy was stated for public information in the Analysis of the Potential Economic Benefits from Rebuilding U.S. Fisheries, NMFS Senior Scientist's Office, in April 1992). On page 1, this paper indicates that, in particular, given the uncertain status of 34% of U.S. fishery resources, NMFS will reduce the risk of overfishing by making management decisions that err toward conservation of the fishery resource. It also indicates that, at the same time, NMFS will reduce the uncertainty in fishery management by significantly expanding the scientific information upon which decisions are based.

4. Question: Is the NMFS policy in writing and, if so, is it available for distribution?

Answer: It is available in the NMFS Strategic Plan and is further referenced and endorsed in NOAA's 1995-2005 Strategic Plan, published July 15, 1993. Refer to the attached material copied from these documents. This material may be distributed.

Attachments

STRATEGIC PLAN

OF THE

NATIONAL MARINE FISHERIES SERVICE

GOALS AND OBJECTIVES

June 10, 1991

Thus, the first goal of the National Marine Fisheries Service is: **Rebuild the Nation's overfished resources.**

Objectives to achieve this goal are:

1. ***Reduce fishing effort on overfished stocks.*** This is the bottom line on what is necessary to correct overfishing. In most cases, it will require controls on catch and the amount of fishing.

2. ***Implement Magnuson Act 602 Guidelines for Prevention of Overfishing.*** These guidelines require Fishery Management Plans (FMPs) to include quantifiable definitions of overfishing, Stock Assessment and Fishery Evaluation (SAFE) reports to determine which fisheries are overfished, and rebuilding plans for depleted fishery resources.

3. ***Reduce bycatch of overfished stocks.*** In some cases, bycatch contributes to overfishing, and may jeopardize recovery of a depleted stock (e.g., Gulf of Mexico red snapper). In other cases, bycatch also results in wasteful discarding of potential yield. If bycatch is a problem, fishing technologies and/or practices may need to be modified.

Planned actions by NMFS to accomplish these objectives include:

- Conduct a national evaluation to determine which resources are overfished, including non-FMP (Fishery Management Plan) fisheries. At present, decisions not to develop an FMP are potential gaps that permit overfishing without scrutiny. Atlantic halibut is an example of a depleted fishery resource that has not been considered by an FMP.

- Work with Regional Fishery Management Councils and interstate Marine Fisheries Commissions to implement effective Fishery Management Plans,, and with the Coast Guard and states to ensure compliance.

- Determine the short-term loss of benefits that will accompany rebuilding of overfished stocks, and identify options to minimize adverse effects. Some short-term loss is inevitable if overfishing is to be corrected; for example, reducing allowable catches will make some fishing operations unprofitable. Thus, losses must be anticipated, and options for mitigating them considered, if management is to withstand pressure from potentially affected segments of the fishing industry.

- Determine the magnitude of bycatch of overfished stocks, and options to reduce it. Options to reduce bycatch may require the design of new types of fishing gear that are more selective for the targeted species. This approach is known as "conservation engineering." In other cases, bycatch can be reduced by controlling fishing practices (e.g., how, when, and where fishing takes place).

GOAL 2. MAINTAIN CURRENTLY PRODUCTIVE FISHERIES.

It is better to prevent overfishing than to suffer the losses necessary to reverse it. The Nation still has many productive fisheries, including Alaska pol-

lock, Mid-Atlantic surf clams, Gulf of Mexico butterfish, Pacific salmon and most Pacific coast rockfish.

There are several reasons why productive fisheries become overfished and unproductive. It is often economically advantageous for individual fishermen to favor short-term benefits over conservation. This situation is reinforced by the open access nature of most fisheries. As more vessels enter a fishery, their owners try to offset declining profits by catching more fish than the resource can sustain, unless the fishermen are restrained by management. Management is complicated by the uncertainty resulting from natural variability in LMRs and the scientific complexity of assessing them. In the face of uncertainty and pressure from the fishing industry, fishery managers have often tended to base their decisions on an optimistic view of the condition of fishery resources. These "risk-prone" decisions eventually result in overfishing.

Other reasons why productive fisheries may become unproductive include implementing fishery management regulations which are by their very nature difficult to enforce (this may reflect yet another type of risk-prone decision), inadequate enforcement of even well designed fishery management regulations, habitat degradation, and natural fluctuations in the environment.

Therefore, the second National Marine Fisheries Service goal is: **Maintain currently productive fisheries.**

Objectives to achieve this goal are:

1. ***Reduce the risk of overfishing.*** This will require a scientifically based limit on fishing pressure. Because fishery management is uncertain, there is virtually always a risk of overfishing. This risk can be reduced by giving the benefit of the doubt to conservation, (i.e., "risk-averse" decisions), instead of erring toward overfishing.

2. ***Reduce uncertainty in stock assessments.*** By achieving this objective, the loss of short-term benefits that results from risk-averse decisions can be reduced.

3. ***Improve compliance with fisheries management regulations.*** Compliance can be improved by making regulations more enforceable, increasing enforcement capability, increasing penalties, and gaining industry support for regulations.

4. ***Advocate conversion from open access to fisheries to controlled access.*** "Property rights" systems of fisheries management, such as individual transferable quotas (ITQs), are a form of access control. Theoretically, access control is not required to prevent overfishing, but it helps prevent the "race for the fish" that makes fisheries economically inefficient. In addition, experience indicates that the economic inefficiency which results from open access fisheries reinforce pressure to overfish.

5. ***Correct ineffective elements of the management processes.*** It is critical to learn from past mistakes, which might have resulted from inadequate scientific information, from flaws in institutional structures for making conservation and allocation decisions, or from lack of compliance.

Planned actions by NMFS to accomplish these objectives include:

- Critically evaluate Fishery Management Plans to determine if they are working, and if not, why.

- Improve communication between scientists and fishery managers.

- Obtain authority to charge user fees for access to fisheries. If access to fisheries is controlled or property rights are assigned, managers should consider how benefits will be distributed. There are few other industries that have free access to the Nation's natural resources.

- Improve knowledge of stock structure and migrations. One uncertainty in fisheries management is in the determination of which fish belong to the stock that is being managed. This problem is particularly important for species that migrate across international boundaries, such as Atlantic swordfish, several species off New England and Atlantic Canada, Bering Sea "Donut Hole" pollock, Pacific halibut, and king mackerel in the Gulf of Mexico.

- Increase the precision and accuracy of resource surveys. Resource surveys are a critical element of stock assessments. They can be made more precise by increasing sampling, using more efficient designs, and improving sampling technology.

- Develop efficient regional fisheries data collection and data management programs, integrating state activities as appropriate. Fisheries data are another critical element of stock assessments and management decisions, and included are commercial and recreational fisheries statistics, at-sea fishery observer data, and socioeconomic information. In general, more and better fisheries data are needed. Comprehensive collection and data base management programs are needed for stock assessments and management, including data collected by states, instead of piecemeal efforts that may result from individual FMPs. The degree to which enforcement and stock assessment data can be collected simultaneously must be evaluated.

- Conduct biological and ecological research on LMRs that integrates appropriate state research activities, for example, growth and mortality rates, reproductive rates, and habitat requirements. Much is known about these parameters for exploited species, but they are still a source of uncertainty in stock assessments and fishery management.

- Employ state-of-the-art technology and stock assessment methods to improve accuracy and precision of scientific information. For example, hydroacoustics may be used to improve the precision of resource surveys, and molecular biology may be used to define stocks.

- Assess the degree of compliance with fisheries management regulations, evaluate the factors that have contributed to non-compliance, and correct problems.

National Oceanic and Atmospheric Administration

1995 - 2005 STRATEGIC PLAN

July 15, 1993

NOAA

1995 - 2005 Strategic Plan

July 1993

D. James Baker
Under Secretary for Oceans and Atmosphere

Douglas K. Hall
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stability of some regions depend on sustainable use of fishery resources. For many developing countries, sustainable use requires technical assistance from the U.S.

1.4 WHAT ARE THE PROGRAM ELEMENTS?

Fulfilling the NOAA vision of greatly increasing the Nation's wealth by rebuilding U.S. fisheries requires new approaches to fisheries management, as described in the 1991 National Marine Fisheries Service's Strategic Plan for the Conservation and Wise Use of America's Living Marine Resources. The Strategic Plan calls for a commitment to making risk-averse decisions in the face of uncertainty, reducing uncertainty in management decisions, controlling access to fishery resources, developing more selective fishing practices to reduce waste. It also seeks to reduce impediments to aquaculture, improve international relationships, and ensure safe seafood.

In order to fulfill the plan and restore fisheries productivity and to ensure the economic health of the fishing industry, NOAA proposes seven strategic actions:

- assess the status of fishery resources,
- advance fishery predictions,
- manage for economic growth and a healthy fishing industry,
- ensure adequate compliance,
- reduce bycatch,
- accelerate growth of U.S. aquaculture, and
- promote global stewardship by fulfilling UNCED commitments

1.5 WHAT ARE THE EXPECTED BENEFITS FOR THE NATION?

This plan is structured on a fishery-by-fishery basis to achieve the full potential benefits from U.S. fishery resources. Summed over all fisheries, the potential increase in net revenues is estimated as $2.9 billion per year. The annual impact on the national economy (direct, indirect and induced) associated with rebuilding fisheries is about $25 billion, including an $8 billion impact on the Gross Domestic Product (GDP), and about 300,000 jobs. This will lead to increased tax revenues of about $1 billion from the harvesting sector alone as it becomes profitable; much more if the flow of fisheries profits to other investments is included. In addition, aquaculture and stock enhancement have the potential to produce billions of dollars of economic growth and hundreds of thousands of new jobs. Also, aquaculture production can stabilize the availability of fish to seafood processors as producers market their fish at times of natural shortages, when prices are high. This works to flatten out price changes, stabilize employment and reduce the welfare costs of providing unemployment benefits. Additional benefits include:

- A healthy fishing industry
- Less loss of life and property during commercial fishing by eliminating the dangerous and wasteful "race for the fish."

OUR LIVING OCEANS

REPORT ON THE STATUS OF U.S. LIVING MARINE RESOURCES, 1993

December 1993
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U.S. DEPARTMENT OF COMMERCE

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Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

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Many of the issues and problems described in this national overview and in more detail in the individual fishery units to follow, have existed for many years in U.S. and indeed world fisheries. The many case studies in fisheries management both inside and outside the United States and the large body of scientific information now available, which makes a document such as "Our Living Oceans" possible, is pointing the way to solutions to many of our fishery management problems. The NOAA Strategic Plan (1993) has as goals, with respect to marine resources, to build sustainable fisheries for the long-term benefit of the Nation, recover protected species, and promote healthy ecosystems. The strategic plan advocates conversion of fisheries management from open access to controlled access (recognizing that it is the prerogative of the relevant Council to decide when such measures need be instituted); rapid expansion of scientific information; and risk-averse decisions on management actions. These three general strategies relate to each of the issues discussed above. Controlling fisheries access addresses the problems of management controls, overcapitalization, allocation, and jurisdiction. An increase in scientific information addresses the approximately 30% of stock groups whose status is unknown, and provides a stronger basis for the development of future management controls and recovery plans for protected species. In addition, improved scientific information will be essential for ensuring ecosystem health and addressing habitat concerns. Risk-adverse decision-making is a key element in the development of any improved management system. This means that managers should err on the side of caution with respect to long-term resource health when making decisions. Making decisions based on short-term goals often places long-term health at risk. The NOAA Strategic Plan and the NMFS are tasked with managing living marine resources for the sustained benefit of the Nation. We are moving in the right direction and there is great promise for increased benefits for the domestic fishing industry, recreational anglers, the general public, and future generations.

Appendix C. Measures For Which No Action Is Proposed.

C.1. Minimum size limit.

Do not specify a minimum size limit at this time given the escape gap will cull smaller crabs on the bottom while fishing and there is no market for small crabs. If small crabs are landed, the Council will consider implementing a minimum size limit through the framework procedure.

Biological Impacts

The escape gap (Action 5) will result in an effective minimum size limit of 5" (127 mm). A minimum size limit set at 5.25" to 5.5" (135-140 mm) would provide additional biological protection given the lack of information on size of males competent to mate. However, both males and females are mature at 5".

Economic Impacts

No expected economic impact. The market determines the size that is harvested. Fishermen will not harvest golden crabs below the accepted market size. A minimum size limit could lead to inefficiency if fishermen have to measure crabs on deck.

Social Impacts

This option has the support of the Golden Crab Advisory Panel and most likely the larger support of the industry as a whole. There would be few social impacts with this option.

Conclusion

The Council concluded, based on the information available, the escape gap would provide sufficient protection for sexually immature male and female golden crabs. Not requiring a minimum size limit (in addition to the required escape gap) minimizes regulations on fishermen while not endangering the reproductive potential of the golden crab. The Golden Crab Advisory Panel recommended no minimum size limit at this time with the escape gap requirement; however, if smaller crabs are landed the Council should implement a minimum size limit. In addition, limiting effort (Action 19) will limit mortality and further reduces the need for a minimum size limit at this time. The Council will examine this issue when additional data become available, and if the industry begins landing golden crabs in significant numbers below 5" or data indicate the reproductive potential is being endangered, a minimum size limit will be evaluated under the framework provision.

Other Possible Actions:

Option 1. Specify a minimum size limit of 4 and 3/4 inches carapace width.

Biological Impacts

This will protect the golden crabs until both males and females reach maturity which is essential for maintaining the biological integrity of the fishery. Most smaller crabs will be released with use of escape gaps or rings (see Action 5). However, any smaller crabs caught should be returned immediately in order to

maximize the output from the fishery. Tag recaptures and extensive maintenance in aquariums after capture indicate that released crabs will survive. This will provide further biological protection.

The following scientific input was received (Elizabeth Wenner, letter dated August 15, 1995): "A minimum size limit is certainly advisable; however, the proposed size of 4 3/4 inches may be too small. Until sufficient information is available on size of males competent to mate, then a minimum size of males set at 135-140 mm may be advisable. Scientific evidence indicates that large crabs occur in shallow (250-350 m) and deep areas (>700 m), so it is unlikely that fishing would only occur at deeper depths if a higher minimum size was adopted. Setting a minimum size limit at 5.25-5.5 inches in conjunction with escape gaps seems to be a conservative yet reasonable approach until more data are available on incidence of insemination of females."

Economic Impacts

Public testimony at the April 1995 Council meeting indicated that the industry is targeting crabs larger than one to one and a quarter pounds. This size of crab is approximately 5 inches. Thus, the proposed minimum size would have little or no impact on harvest. It is not expected to reduce catches in the short-term, but could likely increase economic benefits from the fishery in the long-term through increasing or maintaining current yield levels.

Social Impacts

Minimum size limits would have few social impacts unless they were set so high that industry would not be able to market the crabs harvested. Information from public scoping indicates some fishermen are presently harvesting crabs at a minimum weight of one and a quarter pounds. This seems to be a marketable size and primarily a result of the utilization of escape gaps which allow smaller crabs to leave the trap. Information from fishermen suggests larger crabs may be caught in deeper waters, suggesting that if a size limit is set high, only larger vessels which can fish deeper waters would be able to harvest. The Council must consider that choosing a high minimum size may force fishermen to move to deeper waters requiring larger vessels. This may introduce an artificial constraint on the fishery which excludes small boats. On the other hand, setting size limits too low could impact stocks and affect the sustainability of the fishery.

Conclusion

The Council rejected specifying a minimum size at this time because the escape gap (Action 5) provides sufficient protection for maintaining the reproductive potential. The Council will examine this issue when additional data become available, and if the industry begins landing golden crabs in significant numbers below 5" or data indicate the reproductive potential is being endangered, a minimum size limit will be evaluated under the framework provision.

Option 2. Specify a minimum size limit of 4 inches (102 mm) carapace width.

Biological Impacts

This minimum size limit would protect immature females but would not provide sufficient protection for immature males which could reduce the reproductive potential of the stock.

Economic Impacts

See discussion on Economic Impacts under Option 1.

Social Impacts

See Social Impacts under the proposed action.

Conclusion

The Council rejected specifying a minimum size at this time because the escape gap (Action 5) provides sufficient protection for maintaining the reproductive potential. The Council will examine this issue when additional data become available, and if the industry begins landing golden crabs in significant numbers below 5" or data indicate the reproductive potential is being endangered, a minimum size limit will be evaluated under the framework provision.

Option 3. Specify a minimum size limit of 3.5 inches (89 mm) carapace width.

Biological Impacts

This minimum size would protect immature females but would not provide sufficient protection for immature males which could reduce the reproductive potential of the stock.

Economic Impacts

See discussion on Economic Impacts under Option 1.

Social Impacts

See Social Impacts under the proposed action.

Conclusion

The Council rejected specifying a minimum size at this time because the escape gap (Action 5) provides sufficient protection for maintaining the reproductive potential. The Council will examine this issue when additional data become available, and if the industry begins landing golden crabs in significant numbers below 5" or data indicate the reproductive potential is being endangered, a minimum size limit will be evaluated under the framework provision.

C.2. Quota management.

Do not adopt quota management at this time. Information necessary to establish a quota is very limited. The Scientific and Statistical Committee concluded MSY could not be estimated at this time. When the necessary data become available and if quota management appears appropriate for the golden crab fishery, the Council will consider implementing a quota through the framework procedure.

Biological Impacts

A quota would provide a cap on mortality, however, sufficient data are not available to calculate an appropriate quota at this time. Effort limitation (Action 19) and the biological measures (escape gap and no retention of females), provide biological protection.

Economic Impacts

Not implementing a quota will allow fishermen in the fishery to continue harvesting golden crab without constraining the poundage they can land in any given time period. Thus, there will be no economic impact as fishermen will harvest and land golden crabs according to their harvesting and technological capacities.

Social Impacts

The social impacts of quotas will depend upon whether all those interested will be able to participate under the level of quota that is chosen. If there is a large vessel and small vessel fishery as indicated above, then the effect on either fishery needs to be considered when determining the quota. With no subquota, the small boat fishery may be limited by the catching rate of the larger vessels. In other words, larger vessels may quickly fill a small quota precluding any sustainable fishery for smaller vessels. At the same time, a quota may affect markets already established by fishermen. In contrast, a quota set too high may induce increased entry into the fishery if no entry limitations are implemented. Unlimited entry into the fishery could produce overcapitalization which would affect the efficiency of harvest and price of golden crab. This scenario would certainly not be looked upon favorably by fishermen who are working towards a sustainable and profitable fishery.

Conclusion

The Council requested public input on the possibility of using quota management for the golden crab fishery. The Golden Crab Advisory Panel does not support a quota and the majority of public comments were not in favor of a quota. Some of the scientific comments favored a quota but recognized that biological information is severely lacking and MSY cannot be estimated which makes specification of a quota difficult.

The Council is not proposing a quota at this time because: (1) sufficient information is not available to estimate MSY which makes selection of a quota difficult at best; (2) establishment of a quota would result in a derby fishery which could have negative impacts on vessel safety and result in lower prices to fishermen; and (3) negative impacts to the developing market for golden crab would result from establishment of a quota and the market could be destroyed if a closure were to occur. The Council concluded controlled access and the other measures will provide sufficient protection to minimize the potential of overfishing. The framework procedure will be used to implement a quota should one become necessary in the future.

The Council has proposed a management program which is designed specifically to obtain information about the fishery, minimize user conflicts, and minimize the possibility of overfishing the

resource. Additionally, a framework procedure includes the ability to implement quotas (including zero quotas), trip limits, limits on number of gear, season/area closures including spawning closures, specifying and altering the MSY and total allowable catch (TAC) once sufficient data are available, and implementing and modifying a minimum size. It is the intent of the Council that once sufficient information becomes available to estimate MSY, TAC be limited by the upper end of an acceptable biological catch (ABC) and that no limit should be placed on the lower limit of ABC. Analyses of available data will be conducted on an annual basis and detailed catch and effort data will be obtained by vessel logbooks. These measures, in addition to the measures proposed for immediate implementation, should minimize the risk of overfishing.

Because of the longevity of the golden crab and minimal fishing pressure prior to 1995, the fishery should experience "the fishing-up effect" as described by Ricker (1975: pages 260-264) in his classic work. The basic features of the fishing up effect is a temporary large increase in catch followed by a sustainable, but much lower level of landings. This is caused by fishing up the accumulated stock of older individuals followed by the fishery becoming dependent upon younger individuals that are recruited annually into the fishery. Fishing not only substantially changes the age structure of the population, but also promotes compensatory growth by thinning out the population. This phenomenon, particularly the temporary nature of the large increase in landings, is poorly understood by fishermen, but is a fundamental characteristic of a population responding to fishing. It is the intent of the Council to monitor landings closely during this transitional "fishing-up" phase and establish an appropriate MSY as soon as sufficient data become available. The framework procedure, in addition to the measures proposed for immediate implementation, will be used to minimize the risk of overfishing.

Other Possible Options:

Option 1. Establish a golden crab quota of 100,000, 500,000, 1,000,000, or 5,000,000 pounds live weight.

Biological Impacts

MSY cannot be estimated at this time due to the extremely limited data available. Based on catches thus far and input from fishermen and scientists, quotas of 100,000 to 1,000,000 would be too restrictive and available biological yield would not be harvested. Certainly, the biological status of the stock would be protected. On the other hand, a quota of 5,000,000 pounds would be too high based on our current knowledge and could result in overfishing.

Economic Impacts

Implementation of a quota in the golden crab fishery could cause a number of economic inefficiencies or disruptions if further measures to restrict fishing effort are not implemented. For example, if fishermen perceive that the level of quota is low, each fisherman would attempt to harvest as much as possible before the quota is filled. This could lead to capital stuffing in terms of excessive number of traps being used and overcapitalization in the fishery. In the short-term, net benefits could decrease due to high operating costs

and low exvessel prices. A secondary effect could cause a disruption of the market as high volumes of golden crabs are landed over a short period, flooding the market. An early closure of the fishery resulting from the quota being filled could disrupt the steady flow of product into the market.

On the other hand, if the quota is set higher than the maximum sustainable yield, overfishing could occur. This would reduce long-term economic benefits since any overfishing would require a long period for recovery. (Golden crabs are long-lived, over 20 years.) Also, a high quota could attract more entry into the fishery if there is no entry restriction or induce present fishermen to increase fishing effort to harvest more golden crabs.

Social Impacts

See Social Impacts under the proposed action.

Conclusion

The Council rejected this option at this time. Controlled access and the other measures will provide sufficient protection. The framework procedure will be used to implement a quota should one become necessary in the future.

Option 2. Establish a golden crab quota of between 100,000 and 5,000,000 pounds live weight and subdivide by area (e.g., north and south of Cape Canaveral, Florida).

Biological Impacts

MSY cannot be estimated at this time due to the extremely limited data available. Based on catches thus far and input from fishermen and scientists, quotas of 100,000 to 1,000,000 would be too restrictive and available biological yield would not be harvested. Certainly, the biological status of the stock would be protected. On the other hand, a quota of 5,000,000 pounds would be too high based on our current knowledge and could result in overfishing.

Economic Impacts

See discussion under Action 8, Option 1. Area partitioning could further lead to a higher concentration of vessels in one area.

Social Impacts

See Social Impacts under the proposed action.

Conclusion

The Council rejected this option at this time. Controlled access and the other measures will provide sufficient protection. The framework procedure will be used to implement a quota should one become necessary in the future.

C.3. Transponders.

Do not require transponders at this time. If transponders become necessary in the future, the Council will consider requiring transponders through the framework procedure.

Biological Impacts

None.

Economic Impacts

Use of transponders will increase operating costs, but could be considered as safety insurance, since the Coast Guard could accurately locate vessel position in case of an emergency. The basic unit that could transmit information on vessel location could be leased for approximately $650 annually. Assuming that the current estimated number of vessels in the fishery are required to use at least the basic unit, it will cost industry about $13,000 annually, based on 20 participants in the fishery. This would likely represent a small percentage of fishermen's operating costs. The NMFS will also have to incur monitoring costs. There is no indication as to an estimate of the monitoring costs.

Social Impacts

Although there was not much opposition to transponders expressed during public scoping, use of transponders has received mixed reviews within the commercial fishing industry. Overall there seems to be dissatisfaction with this type of monitoring system among commercial fishermen. Commercial fishermen tend to see monitoring of this type as an invasion of privacy and an impingement upon their rights as individuals. Some of the opposition is due to perceived high costs of transponders. Several recent technological changes have reduced these costs. Whether that reduced cost will generate renewed interest by fishermen is unknown at this time.

Conclusion

Enforcement of number of vessels in each area would be greatly simplified if all vessels were required to use transponders. Vessel location information within each area would be confidential. The Council is not requiring transponders at this time primarily because fishermen have stated their opposition, because NMFS does not have the funding to implement such a program, and because establishing ownership by limiting the number of vessels will promote voluntary compliance.

Other Possible Options:

Option 1. Vessels permitted in the golden crab fishery are required to use transponders. NMFS will pay for installation, maintenance and monitoring of the transponders.

Biological Impacts

None.

Economic Impacts

See Economic Impacts discussion under the proposed action.

Social Impacts

See Social Impacts under the proposed action.

Conclusion

Enforcement of number of vessels in each area would be greatly simplified if all vessels were required to use transponders. Vessel location information within each area would be confidential. The Council is not requiring transponders at this time primarily because fishermen have stated their opposition, because NMFS does not have the funding to implement such a program, and because establishing ownership by limiting the number of vessels will promote voluntary compliance.

Option 2. Vessels permitted in the golden crab fishery are required to use transponders. NMFS will pay for installation and monitoring of the transponders. Fishermen would be responsible for maintenance.

Biological Impacts

None.

Economic Impacts

This option would likely put about 70 percent of the cost burden on the NMFS. Maintenance cost to fishermen would vary depending on the amount of usage. However, this would be a small percentage of fishermen's operating costs.

Social Impacts

Requiring the NMFS to pay for installation and monitoring of transponders, may increase acceptance of transponders within this fishery. However, reducing costs does not address the more general aversion to this monitoring system that was mentioned earlier under Social Impacts in the proposed action.

Conclusion

Enforcement of number of vessels in each area would be greatly simplified if all vessels were required to use transponders. Vessel location information within each area would be confidential. The Council is not requiring transponders at this time primarily because fishermen have stated their opposition, because NMFS does not have the funding to implement such a program, and because establishing ownership by limiting the number of vessels will promote voluntary compliance.

Option 3. Vessels permitted in the golden crab fishery are required to use transponders. NMFS will pay for monitoring of the transponders. Fishermen would be responsible for installation and maintenance.

Biological Impacts

None.

Economic Impacts

See Economic Impacts discussion under the proposed action.

Social Impacts

See Social Impacts discussion under the proposed action.

Conclusion

Enforcement of number of vessels in each area would be greatly simplified if all vessels were required to use transponders. Vessel location information within each area would be confidential. The Council is not requiring transponders at this time primarily because fishermen have stated their opposition, because NMFS does not have the funding to implement such a program, and because establishing ownership by limiting the number of vessels will promote voluntary compliance.

C.4. Trip limits.

Do not establish trip limits at this time. If trip limits become necessary in the future, the Council will consider implementing trip limits through the framework procedure.

Biological Impacts

Trip limits can be used to slow the rate of harvest and distribute fishing mortality over a period of time thereby minimizing impacts. Scientific comments (Glenn Ulrich, SCDNR, letter dated August 15, 1995) support use of a trip limit: "I favor a 10-12,000 pound trip limit to slow the harvest of golden crabs at least until more information can be assembled. The large vessels entering this fishery will oppose trip limits of this magnitude but we should keep in mind that any penalty imposed on these vessels, will be at least partially offset by their ability to catch a limit in a shorter period of time and to work in weather that would keep smaller boats in port. If a quota is imposed, a high trip limit will be a serious penalty on the small vessels that have been the only participants in this fishery until now."

Economic Impacts

None.

Social Impacts

This option has the support of the Golden Crab Advisory Panel and other industry representatives. At this time, it would have few social impacts. However, future implementation of trip limits may have important social impacts depending upon the limits imposed. See Social Impacts discussion Option 2 below.

Conclusion

The Council concluded that trip limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Other Possible Actions:

Option 1. Establish a trip limit of 8,000 pounds live weight or 4,000 pounds butchered.

Biological Impact

A trip limit would slow the harvest rate of golden crabs which would provide some biological protection.

Economic Impact

Based on public testimony, this option will likely affect most of the vessels currently in the fishery. There is no data to assess the magnitude of the impact.

Social Impact

See Social Impacts of the proposed action.

Conclusion

The Council concluded that trip limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Option 2. Establish a trip limit of 10,000 pounds live weight or 5,000 pounds butchered.

Biological Impacts

A trip limit would slow the harvest rate of golden crabs which would provide some biological protection.

Economic Impacts

This action will impact the activities of large vessels. Public testimony indicated that a few large vessels make trips up to 9 –10 days and go beyond 150 miles offshore. These vessels could not operate profitably under this trip limit. An assessment of the magnitude of the impact cannot be made because there is no record of the catches of these vessels.

Social Impacts

Effort limitations in the golden crab fishery may have many social impacts given the two types of vessels that are now fishing. A 10,000 pound live weight trip limit may create some inefficiency for larger vessels making it impractical to fish deeper waters. Because these larger vessels may be fishing deeper waters much farther from shore, their trips may be much longer and more expensive. A trip limit of 10,000 pounds may be too restrictive according to testimony from public scoping. If this action is chosen the fishery may be limited to vessels which do not fish deeper waters offshore and are much smaller, using smaller gear. Until documented landings are established by larger boats, the effect of a particular trip limit will be unknown.

Conclusion

The Council concluded that trip limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Option 3. Establish a trip limit of 15,000 pounds live weight or 7,500 pounds butchered.

Biological Impact

A trip limit would slow the harvest rate of golden crabs which would provide some biological protection.

Economic Impact

Most of the vessels could operate profitably under this trip limit. However, it is likely some of the large vessels may not break-even. No information is available to assess the impact of this action.

Social Impact

See Social Impacts of the proposed action.

Conclusion

The Council concluded that trip limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Option 4. Establish different trip limits by area. North of Cape Canaveral establish a trip limit of 10,000 to 15,000 pounds live weight or 5,000 to 7,500 pounds butchered. South of Cape Canaveral establish a trip limit of 8,000 to 10,000 pounds live weight or 4,000 to 5,000 pounds butchered.

Biological Impact

A trip limit would slow the harvest rate of golden crabs which would provide some biological protection.

Economic Impact

This option would allow vessels that fish in different areas under different conditions some flexibility. It is unknown how it will impact them, but public input indicated vessels operating north of Cape Canaveral have a higher catch per trip.

Social Impact

This option may accommodate differing trip limit requirements that exist within the golden crab fishery as it pertains to those vessels which fish further offshore, make longer trips, and use larger gear by allowing a greater quota for the larger vessel. As mentioned earlier (See Action 22, Option 2 Social Impacts) testimony during public scoping indicated fishermen were unsure as to what amount of poundage might be required to make trips economically feasible by larger vessels.

Conclusion

The Council concluded that trip limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

C.5. Limit number of traps per vessel.

Do not establish trap limits at this time. If trap limits become necessary in the future, the Council will consider implementing trap limits through the framework procedure.

Biological Impacts

Limits on the number of traps can be used to slow the rate of harvest and distribute fishing mortality over a period of time thereby minimizing impacts. Scientific comments (Glenn Ulrich, SCDNR, letter dated August 15, 1995) support use of a trap limit: "Perhaps we should consider a tiered system in which allowable number of traps should be dependent on the size of traps used and the fishing strategy of the particular vessel. A vessel that did not leave it's traps on the grounds between trips and fished short soak times would undoubtedly need to fish more traps to achieve adequate production. A fishing strategy of this type shouldn't be discouraged as it reduces the potential for gear/area conflicts and the possibility of lost gear."

Economic Impacts

None.

Social Impacts

This option has the support of the Golden Crab Advisory Panel and others within the fishery. At this time it is difficult to determine the need for a trap limit. After more information is gathered concerning the fishery, a trap limit may need to be imposed. But, with little information about the fishery and industry indicating little utility in imposing such a limit, there may not be a need for such limitations at this time.

Conclusion

The Council concluded that trap limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Other Possible Options:

Option 1. Establish a limit of 100, 300, 500 or 1,000 pots per vessel.

Biological Impacts

Limits on the number of traps can be used to slow the rate of harvest and distribute fishing mortality over a period of time thereby minimizing impacts.

Economic Impacts

Lack of data prevents estimating the level of economic impact.

Social Impacts

See Social Impacts for the proposed action.

Conclusion

The Council concluded that trap limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.

Option 2. Establish a limit of between 100 and 1,000 pots per vessel but have separate limits by area (e.g., north and south of Cape Canaveral, Florida).

Biological Impacts

Limits on the number of traps can be used to slow the rate of harvest and distribute fishing mortality over a period of time thereby minimizing impacts.

Economic Impacts

Lack of data prevents estimating the level of economic impact.

Social Impacts

See Social Impacts for the proposed action.

Conclusion

The Council concluded that trap limits are not necessary at this time. Limiting the number of vessels will provide sufficient limits on catch. In addition, given that there is so little information available, the Council wanted to minimize constraints in order to get a true picture of the quantity of resource available for harvest.