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REPUBLIC OF THE GAMBIA



REPUBLIC OF THE GAMBIA

DESIGNATION OF SPECIAL MANAGEMENT AREAS NOTICE, 2013

REPUBLIC OF THE GAMBIA

FISHERIES ACT
Cap 63.01 Laws of The Gambia, 2009.

**DESIGNATION OF SPECIAL MANAGEMENT AREAS
NOTICE, 2013.**

IN EXERCISE of the powers conferred on the Minister of Fisheries and Water Resources under section 14 of the Fisheries Act, this Notice is issued.

1. Citation and Commencement

This Notice may be cited as the Designation of Special Management Areas Notice 2013.

2. Designation of Special Management Areas

The Fishery Co-Management Plan for The Gambia Sole Complex set out in the schedules are designated as Special Management Area.

3. Co-Management Plan for the Cockle and Oyster Plan

The Cockle and Oyster Fishery Co-Management Plan for the Tanbi Area as set out in the schedules are also designated as Special Management Area.

SCHEDULE I

Co-Management Agreement

WHEREAS, the sole fishery is an important resource that employs many people in the coastal zone, produces export earnings for the country, and is primarily an artisanal fishery,

WHEREAS section 14 of the Fisheries Act, and associated regulations of 2008, provide the authority for the Minister of Fisheries and Water Resources to designate special management areas for the purpose of community-based co-management in the interest of conservation, management and sustainable utilization of fisheries resources,

WHEREAS section 11 of the Fisheries Act, and associated regulations of 2008 provide the authority of The Minister of Fisheries and Water Resources to allocate property rights over fisheries resources,

WHEREAS Section 15 of the Fisheries Act, and associated regulations of 2008, provide the authority for the Minister of Fisheries and Water Resources to establish Community Fisheries Centers (CFCs) for the purposes of community-based fisheries management (in consultation with Local Authorities, and where applicable, in accordance with the Local Government Act and any other laws of The Gambia).

WHEREAS, The National Sole Fishery Co-Management Committee (NASCOM) and associated Landing sites Co-Management Committees (LACOMs) represent community based organizations and are affiliated with the CFCs in landings sites where CFCs exist;

THEREFORE, I HEREBY

Declare as a Special Management Area for the purposes of fisheries management, a sole fisheries zone from the Atlantic shoreline and shorelines adjacent to the estuarine areas of The Gambia River out to one (1) nautical mile.

Designate the NASCOM and its associated LACOMs through the Community Fisheries Center Management Committees as having exclusive use rights to the sole fishery in this area.

Delegate authority for the responsible and sustained management and conservation of the sole fishery resources in this area to the NASCOM and its associated LACOMs through the CFCs in accordance with the management plan herein.

Chapter 1: Introduction

Worldwide, there are over 500 species of flatfish including flounders, sole, turbot, halibut, sand dab, plaice and tonguefish. Flatfish resources abound in the eastern Atlantic and are exploited as directed fisheries or often as bycatch fisheries. In The Gambia, the primary species belong to the sole and tongue sole families (Soleidae and Cynoglossidae, respectively). These valuable fish form the basis of an artisanal based export fishery which employs many in the industrial processing sector.

This is the first fisheries co-management plan developed under the new Fisheries Act of 2007. The framework for the plan was developed through a Marine Stewardship Council (MSC) pre-audit for the sole artisanal fishery. The USAgency for International Development (USAID)

Management plans become living documents with frequent review and amendments

funded BaNafaa project implemented by the University of Rhode Island (URI) in partnership with World Wildlife Fund for Nature (WWF) West Africa Ecoregional Programme and the Government of The Gambia was able to support the development of this plan through workshops on co-management, directed trainings, collaborative research and institution building activities. Much of the new knowledge about sole was provided by the fishermen and the industry using local knowledge data gathering methods and confirmed through collaborative research techniques. This plan is adaptive and is expected to change as more data becomes available and with fluctuations of environmental and harvesting conditions.

Fish as a food product is an important source of protein in the diet of 1.5 billion people around the globe. In both The Gambia and Senegal, a large percentage of the population lives within the coastal zone and derives their livelihood, food security, and way-of-life from fishing. Some 200,000 people in The Gambia are directly or indirectly employed in the fishing sector. Seafood products are a leading export of the region and generate as much as 20% of the gross value of exports. Fisheries trade results in valuable foreign exchange earnings, revenue for Government, and employment opportunities that go well beyond the labor directly involved in harvesting. Fisheries products are especially critical to the

rural poor. Fish provides the main source of animal protein for the average rural family in the sub-region, where annual fish consumption can be as much as 25kg per capita. Fish as a source of protein is not just important to the coastal areas; inland populations are equally dependent on fish food for protein in their diet. In many rural areas, fishing serves as a "social safety net" when farming turns unproductive due to depleted soil, drought, disease, conflict or other factors. The artisanal fishing community in The Gambia is made up of people from various countries, especially Senegal.

In addition to direct socioeconomic benefits derived from fishing, a well-managed sector can benefit other aspects of the region's economy and quality-of-life. This includes a growing tourism sector and a number of globally and regionally significant parks and natural heritage areas. With annual tourist arrivals surpassing 120,000 in The Gambia and 400,000 in Senegal, there is clear interest from the tourism sector in having a consistent supply of quality seafood.

However, there are many challenges facing this fishery today: open access, limited information, unknown potential harvesting capacity of the artisanal and industrial fleets, poor prices paid to fishermen, fluctuating export markets, waste and inefficiencies including high post-harvest losses, as well as poor sanitary conditions at landing sites. The sustainable future will rely on using an active co-management approach to limit harvest rates and collect appropriate data to manage the fishery.

1.1 Principles for Management of the Fishery

For small-scale fisheries, information on catch rates and effort is typically quite poor. In these situations, it is useful to use simple statistics to manage the fishery and/or rely on fishermen's knowledge and combine management approaches that are easy to implement and require less intensive information gathering for decision-making. Cooperative and collaborative fisheries planning and research is beginning to capitalize on the knowledge and skills of experienced fishermen and incorporate it into program design and management processes. In the data-poor systems that characterize The Gambian fisheries, traditional and local knowledge is a valuable asset for fisheries managers.

Fisheries are plagued by uncertainties – in number of fish available, price, and the effects of consumer and market

demands. Given these uncertainties and the importance of the sector, the management framework can minimize risk by using the "precautionary approach." The "precautionary approach" calls upon managers to act in a more cautious or conservative manner relative to the level of uncertainty, adequacy, or reliability of the best available information. The precautionary approach also states that the absence of adequate scientific information should not be used as a reason for postponing or failing to take conservation and management measures.

Adaptive management is another concept that is crucial for successful fisheries management—especially in data poor contexts. The adaptive management approach allows for changes in management by evaluating the effects of current management actions on reaching the objectives of management. As actions are implemented, they generate information to use in judging whether those actions are having their intended effect, and to assess if the management "hypothesis" is or is not accurate. If an action did not have the intended effect, managers must decide whether the problem is due to poor implementation of the action, or whether the hypothesis must be reformulated and new actions identified. Adaptive management requires that decisions be made quickly and actions adjusted accordingly, often before the next fishing season begins. Adaptive management is especially suited for decentralized management contexts and data poor situations.

An ecosystem-based management approach to fisheries management (EBFM) focuses on conserving the underlying health and resilience of the ecosystem, thus maintaining the system's goods and services and leading to increased productivity. Developing an ecosystem-based approach to fisheries management need not be complicated. As both the human systems and the natural ecosystems upon which they depend become increasingly vulnerable, fisheries management needs to become increasingly resilient and capable of adapting to changes that will occur. In capture fisheries, systems that are decentralized and use a co-management approach are more capable of adapting to changing conditions. There is increased recognition that fisheries can be more efficiently managed when fisheries stakeholders are involved in the process. As fisheries become self-regulated, issues of enforcement and compliance—often major factors in management failure—typically diminish. Co-management is a partnership arrangement where fishermen and government share responsibility and authority for

managing the fishery. It has many variations ranging from fishermen playing a minor role to being included as major decision-makers, often supporting the science, enforcement, and management of the fishery.

1.2 The Process of Developing the Sole Management Plan

Designing the sole management plan involved several steps: development of management objectives; identifying clear pathways to reach objectives through harvesting and marketing rules; establishing evaluation criteria to determine if objectives are being met (stock assessment with reference points and/or sustainability criteria); development of compliance and enforcement strategies; and determining feedback mechanisms to managers to allow for changes in a timely manner. Starting in 2009, a two-year planning process was implemented that addressed each of these elements noted above. This process involved key stakeholders in the sole fishery including the Department of Fisheries and related government agencies, representatives of the export processors, fishermen from the main landing sites (Kartong, Gunjur, Sanyang, Tanji, Brufut, Bakau, Banjul, Albreda, Bintang, Tendebe and Barra), fish mongers and middlemen involved in the postharvest handling between the landing sites and the export factories, among others. There were periodic meetings at the national level and with the National Sole Fishery Co-Management Committee (NASCOM) which was formed during this planning process, along with its associated Landing site Co-management Committees (LACOMs), and further discussions with stakeholders through discussions and meetings at the landing sites.

1.3 Contents of the Sole Plan

This management plan describes the outputs of the co-management planning process described above for the sole species complex in The Gambia. The plan includes an overview description of the fishery, status of the fish stocks, describes the legal basis for management under this plan, and details the management objectives and related measures to achieve those objectives and means for enforcement monitoring and evaluation of the plan. A number of key technical supporting documents are mentioned in the plan as part of the Appendix and can be downloaded from the website link below.

The Sole Co-Management Plan and Appendices listed in the Plan can be found at:

<http://www.crc.uri.edu/index.php?actid=423>

Chapter 2: The Resources

2.1 The Species

There are four major families of flatfish with representative species found in The Gambian nearshore waters: Soleidae, Cynoglossidae, Psettododae and Paralichthyidae. The species have been confirmed through literature review, and through discussions with local fishermen, processors and The Gambian Department of Fisheries (Appendix 1). The most abundant (and the focus of this plan) are the black/tiger sole, *Synapturacadenati* and red sole, *Cynoglossus senegalensis*.

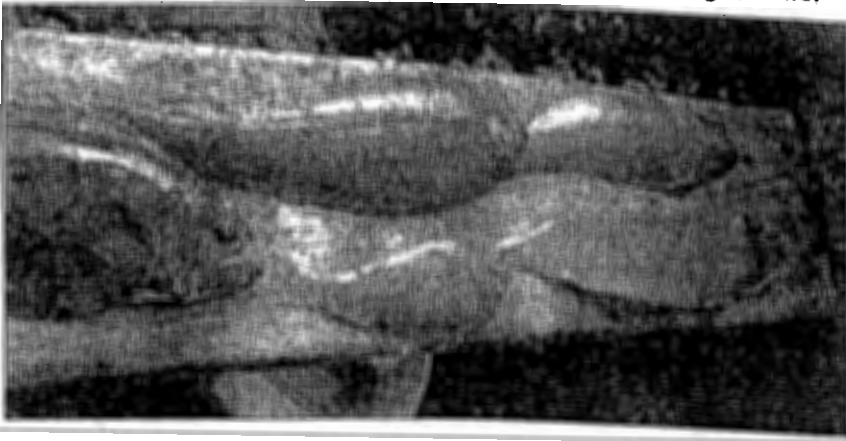


Figure 1. Sole species (From left to right (upper row- Spiny turbot, black sole, red sole (dorsal view); lower row: smooth flounder and red sole (ventral view)).

There is little published information about the biological characteristics of these species. Therefore, a local knowledge approach was used to elaborate on life history characteristics. This has led to collaborative research and data collection to expand the knowledge base for management (Appendix 4).

2.2 Distribution and Migration

Soles occur throughout a wide depth range, from tidepools to deep waters on the outer continental shelves and slopes (to about 1500 meters). They are found on mud, sand and

gravel bottoms. They play an important ecological role as prey and predator in these environments. Small mouth species feed on a broad spectrum of small epifaunal and infaunal organisms.

Fishermen have observed that the red sole is commonly captured in shallower waters than the black sole. The red sole is longer and leaner in size than the black sole. The sole fish are found in the brackish water of The Gambia River. Tendebea is the most upriver location of capture reported by fishermen although some juvenile fish (*C. senegalensis*, *Citharichthys stampflii* and *S. cadenti*) were reported as far upriver as Wale Creek by Vidy, et al. (2004) and Albaret, et al (2004).



Figure 2. Local knowledge describing sole movement from the south.

From fishermen's observations in southern Gambia, the sole fish appear in The Gambian waters starting in January (Figure 2). They migrate from the waters of Guinea Bissau and the Casamance region of Senegal to the coastal waters of The Gambia (First appearance is in Kartong, then Gunjur, Sanyang, Tanji, Brufut and Bakau). The movement back to deeper water occurs in August. Fishermen believe they

migrate from the deeper and cooler waters into warmer shoal water for spawning. Some fishermen from northern points in The Gambia describe a southerly migration from northern Senegal to The Gambia River estuary. These migratory behaviors of the sole species into waters south and north of The Gambia implicates a larger biological stock complex that may be shared with several countries.

2.3 Growth and Spawning

Growth of the tongue sole is described as rapid (Chauvet, 1972). Females grow at slightly higher rates than males (Ajayi, no date). Fishermen state that young of the year recruit to their gear 6 months after spawning. The juveniles stay within the rocky and sandy areas for approximately 6 months. When mature, which may occur within the first year, they move to deeper waters. New information relative to age/length is included in the Appendix.

Recent information obtained by the processing plant in The Gambia, indicate that the length/weight relationship for the red and black sole are only slightly different. There is a great deal of scatter in the weight data for each length of fish, which may be a function of their maturity and spawning stage. The condition factor ($K=100W/L^3$) varies as a function of month ranging from 1.63 and 0.54 (Figure 3). Abowei (2009) found the lowest condition factors during the spawning season for red sole in Nigeria. However, given the data collected to date in The Gambia, it appears that condition factors for red sole increase during the season that fishermen believe is the spawning period (Appendix 4). Information about black sole is missing during this period.

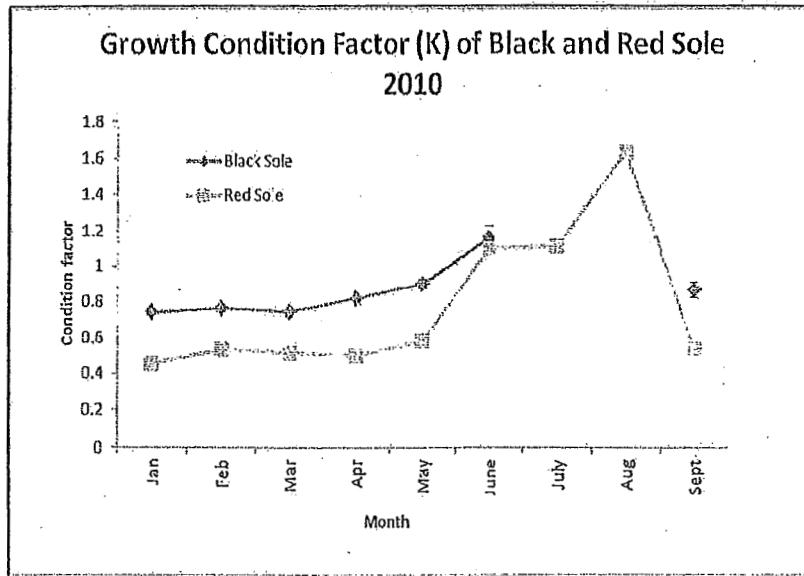
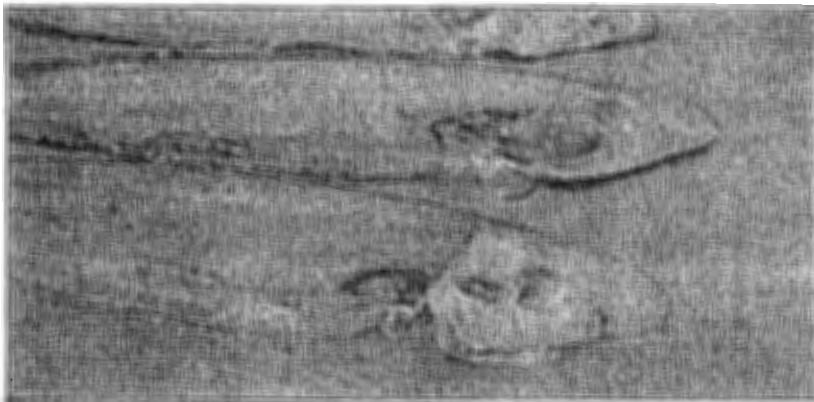


Figure 3. Condition factor of black and red sole.

As the sole move to shallow waters starting in January, the females carry eggs that are not well developed (Figure 4). Fishermen observed that in June to July, the eggs are fully mature and are released in sandy areas known locally as "pass". Contrary to the commonly described spawning behavior of flatfish which produces planktonic eggs that float freely in the water column, it is believed that the eggs of red sole are laid in the bottom sediment when the fish burrow. Larval stages may vary from a few days to a couple of months influenced by water temperature. Fishermen report eggs to be encased in a thin film which hatch after 3 days. More information on spawning condition is being collected to verify these findings.



Chapter 3: The Fishery

3.1 History of Exploitation

The artisanal fishery for sole started in the early 1980's (or at least landings have been recorded since then). According to local history, sole fishing was introduced to The Gambia by the Senegalese fishermen from San Luis and at least 80% of the sole is landed by fishermen of Senegalese origin who leave The Gambia during the muslim holiday of *Tobaski (Eid El Fitr)*, or go cuttle fishing (preferred due to higher price). This accounts for much of the variability in landings (Figure 5).

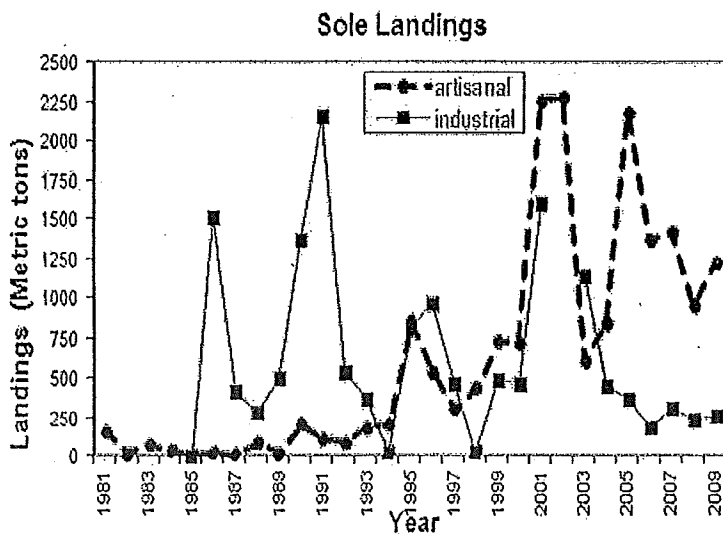


Figure 4. Sole landings (in metric tons) by artisanal and industrial fleets (Source: The Gambian Department of Fisheries).

Initially, the majority of landings were from the industrial fleet which landed their catch in nearby ports in Senegal. With the development of processing plants in The Gambia, the artisanal sector began to supply fish for the local factories for export. The number of processing facilities in operation varies considerably, highly dependent on export markets and production costs. The highest catch was recorded in 2001 and has since declined, especially evident in the industrial catches.

The artisanal fleet consists of coastal and estuarine vessels. The Gambian Department of Fisheries maintains landings records for the combined sole landings. Observers record landings from the industrial based fishery. Industrial boats do not land their catch in Gambia. There is no directed industrial fishery for sole and it is mainly caught as bycatch in the shrimp trawl fishery. A smaller bycatch occurs in the stern trawler fleet targeting red mullet, dorado and octopus.

3.2 Description of Fishermen, Vessels and Fishing Areas

The fisheries of The Gambia are zoned by use. The artisanal fishery has exclusive fishing rights to waters out to 9 nautical miles (nm). Vessels up to 250 Gross Registered Tons (GRT) are allowed to fish between 9-12 nm while beyond 12 nm is open to all licensed vessels. There are 155 landing sites in The Gambia, (all but 11 are in the river) but because of resource limitations, only 13 inland sites and all 11 coastal sites are sampled for catch/effort. The principal landing sites for sole on the coast are (from North to South): Barra, Banjul, Bakau, Tanji, Kunku, Sanyang, Gunjur, and Kartong. On the River Gambia, sole is landed only in the Lower River North Bank (Albreda, Kerewan, Ballingho) and in the Lower river South Bank (Mandinari, Bintang, Tendaba).

Industrial fishing vessels must obtain fishing licenses issued by the Department of Fisheries and endorsed by the Ministry of Fisheries before they are allowed to fish in Gambian waters. Industrial licenses are issued twice each calendar year, in 6 month intervals (Jan-June and July-December). License fees are calculated on the basis of GRT, type of fishing method (shrimp, fish and cephalopod, and tuna) and time period of license. Fishing license fees are calculated by the Fisheries Department but are paid to the Government Treasury. A fishing license is issued by the Department of Fisheries only after receipt of a certified Government Treasury receipt confirming payment of the calculated license fee. For the period July to December 2011, a total of 29 industrial fishing vessels have been issued Gambian fishing licenses comprising: 17 shrimp trawlers (with GRTs ranging from 29-46); 5 vessels targeting finfish and cephalopods (GRTs ranging from 44-314); and 7 tuna longliners (GRTs ranging from 160-714).

Only 1 out of the 29 industrial fishing vessels is owned by a Gambian national, the rest are foreign owned vessels. However, the foreign owned vessels obtained their fishing

licenses through Gambian registered fishing companies which act as agents. Only registered Gambian fishing companies can apply for fishing licenses. The Gambian owned fishing vessel (MV Haddijatou, a shrimp trawler), MV Fleur (shrimp trawler) and MV Renaissance (fish and cephalopod) vessels make their occasional landings at the Banjul port; all the remaining vessels land their catches in Senegal.

Artisanal fishing areas have changed over time. Fishermen state that the main difference that has occurred over the years in fishing for sole has been the distance traveled. The younger fishermen are traveling to new areas that are not familiar to the older generation of fishermen (observed in the local knowledge surveys). Today, a fisherman may travel 2 hours from port to set their nets.

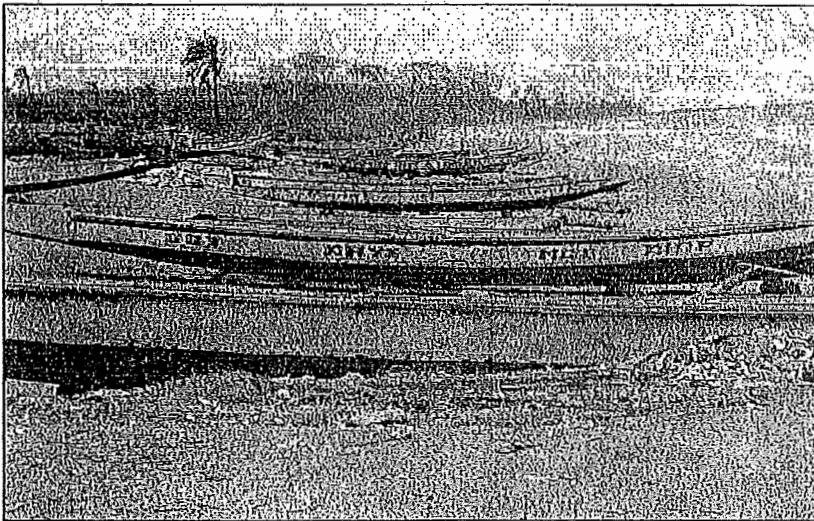


Figure 5. Wooden canoes are principally used by the artisanal fleet.

Fishing as a whole provides direct employment to 1,410 head fishermen and 4,694 fishing assistants (Department of Fisheries, 2007). The artisanal fishery has a fleet of 1,785 canoes (both motorized and unmotorized) from 7-11m length over all (LOA) operating in both the marine areas and The Gambia River (Figure 6). The artisanal fishery is the major source of raw fish materials for the fish processing establishments in The Gambia and the major supplier of fresh fish for The Gambian population. The two most important fishing gears employed in the artisanal fisheries operations in the Gambia are encircling/surround gillnet and bottom set gillnet. These gears are used in fishing operations all year

round and are responsible for most fish landings (Table 1). The bottom set gillnet targets a wide range of demersal and sub-demersal fish species. Landings depend on the abundance and availability of target fish species and these may have some bearing with seasons. In 2006, bottom set gillnets landed 12,555,510 kg of all species of fish.

Table 1. Total Catches, Effort and Catch per Effort by Type of Gear Used for the Atlantic Stratum for 2006 (Department of Fisheries, 2007).

| Type of Gear Used | Total Catches (Kg) | Effort (Days) | CPUE (Kg/Day) |
|---------------------|--------------------|---------------|---------------|
| Encircling Net | 15,521,468 | 22,414 | 692 |
| Set/Bottom Gill Net | 12,555,510 | 55,396 | 227 |
| Drift Gill Net | -- | -- | -- |
| Stownet | 93,290 | 446 | 209 |
| Hook and Line | 818,324 | 3,028 | 270 |
| Purse Seine | 4,295,196 | 5,563 | 772 |
| Other Net | 299,336 | 127 | 2,357 |
| Total | 33,575,249 | 86,974 | 386 |

3.3 Description of Gillnet Gear

The gear used to catch sole is primarily the bottom set gill net (Figure 7). Currently, there is no targeted sole fishery because of the low price and sole are a bycatch of the other benthic species fisheries. When sole was targeted, a low rise gillnet was used (1.5 m height), however, because of the low price, fishermen increased the net height to 2 meters to allow for a more diversified catch. The current fishery is actually a mixed demersal assemblage with the primary species caught being salt water catfish and *Cymbium* species.

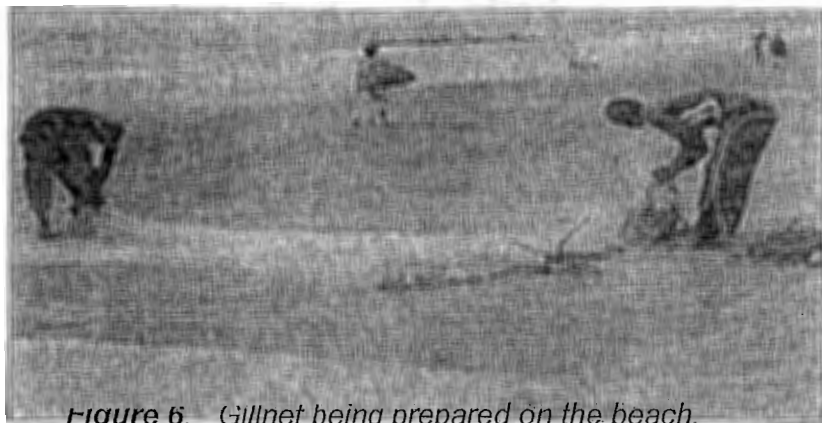


Figure 6. Gillnet being prepared on the beach.

A mesh size of 80 mm (stretched length) is referred to as the minimum mesh size in the regulations. Observed mesh sizes ranged from 80-92 mm. Although it is referred to as a gill net, fishermen describe it as an entanglement net, with fish becoming tangled in the webbing. Nets are typically made up of 20 m sections that may be joined together to make nets up to 800 – 3000m long.

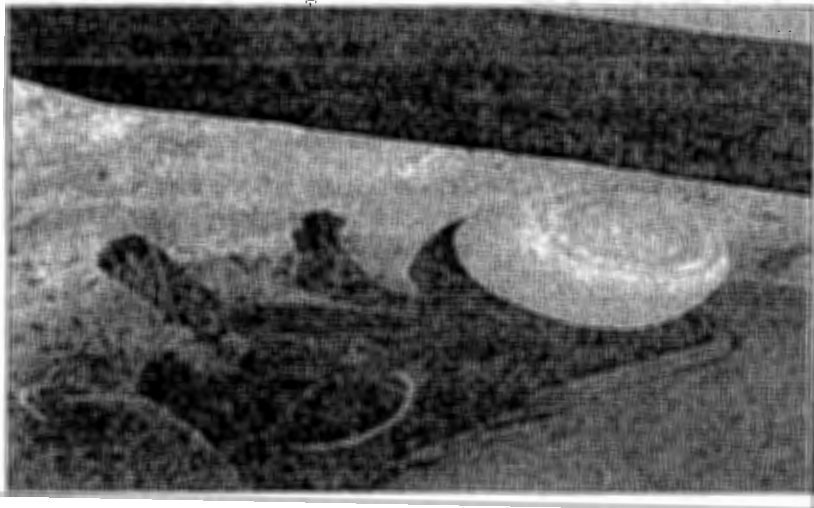


Figure 7. Repairing a monofilament gillnet.

Either monofilament or multifilament netting material is used in the nets. Although the life of the monofilament nets may be between 3-6 months, fishermen are observed repairing these nets and probably extending their useful longevity (Figure 8).

A recent study conducted by the BaNafaa project confirmed the lack of selectivity of these gillnets (Appendix 5), as hanging ratios are not consistent. Head and foot ropes are usually simply strung through the mesh panels and not tied at regular intervals (Figure 9a). The webbing is loose and results in entanglement. The fishermen often do not place sufficient floatation to keep the net upright in strong currents, which allows the nets to lay on the bottom and ideal for catching *Cymbium* species (Figure 9b).

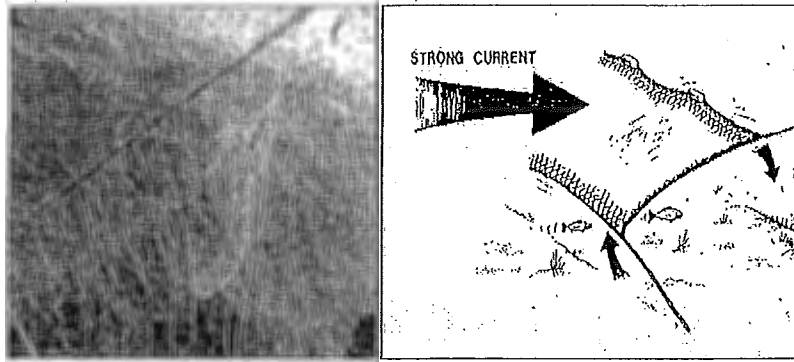


Figure 8. (a) Sole entangled in a gillnet without changing ratio, (b) Illustration of a gillnet in strong current without proper floatation.

3.4 Other Gear Types

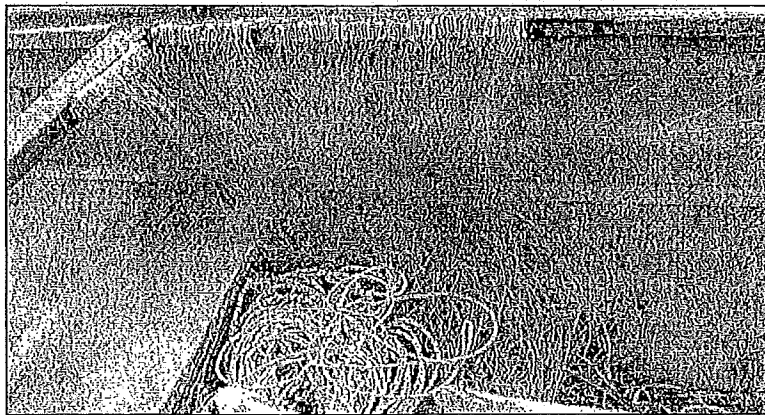


Figure 9. Common longline configuration for catfish.

Longline fishing gear was observed as a common fishing gear in The Gambia (Figure 10). The observed longlines had straight shank J-Hooks with monofilament gangions, which are attached to a monofilament mainline. Fishermen stated that the gangions were typically constructed of 37 pound test monofilament and the mainline was constructed of 60 pound test monofilament. The most common type of bait used in the longline fishery is the madeiransardinella (*Sardinella maderensis*). Similar to gillnets, up and down lines were attached to floats on the surface for easy retrieval. The anchors used were also similar to that used in the gillnet fishery, in that they were constructed of rocks held together in a mesh bags. The target

species identified by the fishermen were catfish and occasionally sole species. Although pelagic longlines exist, they are not common, as other methods are preferred for pelagic species. There is no data on catches from this gear or other artisanal gear types available for comparison.

3.5 Bycatch Species

This fishery lands 100% of all fish caught in nets; discards of bycatch are therefore not currently an issue of concern in this fishery. The legal minimum fish size is currently 25 cm. Landing data showed that the majority of fish captured were above the minimum size (Figure 11). The 2008 Fisheries Regulations introduced a minimum landing size for sole of 30cm. However, this management plan was not implemented for the fishery. Clearly, the current gillnet fishery catches fish smaller than this minimum size. It is not thought that this will lead to a significant discarding problem since there is a qualification in the regulations stating that undersize fish which are dead when caught should still be landed, however mesh size will not be an effective management tool unless gear selectivity is improved.

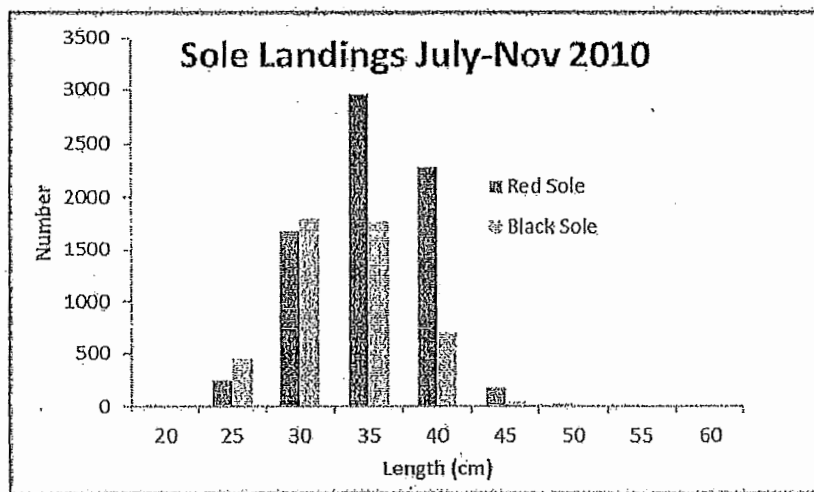


Figure 10. Length frequency of red and black sole captured by gillnet in four main landing sites (Kartong, Sanyang, Brufut and Gunjur).

Sole is essentially a bycatch in a multispecies fishery. Recent bycatch data has been collected by the Department of Fisheries and the Ba Nafaa Project on a monthly basis from four landing sites. A progress report on this study is available in the Appendix.

Molluscs (*Cymbiumcymbium*, *Cymbiumpepo*, and *Cymbium glans*) account for a large percentage of the bycatch in the gillnet fishery (by weight) (Table 2). With molluscs removed (Table 3), the most common fish captured were the sea catfish, rubberlip and sompat grunt, longneck, law and cassava croaker (July-Dec, 2010).

Table 2. Percent (by weight) of *Cymbium* species captured as bycatch in gillnets (July-December, 2010).

| Species | Kartong | Sanyang | Brufut | Gunjur |
|-----------------------|---------|---------|--------|--------|
| <i>Cymbiumcymbium</i> | 3.3 | 3.7 | 7.2 | 7.8 |
| <i>Cymbiumpepo</i> | 20.97 | 9.4 | 6.8 | 18.45 |
| <i>Cymbiumglans</i> | 12.23 | 8.15 | 1.46 | 5.9 |

Table 3. Percent catch (in weight) of remaining species (with *Cymbium* species removed) from four landings sites (July-December 2010). The final column is the risk status associated with that species as determined by the pre-assessment (Medley et al., 2008).

| Name | Kartong | Sanyang | Brufut | Gunjur | Risk |
|------------------------------------|---------|---------|--------|--------|--------|
| <i>Arius latiscutatus</i> | 39.4 | 27.7 | 14.8 | 30.9 | high |
| <i>Pomadasyssjubelini</i> | 8.0 | 4.8 | 8.9 | 15.1 | low |
| <i>Pseudotolithustypus</i> | 4.9 | 5.7 | 8.1 | 15.6 | med |
| <i>Scomberomorustritor</i> | 4.9 | 0.03 | 0.55 | 0.2 | - |
| <i>Cynoglossussenegalensis</i> | 4.9 | 12.6 | 8.6 | 8.3 | target |
| <i>Pseudotolithussenegalensis</i> | 3.1 | 13.5 | 8.7 | 3.1 | med |
| <i>Pseudotolithusbrachynathus</i> | 1.7 | 3.4 | 9.9 | 0.09 | med |
| <i>Pseudotolithuselongatus</i> | 1.2 | 0 | 5.9 | 1.2 | med |
| <i>Plectoryhnuesmediterraneous</i> | 1.2 | 0.06 | 5.4 | 0.7 | low |
| <i>Synapturacadenati</i> | 1.7 | 2.8 | 4.8 | 6.0 | target |
| Total weight of all catch (kg) | 1703 | 2173 | 6034 | 2530 | |

The Marine Stewardship Council (MSC) pre-assessment performed a simple analysis to identify the level of interaction with other species and the consequent effect on those species. The overall conclusion was that the majority of species caught in a sole net were at a low risk of overexploitation. Some were deemed to be medium risk (croaker, rays and lobster) while others were high risk (because of low productivity or high susceptibility of capture). These included guitar fish, catfish, shark and captain fish. Overall it was concluded that there was a medium risk of the

sole fishery causing an overexploitation on other retained species. This study confirms that the majority of fish caught in addition to sole are medium to low category except for the catfish. However, this points to the need to develop a more comprehensive multispecies plan in the future, especially in regards to catfish as a key species to be managed as it is also important food fish locally and with some export of smoked catfish regionally and to the European Union (EU).

Five species of cetaceans are found in The Gambia: the bottlenose dolphin, Atlantic humpback dolphin, Clymene dolphin, long-beaked common dolphin, and short finned pilot whale. The Gambia's Niimi National Park and the outer estuary of The Gambia River are key habitat areas for this species. During the interviews conducted by the Integrated Coastal and Marine Biodiversity Management Project (ICAM), 31% of the respondents stated that had accidentally captured a dolphin in their gear and many times, the animal is released alive (Leeney, et al., 2007). There is no market for dolphin meat and if captured, they tend to be given to the community. However, very few fishermen will sell dolphin meat.

The ICAM-II study (Leeney et al., 2007; Hawkes et al., 2007) confirmed no interactions with sole fishing gear and ETP species (turtles and dolphins). Many species undergo a seasonal onshore-offshore migration. There is a concern that as many fishermen venture further from shore, that encounters will increase.

3.6 Value Chain Analysis

Sole is one of the important demersal species in The Gambia. A value chain analysis was recently conducted in the sole fishery for The Gambia (Figure 12; Appendix 6). It is commercially processed and exported, primarily to Europe. Exports of solefish generate considerable amounts of foreign exchange earnings. In 2007 alone, 297 tonnes with FOB value of D17.7 million were exported. Although there are 5 major processing plants located in The Gambia, only three are presently exporting. Those processing plants are not operating at full capacity due to the shortage of raw material. The price paid to the fishermen is very low compared to other species and fishermen frequently do not target sole (20 Dalasi/kg). Although the new fisheries port under construction will allow for landings of industrial boats in Banjul increasing availability of product, it is unlikely to assist the artisanal community. Electrical costs are some of the highest in Africa leading to high production costs.

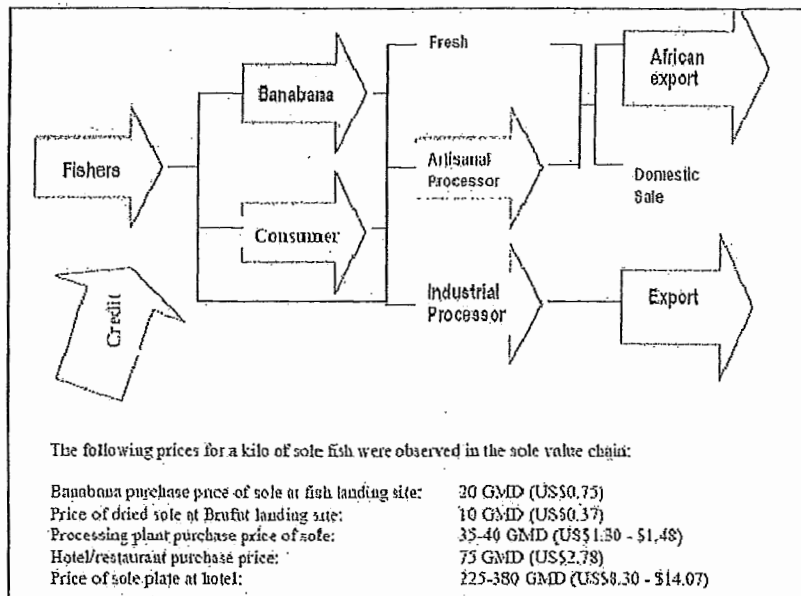


Figure 11. Value chain for The Gambian caught sole.

One of the most important findings of the report was that much of the sole product is not sold in The Gambia, but crosses the border into northern Senegal as southern Senegal-caught fish. This is then processed and exported. This origin mislabeling not only affects stock assessments but also export statistics. Current work investigating cross border trade will attempt to calculate out these amounts.

3.7 Subsidies

There is no evidence of subsidies in the fisheries that would create an unsustainable harvesting condition. Fuel mix subsidies were discontinued in 1994. The Government does provide a duty waiver on the export of fishery products and import of fishing related equipment. The value chain provides more detailed information regarding tariffs and profitability in the fishery.

Chapter 4: Current Status of the Fishery

Preliminary work was conducted as part of a Marine Stewardship Council (MSC) (Medley et al., 2008) pre-assessment to assess the status of the stock using available information. That assessment is summarized below. The following data sets and methodology were used-

- The processors grade fish by species and size. These data are available from the processor, but are not currently collected by the fisheries department. They form the basis for a size based stock assessment.
- One of the processors during the MSC assessment was requested to collect length and weight data over the full size range of the two species being landed. These data were collected and form the basis for interpreting the weight composition data provided by the same processor.
- The processor size composition for export was used to estimate the current fishing mortality and appropriate reference points with the purpose of assessing the status of the stock. This approach to stock assessment can be carried out very rapidly and indicate in general terms the state of the stock and whether current levels of exploitation can be considered sustainable or not.

4.1 Assessment

The MSC assessment consisted of a length converted catch curve fitted to the processor size graded exports and growth model estimated by Chauvet (1972). This estimates the current fishing mortality based on size which can be compared directly to the spawner-per-recruit (SPR) reference points. The assessment uses the weight composition of the landings. These are converted to numbers at age using the growth model and mean weight within each size category. It is then assumed that the relative numbers in each size category is proportional to the relative numbers in the fished population (Figure 13). Taking the log of the numbers and plotting against the mean age should produce an approximately linear decline as long as the proportion dying in each year has remained constant. The slope of this relationship estimates the total mortality (fishing plus natural mortality). Natural mortality can be estimated approximately using Pauly (1980), which also depends on the growth model. The fundamental assumption is that the catches are proportional to the stock size of that length-converted age group.

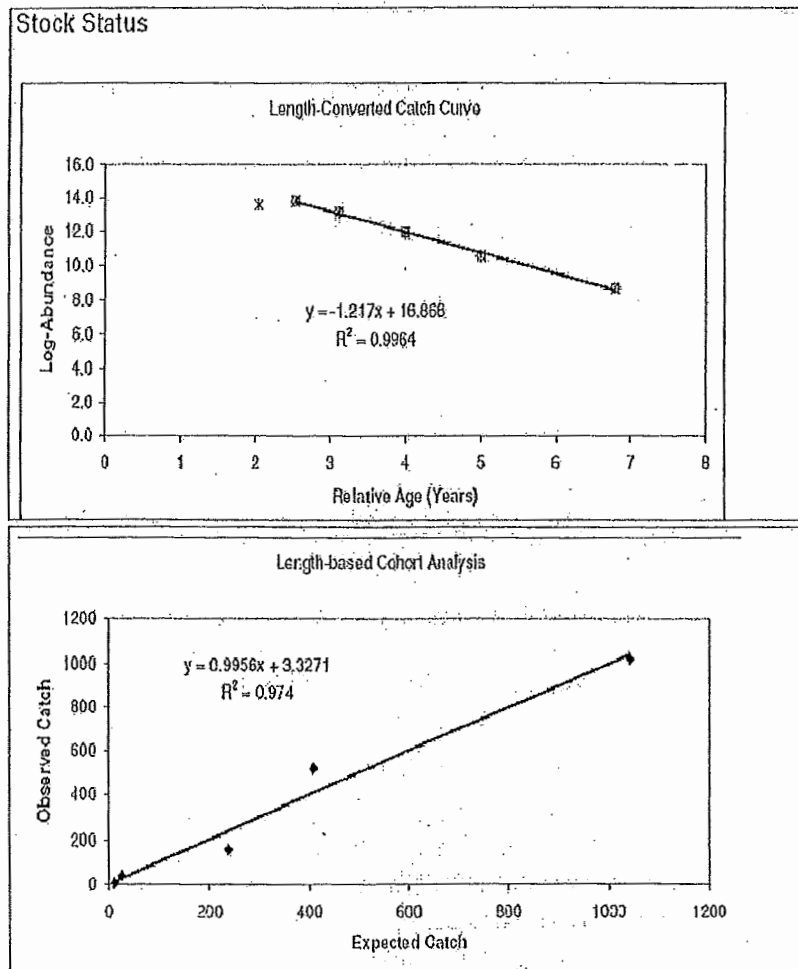


Figure 12. Length converted catch curve and length based cohort analysis.

Length weight data were collected over a short time period for the purposes of the MSC assessment. The main species is red sole, which appears to have a higher asymptotic length than black sole. Black sole tend to have a higher weight with a different shape. One of the original references on growth was unavailable for this assessment, although the instantaneous annual growth rate was reported from an indirect source as 0.34. The maximum length reported in Fishbase for red sole was 66 cm. The maximum length is almost always higher than the asymptotic length (L) required for the growth model, so a precautionary value of 60cm was chosen for this parameter. Unfortunately the estimate of the growth rate usually depends on the estimate of the asymptotic length, so it was unfortunate that the original article could not be found. The only growth parameters

available were for red sole, yet the reported catches do not discriminate between the two species. It was not possible to determine what effect assuming all catches were red sole would have. It is possible that the heavier size group is overestimated, but these would still be correctly interpreted as older animals close to their asymptotic size.

4.2 Reference Points

Reference points were estimated using the standard Thompson and Bell approach. The size at maturity is 30cm, so a very steep logistic was used (steepness -0.5, 50% maturity 30) to define spawning stock. Knife-edged selectivity was assumed at the minimum size of 27cm. Selectivity is likely to be more complex since gill nets are likely to be taking fish around a particular size. Dome-shaped selectivity should, in general, indicate the stock is in a better state, so assuming knife-edge selectivity is precautionary.

The reference points relate to fishing mortality only. As the stock is assumed to be at equilibrium, it is not possible to discriminate between biomass and fishing mortality and in this context the two are treated broadly the same. The estimate of the current fishing mortality can be compared directly with the spawner-per-recruit (SPR) 40, 30 and 20% points, where SPR40% can be seen as a reasonable target, SPR30% a trigger point for specific management action and SPR20% the limit reference point (Table 4). Because the natural mortality is high, the SPR reference points are also high. It should be noted also that the parameters are strongly inter-related, with the natural mortality estimated directly from the growth parameters.

These results suggest that the red sole stock is not overexploited. That is, the quantity of larger sole being reported in the catches is commensurate with a stock which is not overfished. Clearly there is considerable uncertainty with this rapid assessment, but these issues need to be addressed through further data collection and research. The main sources of uncertainty are-

- Species mix in the catches
- Asymptotic length and growth model
- The cohort analysis results are unstable. Alternative likelihoods can lead to unrealistically high mortality estimates. Length based cohort analysis could form the basis of a dynamic size based model. However, the accuracy of the

growth model will become critical in reducing uncertainty of the assessment.

- Gear selectivity: The gear selectivity for the commercial gear is unknown,

Table 4. Spawner-per-recruit (SPR) reference point and current fishing mortality including a sensitivity analysis of the current growth parameters (K, L^∞). Estimates of the current fishing mortality from the two methods are shown and are broadly comparable. The far left estimates represent the growth parameters closest to the estimated values. The results are sensitive to the choice of asymptotic length in particular. At no point in the analysis does the current fishing mortality level exceed the limit reference points. LLCA = Length converted catch curve fishing mortality; LCA: Length based cohort analysis fishing mortality.

| Parameter | Estimates | | | |
|-----------------|-----------|-------|-------|-------|
| | | | | |
| K (per year) | 0.34 | 0.10 | 0.34 | 0.34 |
| L^∞ (cm) | 60.00 | 60.00 | 66.00 | 72.00 |
| LCCC | 0.49 | 0.03 | 1.12 | 1.71 |
| LCA | 0.85 | 0.14 | 1.23 | 1.61 |
| SPR 40% | 0.83 | 0.37 | 0.79 | 0.80 |
| SPR 30% | 1.23 | 0.56 | 1.17 | 1.18 |
| SPR 20% | 1.99 | 0.94 | 1.85 | 1.87 |

Chapter 5: Fishery Management in The Gambia

5.1 Legal Basis for Co-Management

The fisheries legislation of The Gambia (Fisheries Act 2007) provides the legal basis for co-management of artisanal fisheries. Section 14 of the Act gives power to the Minister of Fisheries to declare "Special Management Areas" for the purpose of community-based fisheries conservation and management. Section 15 of the Act also gives power to the Minister to establish Community Fisheries Centers (CFCs) for the purpose of community-based fisheries conservation and management of Special Management Areas or parts of it.

In the 1980's, Government began the establishment of CFCs to better manage artisanal fisheries, then best described as individual family units and operations. The CFCs made it possible to concentrate on shore activities within an area provided with basic fisheries infrastructure including: stores for processed products (dried and smoked); individual lockers

for fishermen to keep outboard motors, fishing nets and other gears; mechanical workshop; boat building yard; fish smoking houses; fish drying platforms; fish handling area; and office building. The most recent CFCs have additional facilities such as ice-making plants and chill rooms.

Initially, the CFC were managed by a partnership between Government (Fisheries Department) and representatives of the different artisanal economic operators (fishermen, fish dryers, fish smokers, fish traders, boat builders, fisheries mechanics, and a representative of the village development committee and the Head of the village as Chairman). However, there was a deliberate policy of Government to gradually devolve management authority to the fisher folk and communities with Government providing advice, guidance and support. Up to the time of enactment of the Fisheries Act 2007, the mandate of the management committees of the CFC was limited to the management of fisheries infrastructural facilities.

The Minister of Fisheries may declare Special Management Areas and may also give authority to the CFCs to manage the fisheries resources within the Special Management Area for the purpose of community-based fisheries management. The Minister of Fisheries may give such powers to the fishing communities and publish it in the Government Gazette to come into force.

5.2 Description of the Special Management Area

For purposes of this management plan, a special management area for the sustainable management of the sole fishery is hereby designated as the entire area of the Atlantic coast of The Gambia and the coastlines of the estuarine areas of The Gambia River, out to 9 nm. The National Sole Fishery Co-management Committee (NASCOM) and its associated landing site committees (LACOMS) through the Community Fisheries Center's Management Committees are hereby delegated the exclusive rights to the artisanal sole fishery and the responsibility for its sustainable management within this special management area.

5.3 Establishment of the Sole Co-Management Committee

The National Sole Fishery Co-management Committee (NASCOM) was recently formed in September 2010 and developed the following vision:

The NASCOM envisages the responsible and safe exploitation of sole fish for conservation, management, protection and development of the fisheries resources for now and the future generation. The NASCOM envisages the conservation and sustainable management of the sole fishery to enhance food production, poverty reduction, and improve livelihoods of fishing communities.

Their mission is-

The National Sole Fishery Co-management Committee is conscious of the urgent need for the development of the fisheries sector as enshrined by Vision 2020. We intend to-

- Close the gaps required by the Marine Stewardship Council (MSC) relating to the deficiencies for eligibility of ecolabeling of The Gambia's sole fish in the international market.
- Ensure that The Gambian sole reaches international quality standards (quality control, co-management, data collection and monitoring)
- Also curb illegal, unreported and unregulated fishing (IUU fishing), and to intervene collectively in order to make a positive difference in the rehabilitation and transformation of resource users into responsible fisheries practitioners.
- Encourage the use of ecosystem approaches to fisheries management which includes ecological, social and economic factors.

The National Sole Fishery Co- management Committee shall operate on the application of co-management strategy. The National Committee shall apply numerous types of mechanisms for implementation. NASCOM committee membership shall be open to all fishers, fish traders, fish processors and to any institution whose work relevance relates to sole fisheries management and the environment.

Each landing site shall pay an agreed upon amount (D 200.00 a year) as a membership fee for affiliation with the National Sole Fishery Co- management Committee. The Landing Site Co-management committees (7) (LACOMS) are the community based stakeholder framework made up of representatives of the community fisheries centers and others. Their objectives are to assist the NASCOM and Government in developing the co-management plans.

Chapter 6: Management Responsibilities

6.1 Roles and Responsibilities

The NASCOM and its associated LACOMs through the Community Fisheries Center Management Committees are hereby granted exclusive use rights to the sole fishery within the special management area. The responsibility of management in the co-management sector is shared. The primary partnership is between the Department of Fisheries and the NASCOM. However, in some cases, one organization may have the majority of the responsibility to implement activities. The responsibilities that define the role of each partner for this management plan are described below. This may evolve as partners and/or capacities change. This will be reviewed on an annual basis and adjusted as needed.

The NASCOM consists of representatives from the fishing communities, fish mongers and processors, LACOMS, the Gambian Artisanal Marine Fisheries Development Association (GAMFIDA), the National Association of Artisanal Fishing Operators (NAAFO), municipalities, the Department of Fisheries and the industrial sector. Advisors to the NASCOM include the Fisheries Advisory Committee and the BaNafaa Project.

The NASCOM will take the lead to-

1. Establish a sole national co-management committee (NASCOM). The committee will have authority to jointly (with Government)-
 - Set management objectives
 - Establish fishing rights based approaches to management
 - Assist and be involved in enforcement
 - Update management plan

- Assist in communication with all stakeholders
 - Assist in research
2. In cooperation with the Department of Fisheries-
- Establish harvest rules appropriate to management objectives
 - Participate in international fishing agreements
3. Work with the LACOMs and the Department of Fisheries to jointly-
- Establish harvest rules for each landing site
 - Assist in compiling landing information.
 - Conduct local periodic assessments based on sustainability criteria to be determined (not full stock assessment).
 - Assist with marketing and processing issues/improvements.

The Department of Fisheries will be to take the lead to-

- Conduct data collection to meet criteria of management plan objectives
- Conduct stock assessment on annual basis appropriate to level of data available
- Help to develop the overall management plan
- Approve the final management plan
- Conduct annual audit of plan implementation to assess whether management objectives are being met.
- Assist NASCOM to revise management plan if reference points and sustainability criteria not being met.
- Review all rule changes annually and advises NASCOM on technical soundness to prevent overfishing
- Determine licenses and fees for the artisanal fishery
- Establish international agreements and recommend to the Minister the composition of the Gambian team to the negotiations of agreements
- Assist private sector in developing value added products and expanding markets
- Promote research and monitoring that aids in

management

- Communication of Government officials on committee and management plan, rulemaking and enforcement
- Assist NASCOM as requested.

The Industrial Sector will work jointly with NASCOM and the Department of Fisheries to-

- Provide data to co-management committee and Department of Fisheries on the processing of sole fish in The Gambia including weight, number, end user destination for catch statistics
- Assist in research such as age/growth, weight/length, maturity and other as needed
- Encourage the use of best hygienic practices (ice, etc.) on the boat and beach landing sites

NAAFO and GAMFIDA will work jointly with NASCOM and the Department of Fisheries to-

- Assist in capacity building of co-management committee and partners
- Assist in research activities needed for management
- Assist in obtaining the MSC certification, other forms of processing and marketing
- Assist in distribution of materials, communication and education

These responsibilities will be reviewed on an annual basis and modified as necessary by the joint group (See evaluation and monitoring section 8.5). If the committee dissolves, the full management responsibility of the sole resource will default to the Department of Fisheries.

Chapter 7: Management Objectives

The overall objectives of The Gambian Government policy for the Fisheries Sector are-

1. to generate employment opportunities for Gambian nationals;
2. to effect a rational and long term utilization of the fisheries resources
3. to improve the nutritional status of the population
4. to generate revenue and foreign exchange earnings

for the country

7.1 Management Objectives for the Sole Fishery

The co-management committee has chosen the following specific objectives for the sole fishery-

- **Economic**
 - Increase yield of catch (size of fish and number of fish)
 - Increase profit to fishermen and processors
 - Improve quality of fish landed
 - Increase market demand (MSC)

- **Biological**
 - Decrease catch of undersize fish (bycatch and discards)
 - Decrease catch of a bycatch species that is overfished
 - Allow more fish to spawn and grow

- **Social**
 - Increase safety at sea
 - Reduce conflict between fishermen
 - Increase compliance
 - Capacity building, education and training for fishermen
 - Behavioral changes to act responsibly

- **Ecological**
 - To conserve the integrity and resilience of the aquatic ecosystem for continued productivity and sustained livelihoods for people dependent on the ecosystem.

Chapter 8: Management Measures

8.1 Current Management Measures

The following harvesting rules have been established and used in the sole fishery-

1. Minimum fish size: 25 cm total length.
2. Minimum mesh size (stretched): 80 mm.
3. Prohibition on use of drift nets in the Gambia River.

8.2 New Management Measures

In the precautionary approach, it is possible to use forward looking tools to protect the fishery from future threats such as increased artisanal fishing effort, changes in environmental conditions, or changing industrial effort.

1. No-take zone during spawning times: One nautical mile from the coastline for all fishing from May 1 through October 31. This will be for all fish species and gear types.



Figure 13. Map showing 1 nautical mile spawning closure area (yellow line).

8.3 Consideration of Future Management Measures

There is some concern about the situation in the mouth of The Gambia River and how to use a spawning closure without causing undue harm to the fishing communities. Since species and gear are different than the coastal fisheries and species abundance and distribution are highly dependent on the salinity regime, this needs to be further investigated for revisions in the future. In Kartong, this closure would also require an agreement with Senegal since waters are shared between the two countries and with the industrial

fleet. A fishery closure in the Casamance area from Kafounting to the Gambia border is currently in effect in Senegal.

Other future actions-

- There is concern that gear restrictions are not sufficient due to lack of selectivity of the gillnet. Changing gillnet mesh or configuration could make the gear more selective taking into consideration the bycatch of catfish. There are several options to consider to move ahead-
 - a. Design a gillnet that returns to selective fishing characteristics or use alternative gear
 - b. Design mesh size to match vulnerable species also caught in the net
- Design training and capacity building programs for fishermen

8.4 Procedures for Adjusting Management Measures

Any subsequent changes to the management measures in this management plan will be detailed in a signed Memorandum of Understanding between NASCOM and Department of Fisheries and the Ministry of Fisheries, Water Resources and National Assembly Matters. This MOU will also detail any changes to the roles and responsibilities outlined in the management plan. The fishery management measures should be evaluated on an annual basis and reviewed as outlined in section 8.5 below.

8.5 Monitoring and Evaluation

There will be an annual meeting between the Department of Fisheries and NASCOM and other interested stakeholders to review progress on meeting the objectives of this management plan. These reviews should:

1. Respond to any changes in stock assessment and stock status, if overfishing is occurring-
 - a. The Department of Fisheries will inform NASCOM of assessment results and suggest appropriate reduction in fishing that needs to occur.

- b. NASCOM will work with LACOMs and instigate immediate action to reduce fishing effort. This may involve closing the fishery or prohibition of gear types, or restrictions on fishing time, area and possibly quotas.
2. Evaluate degree of compliance with management measures and rules including spawning areas-
 - a. Enforcement reports should be prepared and presented quarterly to the NASCOM and the Department of Fisheries for review by LACOMs, Fisheries Officers, and the Department of Fire and Rescue Services. If infractions are occurring, there may be a need to better inform the fishing community of the management measures in place and/or education about conservation of the resource. This will be discussed at annual meetings of NASCOM.
3. Evaluate enforcement actions and penalties-
 - a. Enforcement reports should be prepared and presented quarterly as above to the NASCOM and the Department of Fisheries for review. If infractions are occurring, there may be a need to adjust fishing penalties.
 - b. Update on status of funds from fines. Amount collected and disbursed.
4. Evaluate committee structure and membership, if changes needed.
5. Degree to which biological, ecological, social and economic management objectives outlined in the plan are being met. Discussion at annual meeting.
6. Reassess research priorities at annual meeting between Department of Fisheries and NASCOM.

8.6 Enforcement and Penalties

Enforcement of the artisanal fishery will be the joint authority of the DOFISH and NASCOM from the shore to 9 nautical miles. For enforcement of the closed area-

1. The Department of Fisheries and NASCOM may authorize the safety at sea/rescue units (part of the Department of Fire and Rescue Services) to act on their behalf for the monitoring, control and surveillance (MCS) of the closed areas.
2. Patrols may be conducted by these units at each landing site between May and October. Also, LACOMS may appoint "select fishers" in their respective communities to conduct MCS of the closed areas.
3. NASCOM and the Department of Fisheries will jointly provide fuel for these activities in an agreed upon manner developed as an MOU.
4. The 1 nm line will be marked using reflective buoys at 500m intervals by NASCOM and the Department of Fisheries and maintained by them.
5. All fines are returned to the community and a portion will be returned to NASCOM to fund enforcement activities (fuel)
6. Penalties will be as follows: (The Fisheries Act states that D 10,000 (Ten thousand Dalasi) is limit for fines).
 - Possession of fish captured in closed area. First offence: strict warning, D5,000 for second offense and D8, 000 for third offense and may include a 6 month suspension from the fishery.

Other violations:

- Possession of undersized fish: D10,000 fine, depending on percentage of undersized fish in the catch, fish confiscated
- Mesh size violation: gear and fish confiscated
- Drift net violation: gear and fish confiscated

Chapter 9: Challenges Ahead in the Fishery

9.1 Data Collection

There are many challenges in the management of the sole fishery, especially under the data poor scenario. The current catch monitoring is not sufficient for the collection of catch and effort data and a recent evaluation has identified several

ways to improve this. Capacity building workshops are being carried out with the Department of Fisheries and a new data base prepared to improve access for stock assessment. An estimate of the degree of cross border trade of sole study will assist in the stock assessment estimates.

9.2 Changing Effort

The fishery is principally an artisanal based fishery. This is partially due to the lack of dock infrastructure in The Gambia. However, once the new dock facility is constructed, it is likely that industrial boats will begin to land their catch here if incentives are high enough. This will increase the supply of fish directly to the processors; however, this may also supplant the small scale fishermen who tend to be more inconsistent with the supply and quality of fish, especially during the religious holidays. Fish product traceability will be an important component of the MSC label. There will be a need for strong enforcement of the MSC artisanal caught fish and traceability on the part of the processing plants that will ensure that at sea transfer does not occur, and product is kept separate at the processing site.

9.3 Export and MSC Ecolabel

There are many hindrances to exporting. The demand for sole is moderate and likely to grow as the product competes well against the European Dover sole in EU markets. However, standards necessary to import to Europe are becoming increasingly restrictive with HACCP, traceability and ecolabeling. The MSC label will be helpful to being able to compete in the European market but must be maintained.

9.4 Beach Cleanliness and Hygiene

Gillnet disposal and beach cleanliness and sanitation are important considerations (Figure 15). Problems with seafood safety caused a short embargo on The Gambian product due to sanitary conditions on the boat and the landing sites. Training and education, as well as access to ice, and disposal areas will improve this situation greatly. Sanitation at the landing sites has been identified as an issue for safety and quality of seafood. Recent funding through a USAID Clean Water and Sanitation Services Program will help to remedy this issue. This will include establishing latrines and

other sanitary infrastructure, water quality testing, and training and education in sanitation and hygiene. Potential for recycling old gillnets should be pursued, either for melt down or alternative uses (garden fencing, etc). Some CFCs have established Environmental Committees to ensure environmental sanitation. The committees need to be strengthened.



Figure 14. *Gillnet debris on beach*

9.5 Climate Change and Environmental Fluctuations

Fisheries resources fluctuate as a result of variable environmental conditions. The effects of climate change and possible consequences on fisheries resources and the people who depend upon them are at the forefront of adaptive fisheries management. Climate change can affect productivity or the distribution of resources through many pathways: changing water temperatures and precipitation leading to changing currents and upwelling; changing river characteristics and wetlands; extreme events such as flooding and storms, sea level rise and complex relationships between this and other sectors (i.e. water demand from drought conditions). Care must be taken to build adaptively and resilience for the fishing communities through the fisheries management plans and research.

Chapter 10: Research Priorities

Research needs have been developed through discussions with NASCOM and the Department of Fisheries. Considerable guidance has been received from the MSC report. These will be updated on an annual basis. Some of these research items have been initiated and results included in the appendices that follow this report.

10.1 Biology and Life History

1. Clarification of species- there are many types of sole species that may have different life history parameters. A species guide would be useful for landings data accuracy.
2. Clarification of management units- Given migration patterns elaborated by the fishermen, it is probable that several stocks of sole exist that are shared between countries.
3. Migration patterns- verify migration of sole, both to the north and south
4. Length-weight relationship over a year period for each species by sex assessing condition index.
5. Age/length relationship. This has been partially completed for black sole.
6. Identification of spawning areas and times of spawning by species
7. Size at maturity

10.2 Potential Impact of Climate Change

1. Climatic changes (water salinity and temperature)
2. Impact on migration and spawning
3. Impacts on predators and prey
4. Impact on fisheries

10.3 Fisheries

1. Improved data collection on landing-
 - a. Require processors to submit graded quantities

(species and sizes) on computer forms

- b. Species, length, weight, sex and maturity should be recorded for a representative sample of the landings. Reduced on-going biological sampling at the processing plant should provide the basis for monitoring the stocks in addition to improved beach sampling.
 - c. Separate growth models need to be developed for red and black sole. This would require collecting otoliths.
 - d. A biomass survey should not be central to the management of this stock. A biomass survey would provide estimates of absolute biomass covering a wide range of species. However, biomass surveys suffer from a number of problems associated with selectivity, coverage and small sample size. They also indicate the population sizes at a particular point in time of a fluctuating population. It is more reliable to use surveys as indicators of relative abundance over a time series. Clearly, biomass surveys are expensive, cannot be locally funded and therefore it is important that the local harvest strategy does not rely on this as a critical indicator.
 - e. A tagging program would be useful for sole. If well designed, it could provide good estimates of abundance, fishing mortality and growth. A tagging program is possible with cooperation from the fishers, but also may be expensive.
2. A key to identification would be a helpful tool to have for landings officials and observers and has been developed.
 3. Since many of the fish are exported or landed in Senegal, a joint data program would provide a more complete picture of landings, especially if the stock is shared.
 4. There is no effort category for "sole fishing". Therefore each fisherman can be considered a unit of effort in the fishery that can be adjusted using the landings by

site data. However, it would be very useful to have effort data for sole.

5. Fishermen also state that many foreign trawlers use explosives and dredges in their fishing operations. This is undocumented and needs to be investigated.
6. Selectivity of different mesh sizes and twine type. Since the net is functioning as an entanglement net, it is unlikely that mesh size will play a role in selectivity of these nets. It may be more important to evaluate hanging ratio or tie-down prohibition as harvest rules.
7. Bycatch species may be gilled so selectivity of the gear may be more important for bycatch size control.
8. More information regarding the fate of discarded nets in water and on the beach

10.4 Bycatch

1. Status of other stocks unknown, with highest priority on catfish.
2. Review current information on ETP species

10.5 Other

1. Mislabeling of Gambian caught sole fish as from Senegal
2. Traceability

Appendices

1. Identification of the sole resources of The Gambia
2. Length-weight relationship and condition factors
3. Aging determination of the black sole using otoliths
4. The use of local knowledge
5. Characterization of the sole fishery - gillnets
6. Sole bycatch progress report
7. Sole fishery value chain assessment

These can be accessed on line at:
<http://www.crc.uri.edu/index.php?actid=423>

SCHEDULE II

Co-Management Agreement

WHEREAS, the Tanbi Wetlands National Park (TWNP) has been declared a RAMSAR site in 2007 and designated as a National Park – due to its significant biodiversity assets of regional and national importance,

WHEREAS, the Tanbi Wetlands National Park provides significant food security and income for hundreds of women cockle and oyster harvesters,

WHEREAS Section 14 of the Fisheries Act, and associated regulations of 2008, provide the authority for the Minister of Fisheries and Water Resources to designate special management areas for the purpose of community-based co-management in the interest of conservation, management and sustainable utilization of fisheries resources,

WHEREAS, the designation of the Tanbi Wetlands National Park as a special management area is fully consistent with The Biodiversity and Wildlife Act, Forestry Act and National Environment Act, as well as the Tanbi Wetlands National Park Management Plan,

WHEREAS Section 11 of the Fisheries Act, and associated regulations of 2008 provide the authority for the Minister of Fisheries and Water Resources to allocate property rights over fisheries resources,

WHEREAS, The TRY Association of Cockle and Oyster Harvesters is an official and legally registered Association,

THEREFORE, I HEREBY -

Declare the area congruent with the Tanbi Wetlands National Park as a Special Management Area solely for the purposes of fisheries management;

Designate The TRY Association as having exclusive use rights to the cockle and oyster fishery in this area;

Delegate authority for the responsible and sustained management and conservation of the cockle and oyster resources in this area to The TRY Association.

Signed this..... day of 201

.....
MASS AXI GAI
Minister of Fisheries and Water Resources

1. Introduction

This is the first co-management plan for the Cockle and Oyster Fishery of The Gambia. The plan is specially prepared for the oyster and cockle harvesting areas within the Tanbi Wetlands National Park as a Special Management Area for the purposes of harvesting cockle and oyster resources. The legal basis to designate a Special Management Area is provided for in the Fisheries Act 2007. Section 15 gives power to the Minister of Fisheries and Water Resources to declare Special Management

Areas for purposes of community-based management and Section 11 allows for the allocation of property rights and catch share allocations. The cockle and oyster harvesters that operate within the Tanbi Wetlands National Park have already been organized into a community based organization called TRY Association. Through approval of this co-management plan, the TRY Association is allocated the exclusive rights to harvest cockles and oysters from this area and is responsible for the co-management of the cockle and oyster fishery in partnership with other stakeholders including governmental and non-governmental organizations and local authorities.

The purpose of this co-management plan is to ensure the sustainable management and development of the cockle and oyster fishery and enhanced benefits to those involved in the market value chain. An additional aim for this co-management plan for the nine cockle and oyster harvesting communities within the Tanbi Wetlands National Park is to serve as a pilot and if successful, this co-management model can be scaled-up to other cockle and oyster harvesting areas in the country.

The co-management plan was developed through a process that included community meetings, participatory rapid appraisals (PRAs) in cockle and oyster harvesting communities, workshops on co-management, institutional strengthening and capacity building activities, study tour experiences and regional exchanges, collaborative research, and the participation of Government Institutions, Local Government Agencies and Municipalities throughout the process. The co-management plan is divided into six (6) major Sections as follows: Section 1 is the Introduction that briefly outlines the legal basis for co-management of the fishery, the purpose and goal of the co-management plan, and the process of developing the plan and the stakeholders involved. Section 2 gives Background Information on the Tanbi Wetlands National Park and TRY Association. Section 3 provides a description of the fishery and a map of the Tanbi National Park, showing the nine communities where cockles and oysters are harvested, and the area of focus of the co-management plan. This Section also provides a description of the biology of the cockle and oyster species harvested, the harvesting methods, post-harvest processing and marketing methods, and an annual activity calendar of the fishery. It also provides an overview of the status and issues in the fishery including water quality and hygiene. Section 4 outlines the management objectives of the fishery divided into biological, ecological, economic and social objectives. Section 5 addresses the management measures to achieve the objectives of the plan. These measures include community exclusive zones, size limits of harvested species, permanent and closed seasons in open access zones, penalties and fines for violation of rules, aquaculture development, strengthening of TRY Association as well as research and monitoring needs. Section 6 includes the institutional arrangements and legal framework for co-management.

The co-management plan is designed to be adaptive and is expected to change over time, taking into account changes in harvesting methods and technologies, environmental changes and fluctuations including those that may be caused from climate change, and allows for the efficient and timely introduction of new management measures and strategies warranted by changing circumstances and situations in the fishery.

The development of the co-management plan has been supported by the USAID funded Gambia-Senegal

Sustainable Fisheries Project (*Ba Nafaa*). The *Ba Nafaa* project is implemented by the Coastal Resources Center of the University of Rhode Island and the World Wide Fund for Nature - West Africa Marine Ecoregion (WWF-WAMER) in partnership with the Department of Fisheries and the Ministry of Fisheries, Water Resources and National Assembly Matters.

2. Background

2.1 Description of the Tanbi Wetlands National Park

The central coordinates of the Tanbi Wetlands National Park (TWNP) are 13°26' North and 16°38' West. TWNP has an area of 6,304 hectares. TWNP is a mangrove swamp that fronts the Atlantic Ocean to the north and the Gambia River to the east. It is located at the mouth of the River Gambia, occupying the southern portion of the estuary (see Figure 1 below). It has developed through the combination of deposition of fluvial and marine sediments. It is an estuarine and intertidal forested wetland primarily of low mangrove forest, with a complex of vegetation types on its northern boundary and along the mangroves fringing the mainland. The TWNP functions include coastal stabilization, fish breeding and oyster and cockle production, recreation and carbon sequestration.

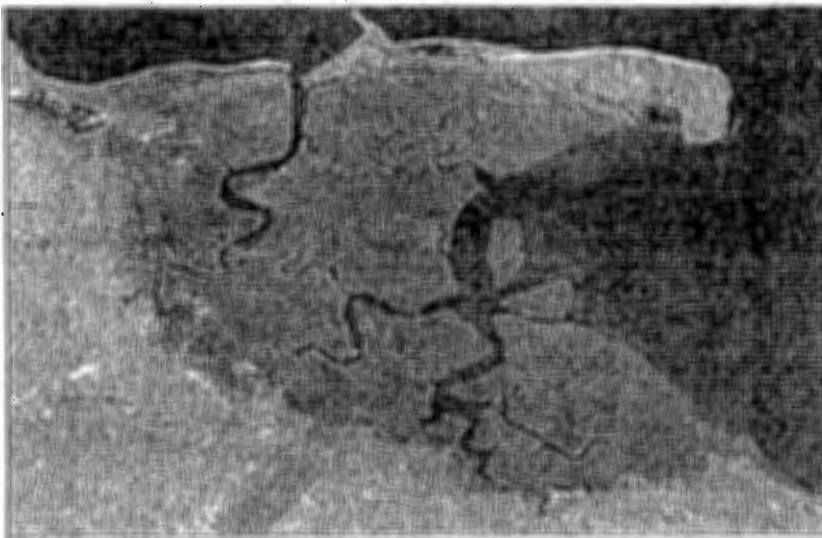


Figure 15. Satellite image of The Tanbi wetland area

The area is characterized by a network of channels that dissect the mangrove forest and the coastal strip on the northern fringe. The entire complex is essentially estuarine in

nature, though it is subjected to full salinities on the northern fringe during flood tides, and there are numerous freshwater flushes around the periphery during the rainy season. Hyper saline conditions can develop in some of the coastal lagoons and in the upper reaches of the *Bolongs* (tributaries or channels in the mangrove system). The fringe of the wetlands is seasonally flooded through rainfall and runoff which affects the salinity regime within the mangrove and lagoon complex. Freshwater is found at approximately 2m depth in this fringe and during the dry season.

A chain of lagoons runs between Cape Creek and Oyster Creek Bridge and a single lagoon occurs on the east of Toll point lagoons, which are subject to limited tidal inundation through narrow channels. This is a dynamic and ever-changing stretch of coast-line with extensive erosion and deposition occurring. This being so, there is a risk that the lagoons may be breached in several new places in the near future.

Mangrove forest dominates the TWNP south of the Banjul Highway and covers approximately 4,800ha. The numerous *Bolongs*, which dissect the mangroves, form a mosaic of islands up to 800 ha, in size. The mangrove community along the channels reflects slight variation in soil levels, with sections of the fringe forest interspersed with over wash forest. The extent to which these communities extend from the *Bolongs* is variable and often difficult to determine due to the thicket of branches and prop roots of these low forests. The mean height of the *Rhizophoraspp.* forest from soil level is 6-7m. At the head of many *Bolongs* however, individual trees of up to 10m occur, which may be a result of localized freshwater flushes reducing the osmotic pressure of particular trees.

There are extensive areas of tannes (seasonal saline flats) on the periphery of the TWNP that are subjected to seasonal flooding and subsequent drying following the rains. The associated vegetation varies with the degree of salinity. It ranges from the bare tannes to halophytic dominated vegetation including seasonal purslane, beach morning-glory and *Phloxerusvermicularis*, merging into grassland dominated by *Sporoboluspicatus*, *Phragmitesaustralis* and *Paspalumvaginatum*. As the dry season progresses the vegetation of the seasonal saline flats dies back (DPWM 1999).

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Humans settled around this area for five centuries. The area is bordered by twelve villages. The Greater Banjul human settlement surrounds TWNP to the south and east. Mandinary, Lamin and Abuko towns are bordering TWNP to the south; to the west, Fajikunda, Talinding, Ebotown and Jeshwang towns limit TWNP. Banjul is at the north-eastern border while Bakau town is to the north-west of TWNP. The area includes some part of the Banjul City area, some parts of Kanifing Municipality and some areas of the Brikama Area Council.

The population has skyrocketed since the mid-1960s. The high national growth rate (4.2%) and migration from upland and neighboring countries are the major reasons of this high increment of the population. The total population of the twelve villages and/or cities surrounding TWNP is 177,285 (2003 census). In 1993, the total population of the twelve settlements was 128,994. That is an annual growth rate of 2.7%. Trends were not the same in all areas; indeed while the population of Banjul and New Jeshwang is decreasing; it doubles everywhere else between 1993 and 2003. The fringe from Jeshwang to Fajikunda is the most populated area. The high growth of the population changed the landscape pattern. The lowland ecosystem of *Borassusaethiopicum* and natural waterways are the most impacted landscape features by the large human settlement around TWNP. The settlement is claiming land within the hydrological basin; waterways are blocked-up increasing sedimentation of the mangrove ecosystem.

The communities living around TWNP are diverse; one could notice two types of population: one not dependent on TWNP resources and the other directly or indirectly is relying on the wetland resources. For the later, rice cultivation, vegetable growing, oyster and cockle collection by women, shrimp fishing and mangrove cutting by the men for fuelwood and construction purposes are the main activities in the buffer zone and within the wetlands. Tourism is developed around Lamin and Denton Bridge where the surrounding communities gain some employment but they receive few other benefits from it.

Climatic events such as the 1962 drought and the droughts of the 1980's and floods of the 1950's are the major natural events that also put stress on the TWNP and the periphery communities.

The Tanbi Wetlands National Park was designated as a

RAMSAR site on World Wetlands Day in 2007. The Government of The Gambia decided that the 6,304 hectare mangrove system was important due to its high biodiversity and diverse and rare ecosystems with valuable marine resources. It is important to keep the ecosystem healthy, promote sustainable livelihoods and not use destructive means of harvesting the resources.

There are nine cockle and oyster harvesting communities in Tanbi Wetlands National Park. The collection, processing and marketing of cockles and oysters within the Tanbi Wetlands National Park constitute economic activities by predominantly women operating in individual family units within their respective communities. Prior to 2007, there has been no form of organization and no formal rules legitimized via Government except the annual closure during the rainy season, and there were no formalized committees for managing conflicts or determining rules.

A study by Cham and Touray (2008) highlighted the destruction of mangroves and the harvesting of juveniles as major concerns to be addressed in the oyster and cockle fishery. The study made several recommendations including: adoption of best practices, awareness creation and sensitization of harvesters, introduction of aquaculture, broadcasting of cockles from high density areas to low density areas, and alternative livelihood during the closed season.

The first phase of the ICAM (Integrated Coastal Area Management) project, which started in April 2005, introduced oyster culture (the hanging method) to the nine communities within the Tanbi Wetlands National Park. In 2005, the ICAM project took cockle and oyster harvesters on a study tour to Senegal where they came exposed to oyster culture and improved processing technologies for cockles and oysters. The project also made effort to allocate certain *Bolongs* to the communities that traditionally harvest these areas, and also closed certain areas. Not all the communities were happy or satisfied with the allocations and there are still on-going conflicts between communities that the Department of Parks and Wildlife Management has been trying to resolve.

2.2 TRY Association of Cockle and Oyster Harvesters

In July 2007, the TRY Association of cockle and oyster harvesters in Tanbi Wetlands National Park was established

as a community-based non-profit organization. The Association brought together the cockle and oyster harvesters within the Tanbi Wetlands National Park and periphery communities with the aim to raise their standard of living and become self-sufficient through collective actions and practice of improved and environmentally friendly harvesting techniques, market development and access to credit through microfinance activities. The membership of the Association has grown from 40 members in one community to 500 members in 15 communities. The Association elected its first Executive Committee in 2010, and a Board of Directors was established to advise and guide the Association. TRY Association is planning on eventually expanding its membership further to other areas of the country, and the on-going co-management planning process can be replicated to new areas as TRY membership also grows towards becoming a National Association.

The USAID funded Gambia-Senegal Sustainable Fisheries Project (*Ba Nafaa*) commenced in October 2009 with an objective to developing a co-management framework from management of the oyster and cockle fishery in the Tanbi Wetlands National Park. A key strategy was to build on the work that was being done by the TRY Association. In cooperation with the *WulaNafaa* project (a sister project in Senegal), a study tour to Senegal (the Sine-Saloum region) was organized for 26 cockle and oyster harvesters and Fisheries Department field staff. The tour exposed the participants to improved production and processing methods for cockles and oysters which can be adapted in their respective communities. Improved oyster products by the TRY Cockle and Oyster Harvesters Association have been developed that allows for some sale of products through the closed harvest season. A value chain assessment was also conducted to identify ways to improve incomes in the post-harvest chain.

The Association was provided a grant by the *Ba Nafaa* project in 2010 to establish microcredit schemes for the women, develop a business plan, and develop a fundraising strategy to raise funds to establish a permanent Headquarter for the Association which can serve as a meeting and training center. The Association has rented a temporary Centre with the support of the *Ba Nafaa* project. Thirty-five young girls (daughters of the women harvesters) are being trained at the TRY Center in sewing, knitting, soap making and home economics, giving them the opportunity to learn how to earn a living to support themselves and their families rather than

joining their mothers in the field adding additional pressure on the resources with possible negative impacts on the ecosystem.

The members are now practicing responsible harvesting methods targeting mostly mature oysters and cockles and have agreed to extend the period of closure by an additional three months to nine months to allow the oysters to grow bigger. From a marketing perspective, some progress has been made as some members of the Association now have the ability and know-how to pickle oysters for sale during closed seasons to extend income earning for a longer period throughout the year. The Kanifing Municipal Council has also allocated a special area or market point for oyster and cockles in the central Serekunda market. The Association is operating a successful microfinance scheme involving 250 members. The working conditions are improving: all members have been issued with life jackets, 500 working boots were ordered from Taiwan and issued to members, and members are wearing uniforms during marketing. The Association is also receiving support nationally from Government agencies such as Women's Bureau, Department of Community Development, Department of Parks and Wildlife Management and Fisheries Department, and from private citizens, and internationally from the Banesto Foundation of Spain and the Friends of Gambia and Senegal in the United States of America. Recently the Association received a US\$ 20,000 grant from the GEF (Global Environment Facility) through the National Environment Agency for mangrove reforestation and aquaculture. The Association raised more than one hundred thousand Dalasis during a local fundraising event in March 2011.

The *Ba Nafaa* Project assistance to TRY Association is supporting the establishment of organizational systems and procedures. The Association will be audited by a local auditor and a consultant will work with the Association to develop a Standard Operating Procedures Manual. *Ba Nafaa's* support will also provide training for programs that benefit members and build their capacity, literacy and numeracy training and microfinance training. TRY Association will begin graduating its strongest microfinance clients out to an established Gambian microfinance institution. This will enable the Association to gradually phase out its microfinance activities over time.

The *Ba Nafaa* Project will also support physical and equipment investments that will enable TRY Association to

increase its revenues and reduce its operating costs over the longer term. This includes fees for an architect to design the TRY Center permanent building. TRY Association has already received a response to its request to the Government for land allocation, asking for further information and documentation. It will also cover the purchase of chairs and the installation of a demonstration stove from Tanzania for smoking Oysters.

Under the umbrella of TRY Association, co-management planning processes have been initiated in the oyster and cockle harvesting communities within the Tanbi Wetlands National Park. Management committees have been established in each community and actively participated in the planning processes to develop this management plan. TRY Association is about to be signatory to a groundbreaking Cockle and Oyster Co-Management Plan, entitling its members to exclusive use rights to these natural resources of economic value.

3. Description of the Fishery

The shellfish fishery of The Gambia is characterized by oyster harvesting and cockle gathering with landing and processing sites dotted along the river estuary, along tributaries ("*Bolongs*") of the river and lagoons and in wetland areas. The fishery is an important source of livelihood for many people resident in these areas, the majority of whom are women. The development of the fishery became a stated priority for Government since the 1980's, but little has been done to manage the fishery or to provide technical support to develop it until recently. Information on the fishery is limited. The total number of people involved in the oyster and cockle fishery countrywide is not known. Data on oyster and other shellfish production is unavailable because it has not been part of the countrywide frame survey design and data collection effort of the Fisheries Department.

3.1 Status of the Shellfish Resources and Issues in the Fishery

Participatory Rapid Appraisals (PRAs) conducted in the cockle and oyster harvesting communities have revealed significant concerns about over harvesting as women have to travel longer and farther, take more time to gather cockles and oysters, and they are collecting juveniles (see Figure 2).

Conflicts between communities are also emerging as communities start to implement informal and unilateral rules for harvesting (e.g. closed season, exclusive community use zones).

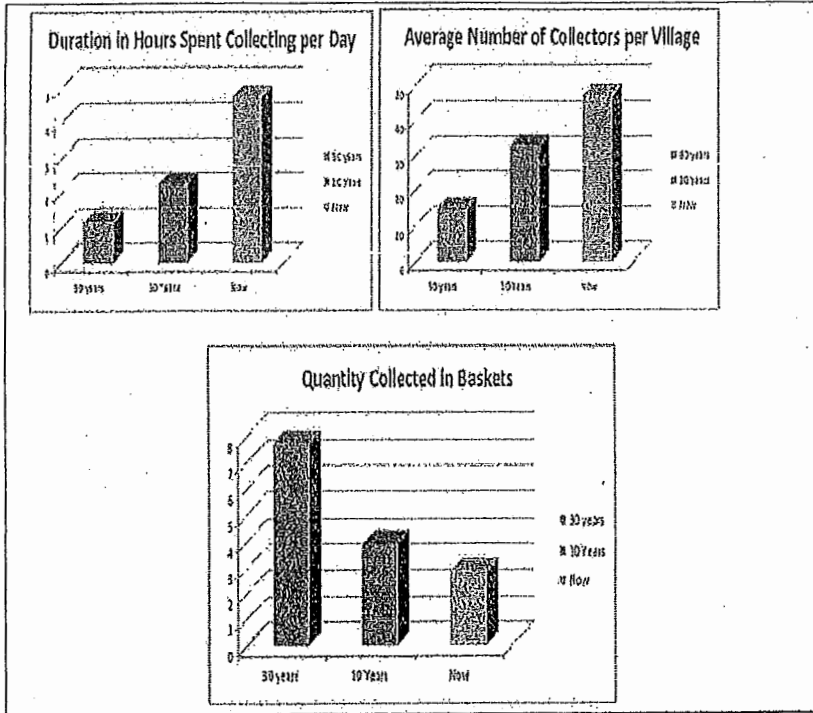


Figure 16. Perceptions of changes in catch & effort as revealed from PRAs

The women from the communities surrounding the Tanbi Wetlands National Park (see Figure 3) harvest the West African mangrove oyster (*Crassostrea gasar/tulipa*) and the blood ark cockle (*Senilia senilis*) as the two primary species of economic importance (Figure 4).

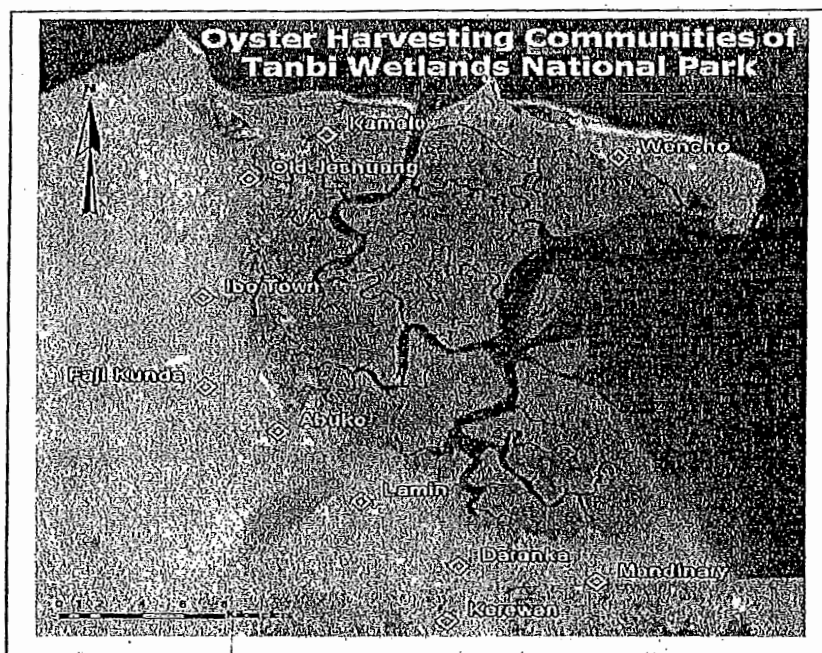


Figure 17. Oyster and cockle harvesting communities of the Tanbi National Park

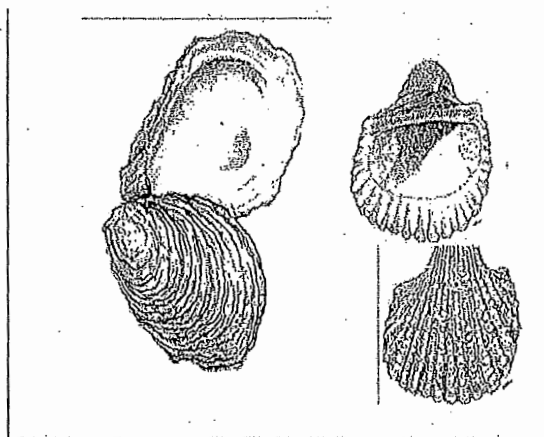
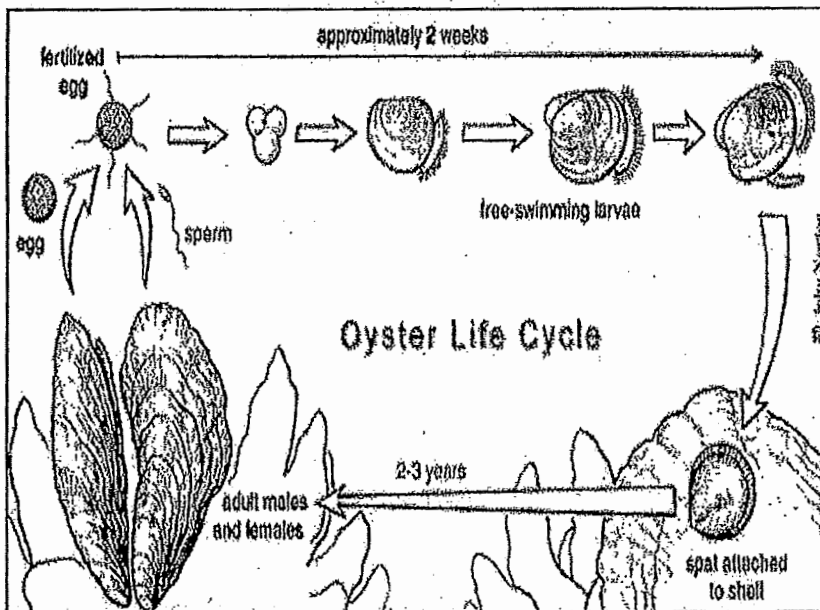


Figure 18. The mangrove oyster *Crassostrea gasar* (left) and the blood cockle (right)

3.2 The biology of the West African mangrove oyster (*Crassostrea gasar/tulipa*)

The biology of the oyster is amazing (see Figure 5). When oysters reach sexual maturity, they start as males, but as they get older, they become females. The male oyster cannot be determined from the female by just looking at the

live oyster. However, local knowledge gathered from oyster women indicated a black spot on the inside of the lower valve of the female oyster which is not found on the male (Kanyi 2010). Bisexual gonads in the very closely related mangrove oyster *Crassostrea rhizophorae* are formed when the animal reaches the size of 7mm, 45 days after settlement (Nascimento et al. 1980). The *Crassostrea tulipa* mangrove oyster is similar in its development and is so prolific a species that it attains maturity within approximately 120 days after settling when it has a height of less than 20mm. The oysters are usually male when they are less than 20mm and change sex after 30mm to female (Yankson, 1996). These oysters have a reproductive cycle similar to many other marine creatures and invertebrates. Spawning occurs when females release eggs and the males release sperm into the water column where fertilization takes place. The fertilized eggs become larvae which are in a planktonic stage, which means they float longitudinally in the water before settling on hard surfaces such as mangrove prop roots or rocks and sticks or on sea grass. Once they settle on hard substrate, they are called spat – very small sized, baby oysters.



SOURCE: Adapted from Maryland SeaGrant
<http://www.mdsg.umd.edu>

Figure 19. Life cycle of the oyster

Monthly data from spat collectors in the Tanbi Estuary system in The Gambia since June 2010 indicate the timing of the settlement of oyster spat (see Figure 6 below). While

settlement occurs every month; there is a distinct maximum of spatfall in October and November following the rainy season as salinity in the estuary rises with the onset of the dry season in the country. Interestingly, the post-rainy season maximum for oyster recruitment is found elsewhere in many other populations of tropical mangrove oysters. This means that the mangrove oysters grow better in high salinity but reproduce better in low salinity. Also, the data seem to suggest that it is possible to develop oyster beds in good growing areas (Lamin and Kubuneh) and transplant the spats to low density areas for grow-out.

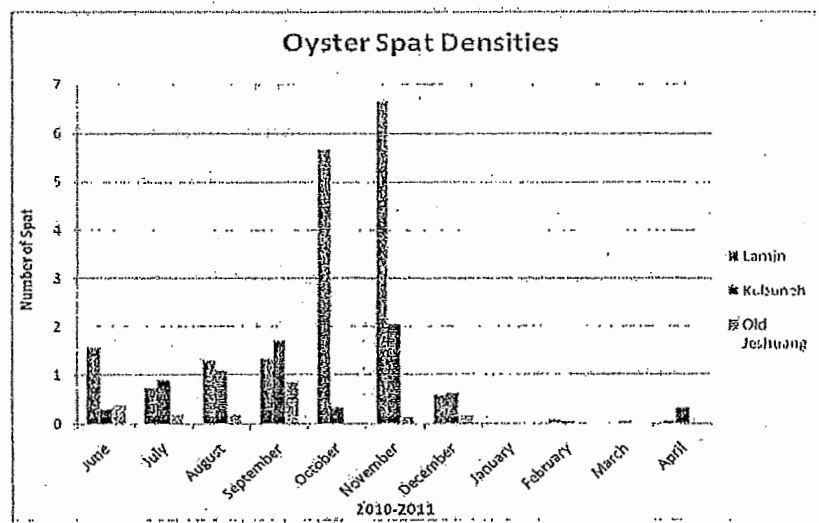


Figure 20. Density of oyster spat by month in the Tanbi Wetland National Park

3.3 The biology of the Blood Ark Cockle (*Senilliasenilis*)

Senilliasenilis also referenced as *Anadarasenilis*. The species occur naturally in water with salinity over 10 ppt and in which there is little difference between diurnal and seasonal fluctuations. *S. senilis* are found in both coarse sand and black mud environments but absent in channels with strong currents. They reproduce when the gonads are ripe at nearly one year old. According to (Yankson, 1981; Rice, 2011), the size of maturity is at approximately 20mm shell length.

The sex of the species is protandric. The eggs are released by the female and the male releases the sperm which fuse together and lead to fertilization. The larvae float in water for a few days and sink to settle on the bottom where it embeds in the substrate for growth. From observations of cockle sea

beds in the Kartong estuary in The Gambia, it was clear that the *Senilliasenilis* can set in very high abundance in localized seed beds to the point that although the cockles are known to grow up to 6cm in shell length, the seed cockles are prone to die before they reach 0.5cm. The phenomenon of seed dying out due to competition for food resources is known to occur in Thailand in the population of the related species *Anadaragrahosa* (Tookwinas, 1983). The collection of seed from local seed beds of high density and seeding the cockles on to specially prepared aquaculture ploys in sand flats in the low intertidal and shallow subtidal zone is possible (Broom, 1982; 1985).

3.4 Harvesting Methods

Harvesting of cockles and oysters is predominantly done by women in the Tanbi Wetlands National Park and the periphery oyster communities belonging to the Jola, Balanto and Manjago ethnic groups, although other ethnic groups are also involved (Cham and Touray 2008). The majority of the harvesters are Gambians but some are migrants from Southern Senegal (Cassamance). The harvesting and collection of oysters and cockles respectively is organized during the six hours of diurnal low tide; therefore the time of departure to the collection/harvesting sites is variable and coincides with the last half of the mid-tidal period. The women walk to and from work every day, walking distance from home to landing site vary from community to community depending on distance from home to the landing site.

3.4.1 Oyster Harvesting

Different methods of harvesting are employed by the women. Presently, there are two distinct tools used for oyster harvesting. These are the cutlass and a small axe. The axe is used to extract the oyster from the prop roots of the mangrove. The axe is more selective than the cutlass. The axe selects the oyster one by one, removing the mature oysters and leaving the small ones to grow. The cutlass on the other hand peels the oyster from the roots of the mangrove scraping the bark of the roots and usually leaving a scar on the roots.

The women use un-motorized canoes and paddle from their bases to the harvesting sites. The canoes are simple dug-outs that are mostly 3-4 metres in length and can carry only one or two people. The harvesting tools, water and food are placed onboard the canoe on departure to the harvesting

sites. They set out to the harvesting sites at low tide when the oysters are exposed for harvesting and return to the landing sites when the tide is high. During high tide, the oysters are submerged and cannot be harvested.

The vast majority of the women do not have their own canoes and there are a few canoes in each community, not enough for all to use at one time. As was the case before the introduction of the canoe, some of the women are still walking on foot to the oyster harvesting sites at low tide. The women walk considerable distances on foot in the mangroves to harvest oysters. They remove the oysters from the mangrove prop roots while standing in water at low tide. They carry either a bag or basket for loading the oysters after harvesting and return to their landing sites before high tide sets in, with their head loads of oyster in bags or baskets.

3.4.2 Cockle Harvesting

The cockles are also harvested by the same women either using canoes to the harvesting sites or walking on foot at low tide. Unlike oyster harvesting by canoe, the women anchor the boat and disembark. When they reach the sand bank where cockles are embedded, they stoop to start collecting cockles by scraping the sand with their fingers to get to the cockles. Sometimes the women put their forefingers in holes where cockles inhabit and pluck out single cockles one at a time. These holes are only noticeable when the tide ebbs completely from the banks. Sometimes spoons are used to pluck out cockles but superstitious beliefs of cockles disappearing from high yield places due to use of spoons, stop the women from using spoons. Similar to the oyster harvesters, as soon as high tide starts to set in, the cockle gatherers return to the landing sites.

3.5 Processing

Processing of oysters and cockles is performed by the same women who harvest them from the wild.

3.5.1 Oyster Processing

Until recently the processing of oysters involved cooking in water or roasting and smoking. However, steaming or boiling is more common nowadays because it is more effective and consumes fewer resources (firewood, water and time). The process begins with removal of foreign matter from the

harvested oyster. The live oysters are then steamed in pans/drums for 30 minutes to one hour during which the shells open up or the muscles soften up to ease opening of the shells and extraction of the meat.

If oysters are to be smoked, (which is now a rare practice), they are placed directly onto the burning fire or on metal grill over the fire. In either case, the oysters are then split open with knives to extract the meat which is collected in woven baskets and marketed often after they are washed clean or even reheated in some sites. In some other places in the country, the meat is preserved by salting and sun drying to very low moisture content before they are marketed.

Meanwhile the oyster shells are gathered in heaps and sold out for cash to users in the production of white lime, for brick making, the preparation of chicken feed and fertilizer.

3.5.2 Cockle Processing

Cockles are normally processed by boiling/steaming in pots, pans or drums for about 30 minutes to one hour during which the shells open up and the cockle meat loosens up or fall out of the shell. After steaming, the cockle meat is usually sieved with perforated trays or they are shaken and separated by gravity when the meat falls to the bottom and shells gently scooped out from the top.

Following separation, individual cockle meat pieces are picked out from the separated shells and returned to the sieved out meat, and small shell particles that remain are also removed/ picked by hand. The meat is then placed in baskets and washed many times in sea water. Water is allowed to drip and the product re-cooked before marketing. In some instances the product is salted and sun dried to very low moisture content before storage and subsequent marketing, similar to oysters.

3.6 Marketing

The selling of cockles and oyster is also done by the same women who harvest and process them. However, it is not uncommon to find younger women (daughters or family members of harvesters) selling processed cockles and oysters along the highway to and from the city of Banjul.

Processed oysters and cockles are marketed in diverse places including the processing site during processing. The

main marketing points are in urban market places and along roadsides while some producers carry the products on their head and sell from one home to another in the neighborhoods. Dried oysters and cockles are sold at the weekly market days in rural communities locally referred to as "loumos"; which move from village to village on a daily basis.

Selling is by a measure of an empty milk tin that contains about 150 grams of oyster or cockle meat. The price of this measure is generally the same in all places. The current price of oysters (in 2011) is GMD15 (approximately 50 US cents). However the large, handpicked grade of processed oysters is currently sold at GMD20.00 for the measure, while the smallest grade is sold at GMD10.00.

Cockles are also marketed in market places either fresh or dried, or carried around on head and sold from home to home and from one village or town to another. The price of fresh cockles is GMD5.00 and dried cockles are also sold at GMD10.00.

Buyers and consumers include individual consumers who buy the product for home consumption, street food vendors, restaurant operators and exporters. Information obtained during the conduct of the value chain assessment show high profitability in oyster food vending but vendors complained about the high cost of oysters.

Currently, limited quantities of oysters enter the international trade. The oyster is exported by individuals who normally carry with them few kilograms as gifts to relatives or are informally sold to close-circuit customers in niche markets. The main export destinations of these small quantities are mainly the USA and UK, where buyers or recipients are mainly Gambians and others from the diaspora, who have occasional preference for traditional foods. The product may also be taken for special ceremonial occasions of Gambians living abroad. Hence exports are classified as traditional ethnic foods of value (Njie and Drammeh, 2011).

Stringent sanitary requirements are constraints to be overcome if raw or fresh product is to be exported in the future. Sanitary requirements and control systems must be adequately met if oysters are to be legally exported, particularly to the European and American markets, including those relating to risk assessment and implementation of sanitation plans, to control food safety risks. There are no medical records specifically linking any food-borne illness to

consumption of oysters in The Gambia.

3.7 Annual Calendar of Activities of Cockle and Oyster Harvesters

The oyster collection used to be carried-out from December to June until recently (2011) when, by consensus, the oyster harvesters agreed to reduce the harvesting season from March through June. When the women are not engaged in oyster harvesting or cockle gathering, they engage in other activities to earn a living such as petty trading, firewood collection, working as house maids, rice farming, small-scale fish trading (selling fresh and smoked fish), as shown in the calendar below (Table.1).

Table 5. Annual calendar of activities of the oyster and cockle harvesters.

| ACTION | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEPT | OCT | NOV | DEC |
|---------------------|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|
| Oyster harvesting | | | X | X | X | X | | | | | | X |
| Cockle harvesting | | | | | | | X | X | X | X | X | |
| Petty trading | | | | | | | X | X | X | X | X | |
| Firewood collection | X | X | X | X | X | X | X | X | X | X | X | X |
| House maid | | | | | | | X | X | X | X | X | |
| Rice farming | | | | | | | X | X | X | X | X | |
| Fish trading | | | | | | | X | X | X | X | X | |

3.8 Water Quality

Water quality studies were undertaken by the *Ba Nafaa* Project in order to determine whether there are public health risks from contamination of the harvesting areas (e.g. contamination from *E. coli* bacteria in the water where oysters and cockles are grown). Initial data was collected (see Figure 7 below) for one year to assess any seasonal variations in potential health risks. Water samples were collected from the 15 oyster harvesting communities within Tanbi Wetlands National Park and Western Region on a fortnightly basis and analyzed at the Water Quality Monitoring and Control Laboratory of the Department of Water Resources in Abuko. Total and fecal coliforms were determined by use of the membrane filtration method, using standard TC and FC media. Coliform counts were done

using 25 mL of filtrate and reported as colony counts per 100mL of sample as is routinely reported in shellfish sanitary water quality literature (e.g. Graybow et al. 1981).

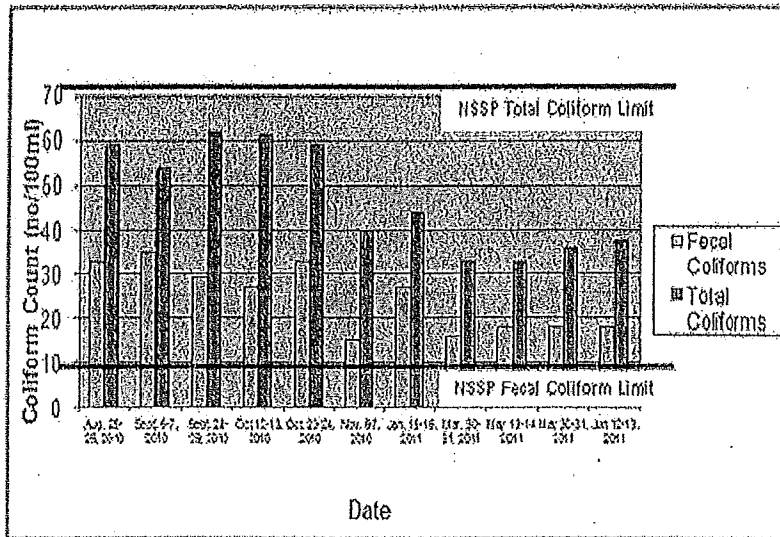


Figure 21. Average Coliform Levels in the 15 Sampling Sites, Tanbi Wetland

The results of the study, so far, show that both total coliform and fecal coliform counts were relatively low in all sample sites. However, a seasonal elevation of coliforms during the rainy season is suggested by the data and slightly elevated coliform counts were found at two locations in the estuary system at Old Jeshwang at a location at which pigs are being raised in pens within the tidal zone, and at Lamin Lodge, the site of a hotel, boat marina, and fishing boat landing. The results are among the lowest counts in many tropical oyster growing grounds and suggest that a shellfish sanitation program could allow for safe harvest of live oysters for a raw oyster market to tourist hotels or eventual export may be feasible. The data from the Tanbi sites appears to be reasonably clean in comparison to US NSSP (U.S. National Shellfish Sanitation Program) Coliform water sanitation standards (70 MPN/100mL Total Coliform and 14 MPN/100mL Fecal Coliform). However, it is important to closely monitor the Old Jeshwang and Lamin Lodge sites to see if coliform and fecal coliform counts are on the increase and to consider closure of these sites if increases beyond acceptable levels are confirmed.

First-level regulations of shellfish growing water might

include the simple closure of areas with obvious potential for fecal contamination. These regulatory closures might include prohibition of shellfish harvesting in areas in which animal husbandry is being carried out close to the shore such as within about 200 meters of the Old Jeshwang site or at boat harbors or marinas such as those at Denton Bridge or Lamin Lodge. Shell fishing closures solely based upon risk assessment from shoreline surveys is consistent with the 2007 protocols of the NSSP. This is a simple first step that Gambian officials can undertake to assure public health.

Since the initial results indicate potentially favorable conditions for marketing raw shellfish, Government staff from the quality control laboratories of the Department of Water Resources, Department of Fisheries and the National Environment Agency underwent training in water quality assessment and enforcement at the central water quality control laboratory in Providence, Rhode Island in June 2011. Water quality data needs to be collected and analyzed for at least three consecutive years, until July 2013, in order to have greater certainty concerning seasonal variations and long term trends.

Towards a Shellfish Sanitation Plan

A draft National Shellfish Sanitation Plan for The Gambia was jointly presented at an interagency meeting at the Ministry of Fisheries, Water Resources and National Assembly Matters in 2011 by individuals who underwent training in the US. The meeting included three representatives of the Agriculture Committee of the House of Representatives of The Gambia. The aim was to start laying the foundation for a shellfish sanitation program including traceability standards that would be appropriate in The Gambia. Such a program would need to involve multiple agencies, so the institutionalization of interagency cooperation and commitment of human resources and funding would be essential to make such a program work. Although initial water quality results are encouraging, the marketing of raw oysters to be eaten raw by the consumer is not a realistic goal for 2011/2012. Initial priorities are to establish a Gambian shellfish sanitation program that could provide local markets with a safe raw or fresh product, especially for hotels and restaurants catering to European tourists. Obtaining export certification for an export product is a longer-term priority. In the near term, the *Ba Nafaa* Project will support improvements in water and sanitation at

one or two oyster landing sites in 2012/13.

Shoreline Sanitation Survey

In addition to in situ water quality testing, shoreline sanitation survey techniques enable decision makers to identify areas of critical threat to shellfish sanitation. In June 2011 a Shoreline Sanitation survey of the Bund Road in Banjul was conducted as a pilot activity and training but a full shoreline sanitation survey of the Tanbi Wetlands National Park is needed as another element to establishing a shellfish sanitation program. In conjunction with water quality data, the results of this survey will provide the Cackle and Oyster Management Committee with critical information for ensuring the quality and safety of harvested shellfish.

4. Management Objectives

Several stakeholder meetings and workshops have been organized with the financial and technical support of the *Ba Nafaa* project, involving representatives from each of the communities harvesting cockles and oysters in Tanbi Wetlands National Park as well as other communities in the Western Region that are affiliated to TRY Association as members. These meetings and workshops have also included local leaders (Alkalos), legislative representatives, municipalities, and key Government agencies including Department of Fisheries, Department of Parks and Wildlife Management, Department of Forestry, and National Environment Agency. The meetings and workshops have built an understanding of the management issues and need for a new management approach. The meetings have also helped to outline an institutional framework for management that includes community-based committees for each harvesting village as well as a Tanbi ecosystem-wide management committee. Training workshops to discuss co-management concepts were also implemented to prepare the women with basic knowledge to start the co-management planning process. Importantly, all the stakeholders are supportive of the contents of this co-management plan including the main objectives for management and measures to achieve these objectives. Key objectives developed by the stakeholders are provided below. The management objectives are based on biological, ecological, social and economic issues-

Biological Objective:

- Sustainable harvesting of the cockle and oyster resources that prevents small sized juveniles from being harvested and allows larger more valuable oysters and cockles to be harvested.

Ecological Objective:

- Maintain the health and functioning of the mangrove ecology, thereby protecting important habitats of oysters and other shellfish, finfish, and marine mammals including the West African manatee, as well as mitigating Climate Change through carbon sequestration.

Social Objective:

- Strengthen Community Participation in planning, implementation and decision making in the rational and sustainable use and management of the oyster and cockle resources.

Economic Objective:

- Access to improved markets, financing, poverty reduction and food security among oyster harvesters.

5. Management Measures to Achieve Objectives

The Management measures have been adopted following an elaborate process involving PRAs at each community, a PRA validation workshop attended by participants representing all the cockle and oyster harvesting communities in Tanbi Wetlands National Park and surrounding communities in the estuary such as Kubuneh, Bafuloto, Kembujeh, Mandinaba, Kuloro and Kartong. The participants deliberated on management measures that will govern the fishery to ensure sustainability of the resources and conserve the ecosystem as well. This was followed by a consolidation workshop to which village heads (Alkalos), Municipalities, elected Councilors and concerned Government agencies/institutions participated. The following management and conservation measures are accepted by all communities:

5.1 Harvesting of Oysters and Cockles

- No harvesting of small sized cockles (approximately 25mm in length) and oysters (approximately 6cm in length)
- A closed season for harvesting Oysters for 8 months (July to February) and open season for 4 months (March to June) for all areas including exclusive community use zones
- There is no closed season for cockles.
- Axe must be used to remove oyster from prop roots of mangrove to avoid harvesting small-size oysters and at same time preserve the mangrove
- Professional I.D. cards for all collectors/harvesters
- No oyster harvester shall operate for more than two days at harvesting sites, but should adopt a shift system.

5.2 Community Exclusive Use Zones and Open Access Areas

The management measures include designation of certain Bolongs in Tanbi Wetlands National Park as exclusive zones for individual oyster communities (see figures 8 & 9). The following Bolongs are designated as exclusive community use zones-

1. KugijachBolong for Wencho
2. OubakauBolong for Karmalloh
3. KirinkiringBolong in Jeshwang
4. SismaiBolong in Ibotown
5. KalanBolong in Fajikunda
6. OgenbenuBolong in Abuko
7. SimatBolong in Lamin
8. KajuwesBolong in Kembujeh for Kembujeh, Kubuneh, Galoya and Bafuloto Cluster.
9. AllaheinBolong in Kartong
10. Yomba Bolong for Mandinary, Kerewan and Daranka Cluster

Within the exclusive use zones, communities can restrict access by individuals from outside the community and establish additional rules for management of the oyster and cockle resources in these areas as they deem necessary (e.g. closures longer than 8 months for all or part of these

belongs, daily harvest quotas, etc.)

Areas outside the community exclusive zones are open to harvesting by all members of TRY Association. The Association may restrict access to non-members or allow access under certain conditions such as after paying a user fee. TRY Association, through its Tanbi Cockle and Oyster management committee, can establish rules and penalties within these open areas that apply to all harvesters and as detailed in the section on Institutional Arrangements.



Figure 22. Community exclusive use zones and closed belongs in the Tanbi Wetlands

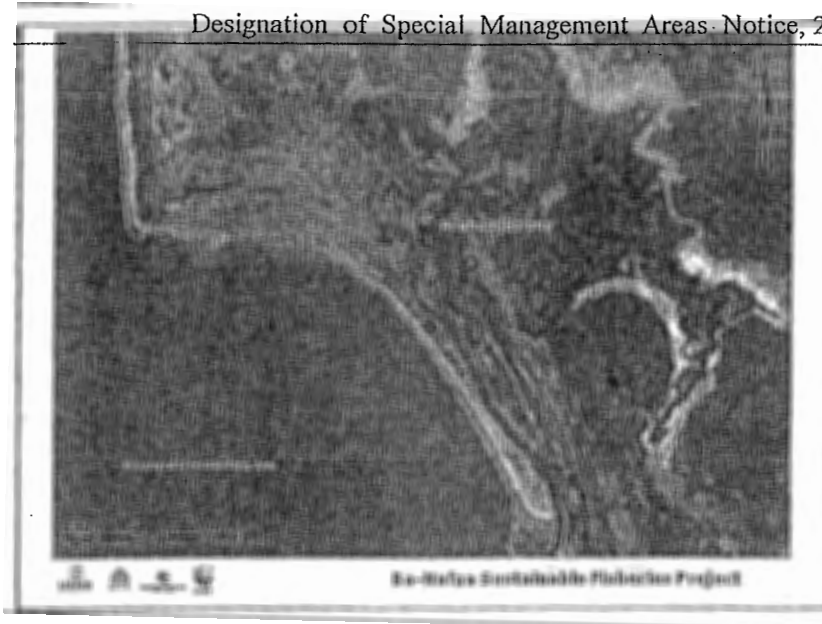


Figure 23. Community exclusive use zone and closed bolong in the Kartong Estuary

5.3 Marketing of cockles and oysters

The communities agree to the following rules on marketing of cockles and oysters-

- School children should not be engaged in the marketing of cockles and oysters and banned from selling at markets and roadsides as well as hawking in town.
- The handling, processing and marketing of cockles and oysters shall be performed under hygienic and sanitary conditions.

5.4 Penalties and Fines

The communities agree on the following penalties/fines for violation of rules established in this plan-

- A fine amounting to GMD 1,000 (One Thousand Dalasis) for harvesting small sized cockles/oysters.
- A fine of GMD 2,000 (Two Thousand Dalasis) if found harvesting in other community's Bolongs
- Oyster harvesters found harvesting on a daily basis shall pay a fine of GMD200.
- A fine of GMD 2,000 (Two Thousand Dalasis) for harvesting oysters during the closed season.
- A fine of GMD 2,000 (Two Thousand Dalasis) for persons found cutting down mangroves.

- Failure to pay fines shall result to seizure and sale of canoe.

It is the responsibility of TRY Association to enforce rules and collect fines from Association members and non-members violating the rules. A receipt must be provided to anyone who pays a fine and TRY Association should keep an accounting record of amount of fines collected and expenses from fine revenues. TRY Association can decide on how fine revenues will be used with the main intent to contribute to the objectives of this co-management plan. Non-members that do not agree to pay a fine or have their canoe seized will be reported to the community's Alkalo and the Department of Fisheries, and their assistance sought in helping to sanction violators as per this plan.

5.5 Alternative livelihood development

Alternative livelihood activities will be promoted by TRY Association for young generations to ease harvesting-pressure on the mangroves and shellfish resources.

5.6 Mangrove conservation

For the conservation of the mangroves, the communities agree to undertake joint monitoring, control and surveillance activities within the Tanbi Wetland National Park with the Department of Parks and Wildlife Management and engage in mangrove reforestation activities in communities where mangroves are being depleted.

5.7 Development of Oyster Aquaculture

The Government of The Gambia has long since realized the importance of aquaculture and its potential to increase national fish production while at the same time reducing the country's total dependence on capture fisheries for fish food supply. The development of subsistence, small-scale and commercial aquaculture is a stated Government policy although emphasis and focus has remained the development of capture fisheries.

In the late 1980's, the Department of Fisheries conducted research studies on the culture of the mangrove oyster of West Africa (*Crassostreatulipa*) under a project funded by the

Canadian International Development and Research Cooperation (IDRC). Results of the studies identified great commercial potential for the products but the market was not adequately developed. The rack system of culture employed by the research project proved a more efficient method for the exploitation of oysters and a more sustainable alternative than other existing harvest methods which used mangrove poles and was destructive to the mangrove ecology. Recommendations from this research were to encourage less destructive aquaculture methods, increase oyster production via aquaculture as well as improve access to credit facilities for the producers.

Mr. Daniel Theisen of the University of Maryland provided professional volunteer services via the *Ba Nafaa* project to conduct training and renewed trials on oyster culture in 2009. The nine communities within Tanbi Wetlands National Park were clustered into 6 groups for training on the construction of lattice racks using bamboo poles ranging from 5-9 cm in diameter, arranged in the form of an inverted "V" and tied together with galvanized wire and rope, stringing and hanging of oyster shells onto the bamboo poles. Following the end of the training, a demonstration aquaculture rack was constructed in each community. These racks also served the purpose of action research on spatfall to determine the best time to hang spat collectors for the purpose of oyster farming. These activities also indicated that oyster culture can be developed for several reasons: to protect the wild mature oysters as a source of spat, to protect the mangroves from damage during harvest, and the culture of oysters has the potential to improve the food security and the social welfare of the oyster harvesters.

Communities agreed to work with the Department of Fisheries on the continued development of environmentally friendly oyster aquaculture in the Tanbi Wetlands National Park. TRY Association via this co-management plan will have exclusive rights to oyster farming in the Tanbi Wetlands National Park and can establish rules if necessary concerning designation of individual or group farming plots. Community committees will establish rules concerning aquaculture plots within the community exclusive use zones.

Cockles are also harvested in the Tanbi Wetlands National Park and as well as in other estuarine areas in The Gambia, such as the small estuary in Kartong. As previously mentioned, cockle ranching to enhance yields is common in Malaysia whereby beds of dense cockle spat are harvested,

transplanted and broadcast to grow-out areas. These grow out areas can be allocated or leased to individual or community groups as grow out plots. The *Ba Nafaa* Project is conducting action research with TRY members in Kartong to determine if this ranching method is viable in The Gambia. If successful, then a cockle ranching plan will be developed for Kartong and could also be applied in the Tanbi area as well.

5.8 Research and Monitoring

The Department of Fisheries and The TRY Association will encourage research into improved practices of management and aquaculture of oysters and cockles. These include oyster aquaculture research, market surveys, water quality studies and oyster spawning studies, and the research on transplant of oysters and cockles from high spat density areas to low density areas (such as the trial being conducted in Kartong), among others. Cooperation with donor projects, universities and NGOs to assist in conducting relevant research and monitoring is encouraged. Research related to Climate Change will also be encouraged. Relevant areas of research include both:

- Measures for adaptation to the potential impacts of Climate Change on the Oyster and Cockle fisheries.
- The potential for oyster and cockle management practices in The Gambia to contribute to Climate Change mitigation.

Potential themes related to Adaptation Measures-

Ocean Acidity: Excessive mortalities of larval oysters in hatchery tanks due to acid conditions brought on by excessive carbon dioxide dissolved in the seawater supply have recently been documented in the United States (Grossman, 2011). This is parallel to some recent laboratory studies that have shown that tiny juvenile shellfish such as oysters and clams may experience shell erosion or even mortality if exposed to acidic sediments (Talmage, 2009; Watson, 2009). Availability of carbonate for shell formation is strongly influenced by pH, with lesser carbonate available as carbon dioxide dissolves in seawater and pH levels decrease. Climate models predicting carbonate availability in ocean waters in the year 2070 if current trends in world carbon dioxide production continue at the present rate suggest that carbonate availability for shell formation would be reduced to

marginal levels in tropical and subtropical waters, including Gambia and Senegal (Watson, 2009; Mucci, 1983). In this context, the oyster and cockle fisheries of Senegal and Gambia may be enhanced by management of shellfish beds and aquaculture development that takes increasing ocean acidity into account. Various aquaculture strategies such as returning shucked shells to the water can act to buffer sediments and bottom water against the effects of carbon dioxide acidification, thereby enhancing bivalve larval sets and juvenile survival (Green, 2004; MacKenzie, 1983). Even before the relationship between sediment pH and the effect on shells of developing shellfish was known, the use of oyster shells as an effective setting cultch for tropical mangrove oysters, aiding in spat survival was demonstrated (Devakie, 1993). In some cases, public policy aimed at maximizing oyster production has included laws requiring return of shucked oyster to harvest grounds to promote sustainability of oyster fisheries (Rice, 2008). A number of studies suggest that aquaculture of seaweeds and filter-feeding bivalve mollusks in the world's oceans may be a means for combating ocean acidification by serving to take up and sequester nutrients and carbon, and allow for their removal upon harvest (Smith, 2011; Rice, 1999).

Sea level rise: Current information on predicted sea level rise due to climate change indicates at least 2 key issues-

1. That inundation of coastal fishing communities, including vulnerability of infrastructure at shellfish landing sites needs to be understood and considered in decision making. The Bund Road levee system in Banjul on the border of the Tanbi Wetland is also particularly vulnerable.
2. That mangrove ecosystems may migrate inland as sea level rise occurs. For systems such as the Tanbi Wetlands, where inland zones are fully developed and mangroves cannot migrate, sea level rise may mean a reduced wetlands area. In this case, intensified aquaculture efforts may be an important adaptive measure to make up for lost natural oyster habitat. For other mangrove systems, management planning might include specification of buffer zones restricted to development along the inland edges of the wetland.

Potential themes related to mitigation measures-

Recent research indicates that the tons of carbon dioxide equivalent per hectare contained in Oceanic and Estuarine Mangrove ecosystems are two to three times that of tropical forests and that the majority of this is held in soil organic carbon rather than in the living biomass. Documenting the extent to which sustainable, ecosystem-based co-management of oyster and cockle fisheries contributes to the maintenance and even the expansion of these ecosystems will be increasingly important. Climate Change Mitigation services provided by these ecosystems and those who manage them have international economic value and markets to compensate for this value are expanding (Murray et al., 2011).

6. Institutional Arrangements & Legal Framework for Management

The area of coverage for this co-management plan includes all of the marine and intertidal waters within The Tanbi Wetlands National Park. The Park was designated as a Ramsar site on World Wetlands Day in 2007. The Government of The Gambia decided that the 6,304 hectare mangrove system was important because of high biodiversity, and diverse and rare ecosystems with valuable marine resources, and the desire to keep this important ecosystem healthy, promote sustainable livelihoods and not use destructive means of harvesting. Under Section 14 of the Fisheries Act 2007, the Tanbi Wetlands National Park, which is a marine protected area, can also be designated as a special management area for the purpose of community-based co-management in the interest of conservation, management and sustainable utilization of fisheries resources. The Wildlife Act, the Forest Act and the National Environment Management Act are all relevant to the management of the Tanbi Wetlands National Park, and are therefore to be harmonized with the Fisheries Act. The Tanbi Wetlands National Park is under the responsibility of the Department of Parks and Wildlife Management; the Department of Forestry has responsibility over the mangroves; the Department of Fisheries has responsibility over the fisheries resources including oysters and cockles; and the National Environment Agency is the umbrella agency for all environmental management matters which includes the management of national parks and all other areas of the country. The activities of the stakeholders within the coastal zone (which includes the Tanbi Wetland National Park) will be coordinated through the Coastal and Marine Working

Group. The Working Group includes, among other stakeholders, the Department of Parks and Wildlife Management, Department of Fisheries, Department of Forestry and the National Environment Agency as Chair.

6.1 Designation of the Tanbi Wetlands National Park as a Special Management Area

As per Section 14 of the 2007 *Fishery Act* and Regulations of 2008, the area congruent with the boundaries of the Tanbi Wetlands National Park is hereby declared a special management area solely for the purpose of community-based management of the cockle and oyster fisheries. TRY Association is hereby authorized as having exclusive use rights to the oyster and cockle resources within the Park. Associated with the allocation of these use rights comes the responsibility for TRY Association to manage these resources in a responsible manner that prevents their overexploitation and use good harvest practices that help conserve associated habitats, flora and fauna.

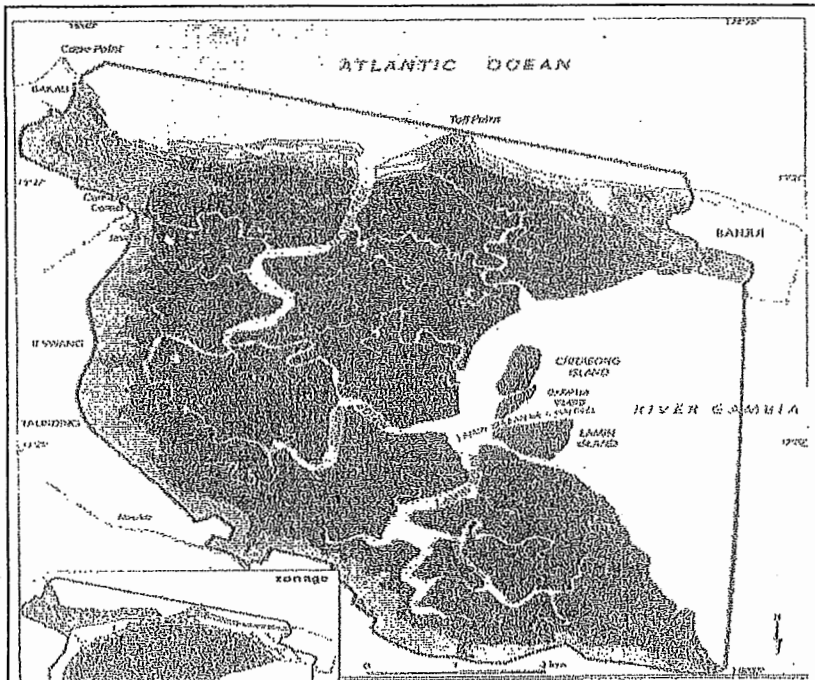


Figure 24. Boundaries of the Tanbi Wetland National Park which also serve as the boundaries for the special management area solely for the purpose of community-based management of the cockle and oyster fisheries.

6.2 Tanbi Cockle and Oyster Fishery Management Committee

TRY Association is hereby authorized to establish a Management Committee for the purposes of managing the cockle and oyster resources in the Tanbi Wetlands National Park. The TRY Association shall decide on the make-up, duration of membership, and how committee members shall be appointed. This committee shall have the authority to set and change management measures applicable throughout the Tanbi special management area, to designate exclusive community use zones, and is authorized to enforce rules, assess fines and seize gear and equipment of violators. Specific authorities include the following-

- Set length of seasonal closures of oysters and cockles and timing of openings for each
- Establish minimum size limits
- Designate community exclusive use zones
- Restrict the number of harvesters collecting in "open" areas - outside of community exclusive use zones
- Charge user fees or license harvesters in "open" areas - outside community exclusive use zones
- Restrict harvesting only to Tanbi Wetlands National Park community residents or open to non-community members under certain conditions (e.g. charge an access fee)
- Establish permanent closures or closed areas for periods longer than the annual Tanbi-wide closure in "open" areas - outside community exclusive use zones
- Require traceability of product from harvest areas to end consumers for any product sales intended for raw consumption
- Establish closed areas anywhere in Tanbi special management area for reasons of seafood safety due to water quality contamination or risks
- Establish penalties including fines not to exceed Dalais5000 for violations of rules, and for repeat

offenders, can confiscate harvest gear or ban individuals from further harvesting for a period up to one year

- Rules need to be approved by the majority of the TRY management committee in a meeting where a quorum (majority) of committee members are present and noted in written minutes. Rules must be communicated to all TRY members via TRY community committees verbally or in writing within 14 days and transmitted for information purposes only (not approval) to the Department of Fisheries, Department of Parks and Wildlife Management and Department of Forestry for assistance in enforcement and as a basis of annual audits and to ensure consistency with existing national laws and regulations.
- Communities shall be trained on cockle and oyster safety and quality assurance.

6.3 Community Based Management Committees

Under the Tanbi Cockle and Oyster Management Committee, community-based committees will be established for the purposes of managing the cockle and oyster resources in the Tanbi special management area. The Tanbi Cockle and Oyster Management Committee shall decide on the make-up, duration of membership, and how community-based committee members shall be appointed. These community-based committees shall have the authority to set and change management measures applicable only within designated exclusive community use zones established in this co-management plan or in other areas designated by the Tanbi Cockle and Oyster Management Committee. Community-based management committees can establish the following type of measures within their zones-

- Set daily quotas on harvests of individuals from community zones during open seasons
- Establish daily closures on harvests from community zones during open seasons (e.g. no harvesting on Monday, Wednesdays and Fridays. or on Tuesday and Thursday, etc. or alternate who can harvest on which days)
- Restrict number of harvesters collecting in exclusive use areas
- Charge user fees or license harvesters

- Restrict harvesting only to local community (exclude non-community members) or open to non-community members under certain conditions (e.g. charge an access fee)
- Establish permanent closures or close areas for periods longer than the annual Tanbi-wide closure.
- Establish penalties including fines not to exceed GMD 5000 for violations of rules, and for repeat offenders, can confiscate harvest gear or banned from further harvesting for a period up to one year

Community-based committees cannot-

- Set a size limit smaller than Tanbi wide size limit (if established), but can be larger.
- Set a seasonal/annual closure less than the Tanbi wide closure, but can be longer.

Rules established for community exclusive use zones need to be approved by the majority of the TRY community-based management committee members. These must be endorsed by the Alkalo either verbally in a TRY community meeting or via a letter. Rules take effect once they are announced in a TRY community wide meeting and verbally explained. Rules should be transmitted verbally or in writing to TRY Tanbi-wide management committee for information purposes and review to ensure they do not contradict Tanbi-wide rules.

6.4 Tanbi Advisory Committee

- Membership: One member who is a local representative to a Municipal council who serves a chair, Department of Fisheries, Department of Parks and Wildlife Management, Department of Forestry, National Environment Agency, National Nutrition Agency and the National Consumer Group.
- Advises the Tanbi-wide management committee on management plan performance and provides technical services on status of stocks and other ecosystem issues relevant to management of the cockles and oysters.
- Makes recommendations to the Director of Fisheries and Minister of Fisheries, Water Resources and National Assembly Matters on status of plan implementation and performance and if interventions to correct deficiencies are required.

6.5 Role of the Department of Fisheries

- Endorses approval of the overall co-management plan to the Minister of Fisheries, Water Resources and National Assembly Matters.
- Approval by the Director of Fisheries of substantive changes in plan goal or objectives, in consultation with Director of the Department of Parks and Wildlife Management.
- Conduct annual audits of plan implementation in collaboration with the Department of Parks and Wildlife Management to assess whether management objectives are being met or progress towards objectives is satisfactory.
- Require the TRY management committee to revise management plan rules if not making progress towards sustainability objectives and goal.
- Review all rule changes annually in collaboration with the Department of Parks and Wildlife Management, Department of Forestry and National Environment Agency and advise TRY management committee on technical soundness to prevent overexploitation of cockles and oysters and to meet other management objectives.
- Establish a shellfish sanitation program for oysters and cockles that may include-
 - Establishing closed areas for reasons of seafood safety due to water quality contamination or risks
 - Requiring and setting as needed, traceability requirements and procedures for harvest, sale and distribution of product intended for raw consumption
 - Establishing fines for any harvester or seller in the value chain of the product intended for raw consumption that does not have traceability labels
 - Establishing sanitary standards and criteria for harvest and distribution of product intended for raw consumption
 - Establishing fines for any harvesters taking product intended for raw consumption in violation of traceability rules, or sanitary requirements or harvest prohibitions
 - Establishing water quality monitoring protocols to ensure harvest of safe shellfish
 - Conducting water quality monitoring (directly or via interagency agreements w/ other agencies

laboratories) and implement other shellfish sanitation plan actions as may be required

- Promoting sustainable aquaculture and ranching of oysters and shellfish among TRY members.
- Assist TRY in developing value added products and expanding marketing opportunities locally, regionally and internationally.
- Approves overall co-management plan.
- Assist TRY in enforcement of management rules.
- Promote research and monitoring that aide in management, including adaptation measures for climate change impacts.
- Assist with implementation of management measures as requested by the Tanbi Cackle and Oyster Management Committee.

6.6 Role of the Department of Parks and Wildlife Management, Department of Forestry and National Environment Agency

- Recommend the approval of the overall co-management plan to the Minister of Forestry and Environment.
- Assist TRY Association in enforcement of management rules.
- Promote research and monitoring that aide in management.
- Assist with implementation of management measures as requested by the Tanbi Cackle and Oyster Management Committee.
- Substantive changes in plan goal or objectives require approval by the Director of Fisheries in consultation with Director of the Department of Parks and Wildlife Management, Department of Forestry and National Environment Agency.
- Cooperate with the Department of Fisheries on annual audits of plan implementation and changes in rules to ensure consistency with national forestry, biodiversity and wildlife laws, regulations and policies and with the TWNP management plan.
- In collaboration with the Department of Fisheries conduct annual audits of plan implementation to assess whether management objectives are being met.
- Monitor essential habitat quality (status of mangrove ecosystem).

- Conduct research on Vulnerability Assessment and impacts of Climate Change.
- Coordinate the activities of the stakeholders within the coastal zone through the Coastal and Marine Working Group.

7. Monitoring and Evaluation of Plan Performance

The Tanbi Cackle and Oyster Fishery Management Committee of TRY will periodically review progress on meeting the objectives of this co-management plan, at least annually. The review should be conducted with advisory committee members, or discussed in a meeting with the advisory committee after the committee's deliberations and review. Such periodic reviews should specially look at-

- Issues concerning degree of compliance with management measures and rules, including closed seasons, closed *bolongs* and minimum sizes and marketing restrictions
- Difficulties, if any, in implementing enforcement actions and penalties
- Status of funds obtained from fines – amount collected and if any disbursed or expensed
- Issues, if any, concerning operations of the Tanbi-wide committee and the community-based committees
- Degree to which biological, ecological, social and economic management objectives outlined in the plan are being met including-
 - Review of the length of the closed season for oysters and cockles in relation to allowing them to grow to mature and more marketable sizes.
 - Status of oyster and cockle stocks and harvesting pressure: Are sizes getting smaller? Is it taking longer to collect the same amount? Are more people harvesting? What additional management measures may be needed to better control total harvest and catch rates?
 - Group marketing issues if any
 - Impacts of alternative livelihood activities, mangrove conservation, and aquaculture activities?
- Priority actions the management committee must take

in the near term for managing the oyster and cockle fishery

Issued this 27th day of November, 2013

HON. MASS AXI GYE
MINISTER OF FISHERIES AND WATER RESOURCES