Fishery Co-Management Plan
For The Gambia Sole Complex

(focus on artisanal fisheries sub-sector)

January 2012

Ministry of Fisheries, Water Resources and National Assembly Matters

REPUBLIC OF THE GAMBIA

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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, the Fisheries Act of 2007, Section 14 and associated regulations of 2008, provide the authority for the Minister of Fisheries, Water Resources and National Assembly Matters 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 Fisheries Act of 2007, Section 11 and associated regulations of 2008 provide the authority of The Minister of Fisheries, Water Resources and National Assembly Matters to allocate property rights over fisheries resources,

WHEREAS, the Fisheries Act of 2007, Section 15 and associated regulations of 2008, provide the authority for the Minister of Fisheries, Water Resources and National Assembly Matters 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 9 nautical miles.

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.

Signed:_____[signed]_____ 17Jan. 2
Minister of Fisheries, Water Resources and National Assembly Matters Date

Concur:
_____[signed]_____ 17Jan. 2012
Director, Department of Fisheries Date

_____[signed]_____ 17Jan. 2012
President, NASCOM Date

REPUBLIC OF THE GAMBIA

Chapter 1: Introduction

Worldwide, there are over 500 species of flatfish including flounders, sole, turbots, 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.

Management plans become living documents with frequent review and amendments to adjust to changing fishery and environmental conditions.

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 US Agency for International Development (USAID) funded Ba Nafaa 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 25 kg 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 a 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, Tendeba 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, *Synaptura cadenati* 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. Tendeba 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.

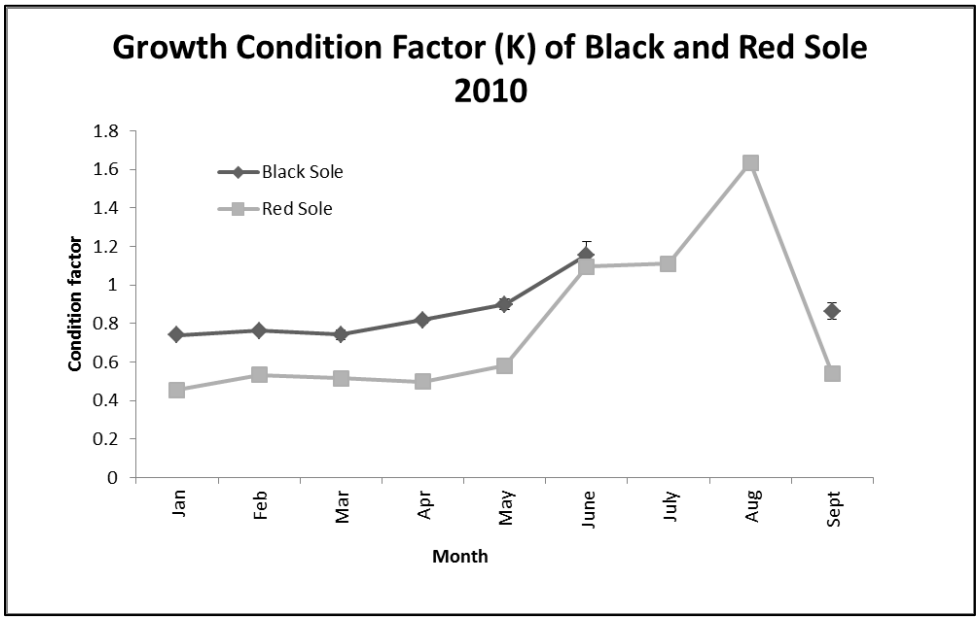

Figure 3. Condition factor of black and red sole.

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.

Figure 4. Eggs are clearly visible in the processed product.

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).

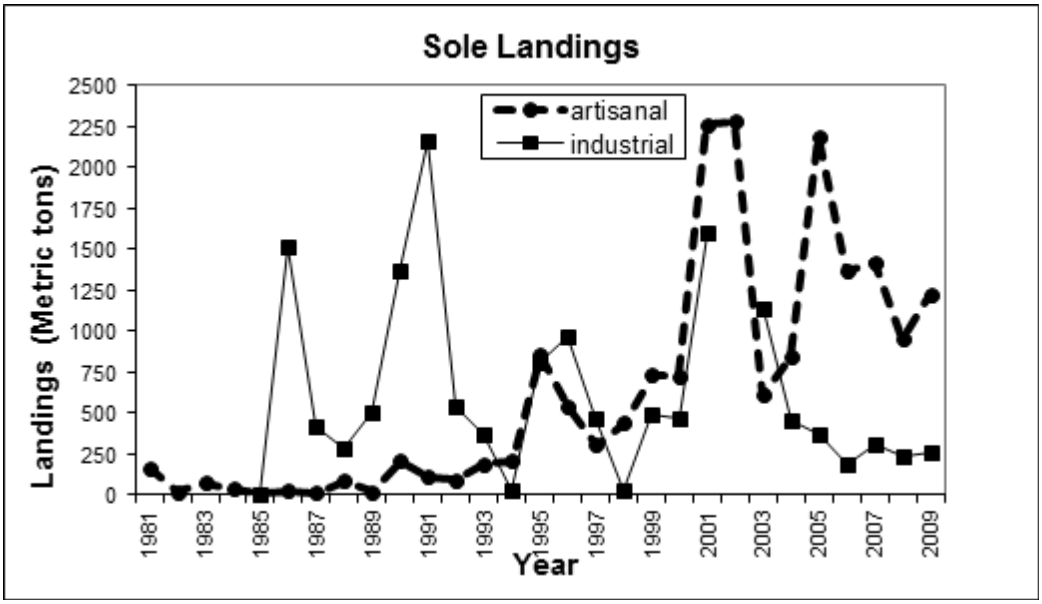

Figure 5. Sole landings (in metric tons) by artisanal and industrial fleets (Source: The Gambian Department of Fisheries).

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 6. 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 7. 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 – 3000 m long.

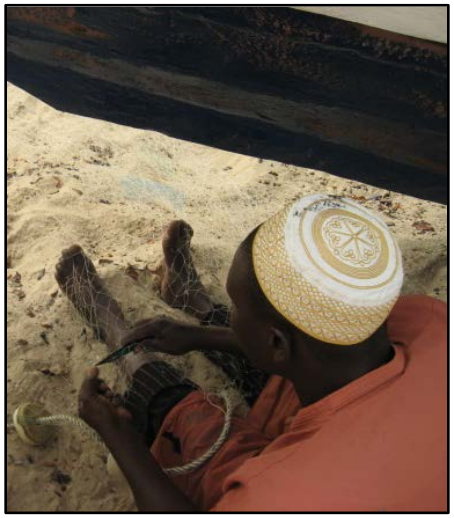

Figure 8. Repairing a monofilament gillnet.

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 Ba Nafaa 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 though 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 9. (a) Sole entangled in a gillnet hung without a hanging ratio, (b) Illustration of a gillnet in strong current without proper floatation.

3.4 Other Gear Types

Figure 10. 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 madeiran sardinella *(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 30 cm. 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.

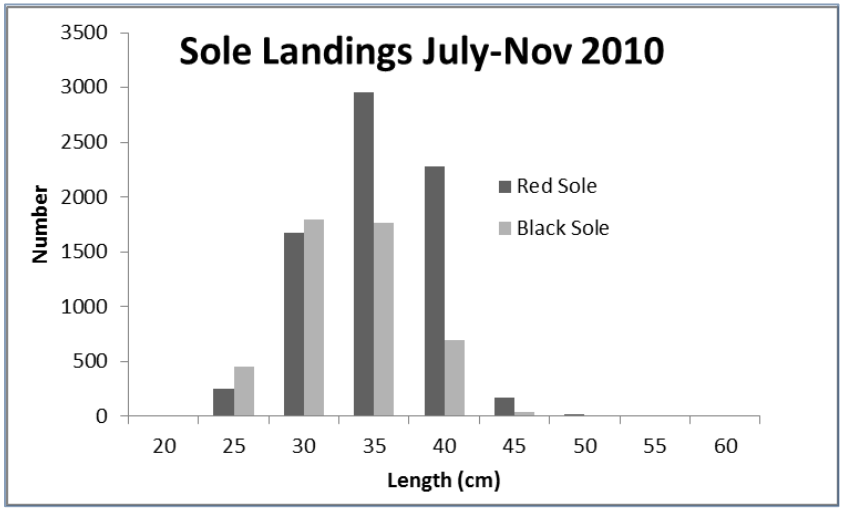

Figure 11. Length frequency of red and black sole captured by gillnet in four main landing sites (Kartong, Sanyang, Brufut and Gunjur).

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 (*Cymbium cymbium, Cymbium pepo, 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
Cymbium cymbium	3.3	3.7	7.2	7.8
Cymbium pepo	20.97	9.4	6.8	18.45
Cymbium glans	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
Arius latiscutatus	39.4	27.7	14.8	30.9	high
Pomadasys jubelini	8.0	4.8	8.9	15.1	low
Pseudotolithus typus	4.9	5.7	8.1	15.6	med
Scomberomorus tritor	4.9	0.03	0.55	0.2	-
Cynoglossus senegalensis	4.9	12.6	8.6	8.3	target
Pseudotolithus senegalensis	3.1	13.5	8.7	3.1	med
Pseudotolithus brachynathus	1.7	3.4	9.9	0.09	med
Pseudotolithus elongatus	1.2	0	5.9	1.2	med
Plectoryhnues mediterraneous	1.2	0.06	5.4	0.7	low
Synaptura cadenati	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 Niumi 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 accidently 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.

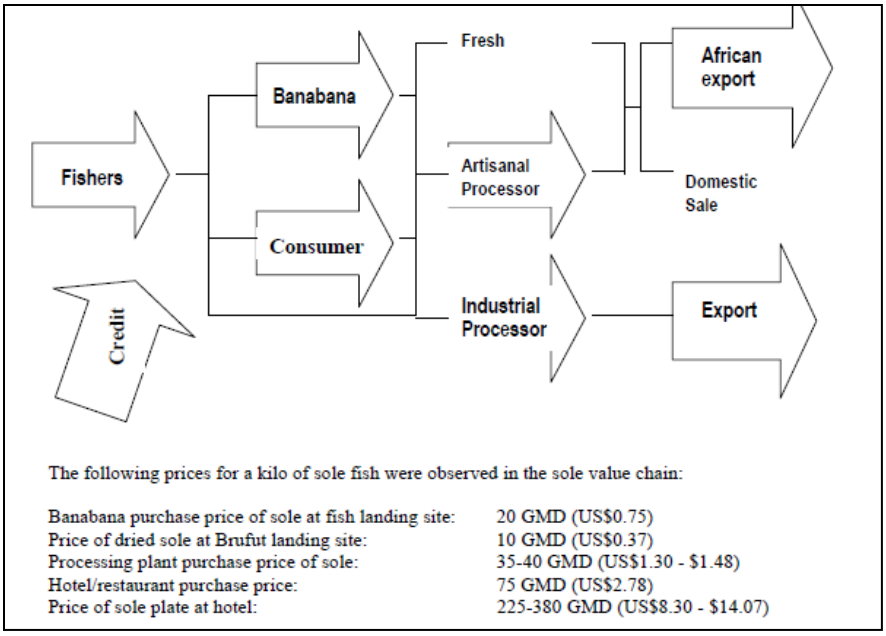

Figure 12. Value chain for The Gambian caught sole.

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 consider 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.

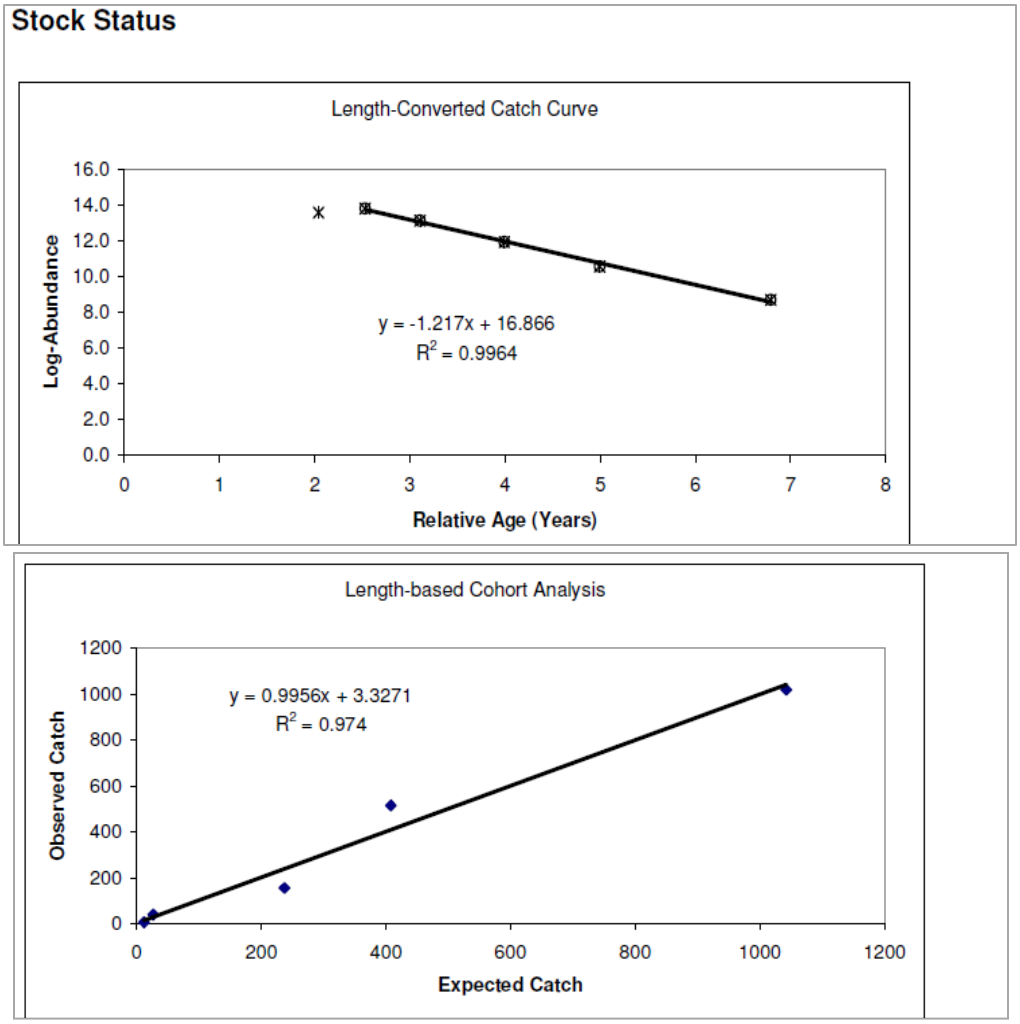

Figure 13. Length converted catch curve and length based cohort analysis.

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 60 cm 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 30 cm, 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 27 cm. 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 SPR 40% can be seen as a reasonable target, SPR 30% a trigger point for specific management action and SPR 20% 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. Generate employment opportunities for Gambian nationals
2. The effect a rational and long term utilization of the fisheries resources
3. To improve the nutritional status of the population
4. The 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 processers
  - 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 May1 through October 31. This will be for all fish species and gear types.

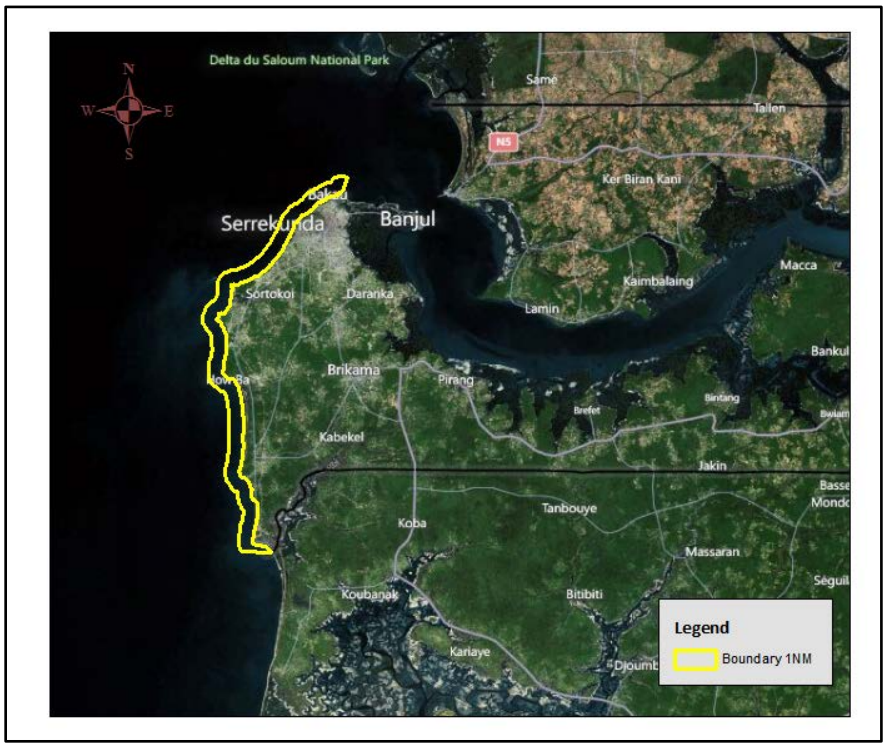

Figure 14. Map showing 1 nautical mile spawning closure area (yellow line).

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:

- 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.

- 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.
- NASCOM and the Department of Fisheries will jointly provide fuel for these activities in an agreed upon manner developed as an MOU.
- The 1 nm line will be marked using reflective buoys at 500m intervals by NASCOM and the Department of Fisheries and maintained by them.
- All fines are returned to the community and a portion will be returned to NASCOM to fund enforcement activities (fuel)
- 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, D 5,000 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 15. 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.
    - Require processors to submit graded quantities (species and sizes) on computer forms
    - 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.
    - Separate growth models need to be developed for red and black sole. This would require collecting otoliths.
    - 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.

- 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

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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

List of Acronyms

CFC	Commercial Fisheries Centres
CRC	Coastal Resources Center
EBFM	Ecosystem Based Fisheries Management
ETP	Endangered, Threatened and Protected Species
EU	European Union
FOB	Free on Board
GAMFIDA	Gambian Artisanal Marine Fisheries Development Association
GMD	Gambian Dalasi
GRT	Gross Registered Tons
HACCP	Hazard Analysis Critical Control Point
LACOM	Landing Site Committee
MSC	Marine Stewardship Council
MCS	Monitoring, Control and Surveillance
MV	Merchant Vessel
NASCOM	National Sole Co-Management Committee
NGO	Non-governmental Organization
SPR	Spawner-Per-Recruit
URI	University of Rhode Island
USAID	United States Agency for International Development
WWF	World Wide Fund for Nature