Marine Biodiversity Assets and Threats Assessment

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Gambia-Senegal Sustainable Fisheries Project

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Abbreviations and Acronyms

ADB	African Development Bank
AFDP	Artisanal Fisheries Development Project
BADEA	Arab Bank for Economic Development
CCLME	Canary Current Large Marine Ecosystem
CFC	Community Fisheries Center
CMC	Central Management Committee
DOF	Department of Fisheries
FAO	United Nations Food and Agriculture Organization
LME	Large Marine Ecosystem
NAAFO	National Association of Artisanal Fisheries Operators
GAMFIDA	Gambia Fisheries Development Association
NEA	National Environment Agency
DoF	Department of Fisheries
SUME	Sahelian Upwelling Marine Ecoregion
WAMER	West African Marine Ecoregion
WWF	World Wildlife Fund

BACKGROUND

The *Ba Nafaa* Project is a five-year regional initiative supported by the American people though the U.S. Agency for International Development (USAID)/West Africa Regional Mission. It is implemented through the University of Rhode Island (URI)-USAID cooperative agreement on Sustainable Coastal Communities and Ecosystems (SUCCESS). The World Wide Fund West Africa Marine EcoRegional (WAMER) Program is the regional implementing partner. Project activities are carried out in partnership with the Department of Fisheries (DoFish) and stakeholders in the fisheries sector in The Gambia and in Senegal. Most of the project activities focus on The Gambia.

Senegal and The Gambia are located within one of the most diverse and economically important fishing zones in the world - the WAMER. Over 1,000 species of fish have been identified, along with several species of cetaceans including dolphins and whales, and five species of endangered marine turtles. The coastal wetlands are globally significant breeding and over-wintering grounds for numerous migratory birds. However, this extraordinary biodiversity is threatened by overfishing. In partnership with the Government of The Gambia and WWF, this Ba Nafaa project aims to formulate, adopt and implement strategies to overcome unsustainable and destructive marine resource use practices that threaten biodiversity conservation in the Ecoregion.

USAID funds for this program are part of the U.S Congressional Earmark for biodiversity conservation within USAID. As such, it has certain requirements it must meet by law. The Agency's "biodiversity code" guides the Agency in determining what programs are included in the accounting toward the biodiversity earmark. Within the code are four criteria:

1. The program must have an explicit biodiversity objective, it is not enough to have biodiversity conservation result as a positive externality from another program;
2. Activities must be identified based on an analysis of threats to biodiversity;
3. The program must monitor associated indicators for biodiversity conservation;
4. Site-based programs must positively impact biologically significant areas.

This Biodiversity Assets and Threats Assessment of marine fishery related resources of The Gambia and Senegal is based on a desktop review of many reports and documents and a two-week visit to The Gambia and Senegal in June 2009. The fact finding trip included expert consultations; interviews with government officials, fishermen and women, and the private sector fishing industry; a two-day stakeholder workshop, and a meeting with The Gambia National Fisheries Advisory Committee. A list of individuals consulted is included in Appendix 1 of this report.

Objectives for the *Ba Nafaa* Project are based on this Marine Biodiversity Assets and Threats Assessment. Accordingly, key *Ba Nafaa* results are to:

- Contribute to government objectives of sustained and increased social and economic benefits for artisanal fishing communities including food security, increased income and employment.

- Build institutional capacity at all levels of governance to implement a fisheries co-management approach is strengthened in order to sustain socio-economic benefits for fisher folk and other beneficiaries in the market value chain.
- Reduce unsustainable and destructive marine resource use practices, including by-catch of marine turtles and juvenile fishes.
- Protect key habitats and marine areas important in the life stages of commercially important fish as well as threatened and protected species of marine turtles and mammals.

Within The Gambia, specific objectives are to:

- Strengthen the capacity of community fisheries centers to manage fisheries and engage in more effective enforcement of rules through training and learning-by-doing.
- Strengthen the capacity of the DoFish and community management committees to conduct fisheries stock assessments and implement community-based management plans.
- Identify and then implement opportunities for improvements in the value chain of the key species of economic importance, including export opportunities that provide socio-economic benefits to Gambians.
- Establish community-based protected areas to serve as critical habitats for marine turtles and mammals and as spawning and nursery grounds for commercially important fish.

Project Strategies

- A participatory co-management approach that engages fisherfolk in decision-making.
- An ecosystem-based approach that looks not only at the fish, but protection of critical habitats and reduction of fishery impacts on threatened marine species
- Mainstreaming gender dimensions that provide opportunities for both men and women to benefit economically and participate in decision-making.
- A threats-based approach to coastal and marine biodiversity conservation.

Regionally, the *Ba Nafaa* Project aims to:

- Strengthen regional management of shared stocks by addressing licensing and registration issues for domestic and foreign fishermen.
- Improve international trade competitiveness through harmonized policies.
- Increase regional cooperation for conservation of marine turtles and mammals.
- Promote bilateral exchanges of communities and government officials to share lessons and experience in improved management of fisheries.

THE MARINE BIODIVERSITY ASSETS OF THE WEST AFRICAN MARINE ECO-REGION

Introduction to the West African Marine Eco Region

Senegal and The Gambia are centrally located within the West African Marine Eco-region (WAMER) that spans 3,500km of the coasts of Mauritania, Senegal, The Gambia, Cape Verde, Guinea Bissau, and Guinea (Figure 1 and Table 1).

Fig. 1: Map of the West African Marine Eco Region (WAMER)

Source: WWF-WAMER, 2003

At the southern edge of the Sahara desert, the region is the northern limit of distribution for a large number of coastal and marine animals and plants. Coastal habitats in the region are diverse; they vary from the desert sandy shores of Mauritania in the north, through deeply indented, estuarine and island coasts (e.g. Guinea-Bissau and the Gambia), to the lagoonal coasts with their extensive barrier beaches on the Gulf of Guinea (UNEP, 2007). The Senegal, Volta and Niger rivers are dammed variously for agricultural irrigation and hydropower, altering the nature of water and sediment discharge to the coast (UNEP, 2007). The Gambia River, however, is not yet dammed and is lined with extensive mangrove forests along the tidal stretches.

The estuarine wetlands of the region are globally significant breeding and over-wintering grounds for numerous migratory birds. The countries have designated ecologically significant reserves, parks, and protected areas. These include but are not limited to the Sine-Saloum Delta Biosphere Reserve in Senegal and in The Gambia to the Niumi National Park, the Baobolon Wetland Reserve, and the Tanbi Wetland Complex—all are designated Ramsar sites and contain globally significant wetlands (Figure 2).

Table 1: Characteristics of the WAMER countries

	Mauritiana	Senegal	The Gambia	Guinea Bissau	Guinea	Cape Verde
Total Area (km^2)	1,030,700	196,190	36,120	289,587	289,587	4,033
Exclusive Economic Zone (EEZ) (km^2)	141,334	147,221	20,530	86,670	96,973	742,438
Length of Coastline (km)	754	718	80	350	320	965
Population (millions) 2009	3,129,486	13,711,597	1,782,893	1,533,964	10,057,975	429,474
Population growth rate (%) 2009	2.399%	2.709%	2.668%	2.019%	2.572%	0.561%
Value of fishing industry (USD) 1999	184,600,000	457,120,000	4,400,000	51,400,000	98,456,000	9,885,000

Source: Earthtrends (WRI), CIA Factbook

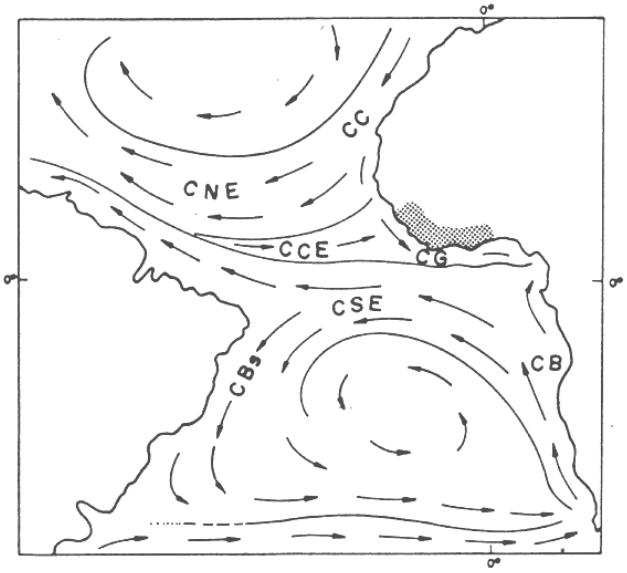
Marine Biodiversity Assets in the WAMER

The WAMER is one of the world's most biologically outstanding marine habitats, ranking among World Wide Fund for Nature's Global 200 eco-regions, (WWF, 2009 a). Four species of endangered marine turtles: green turtles, hawksbill turtles, loggerhead turtles, leatherback turtles, nest in this region. Additionally, the region is the most important breeding site in the world for the highly endangered monk seal. The region hosts 20 species of endangered cetaceans (including the Humpback Whales) and the severely threatened West African Manatee It is classified as a rare species. The sawfish- an emblematic fish of the eco region- is endangered (WWF WAMER, 2003). Areas of international, regional and local significance within the WAMER are shown in Figure 2. The stretch from the Saloum Delta in Senegal, The Gambia River and the entire coastline of the Gambia, as well as the Casamance river system is one contiguous area that has regional biodiversity significance.

This remarkable marine biodiversity is sustained by upwelling from oceanic currents.The seas off Mauritania, Senegal and TheGambia form part of the Canary Current large marine ecosystem (LME), sustained by the cold, southward flowing Canary Current, with

its nutrient-rich coastal upwellings. Countries from Guinea-Bissau to Nigeria flank the Guinea Current LME which is sustained by the eastward-flowing warm Guinea Current (Fig.3). These powerful oceanic currents create a tremendously productive food chain that supports one of the most diverse and economically important fishing zones in the world. Over 1,000 species of fish have been identified, along with several species of cetaceans including dolphins and whales, and five species of endangered marine turtles. This immense productivity is further enhanced by several major river/estuary/delta complexes that provide additional influx of nutrients and sediments to the marine realm, adding to its biological productivity.

Fig. 3: The Canary Current, The Equatorial Counter Current and the Guinean Current



Source: http://www.fao.org/docrep/003/u1509e/U150902.gif

Fish that spawn in northern nurseries seasonally migrate southwards (as do the fishermen) and provide food for human fishing communities along the way. In addition, recent satellite tracking has confirmed that green turtles lay eggs along the remote beaches of Guinea Bissau and travel northwards through Senegalese and Gambian waters to graze in the rich sea grasses of Mauritania. In short, the unique combination of climate and upwelling supports species and habitats that represent critical resources locally, nationally, regionally, and globally.

Fish: Over 1,000 species of pelagic and demersal marine fish have been identified in the region. Other species of significance include sharks, rays, tuna and hake. More than half of the commercial catch comprises small pelagic clupeoids (herring, sardines and anchovies) (UNEP, 2007). Many coastal wetlands support important fisheries. Fish that spawn in northern nurseries seasonally migrate southwards (as do the fishermen) and

provide food for human fishing communities along the way (WWF, 2009). Marine fisheries make an important contribution to food security, employment and national income to each of the countries in the region. However, a look at the current fishery stock shows alarming decreases in average size of fish caught, as well as reductions in Catch per Unit of Effort (CPUE) for various species.

Marine Mammals: The region is home to several species of cetaceans including dolphins such as the bottlenose and humpback dolphins, and whales, the West African manatee and a colony of 100 monk seals—the largest breeding colony on earth (UNEP, 2007). In Mauritania, an estimated 23 per cent of the mammals are now at risk (WCMC 1992).

Turtles: The region is home to four species of marine turtles1) green turtles (*Chelonia mydas*) 2) hawksbill turtles (*Eretmochelys imbricata*;) 3) loggerhead turtles (*Caretta caretta*) 4) leatherback turtles (*Dermochelys coriacea*). All are classified as either endangered or critically endangered on the IUCN red list.

Birds/ Waterfowl: The wetlands and estuaries are globally significant breeding and over-wintering grounds for numerous migratory birds, including palaearctic migrants along their migration route between Southern Africa and Northern Europe. These include: waders, terns, herons, osprey, and other birds of prey. The WAMER is a significant part of the East Atlanic Flyway (WWF-WAMER,).

Invertebrates: Little is known about invertebrates in the WAMER**.** The most important commercially fished species are cephalopods and shrimp (UNEP, 2007).

Seagrass: Recent satellite tracking has confirmed that green turtles that lay eggs along the remote beaches of Guinea Bissau travel northwards through Senegalese and Gambian waters to graze in the rich sea grasses of Mauritania (WWF-WAMER, 2003).

Mangroves and Wetlands: Mangroves are abundant in the Niger Delta covering many thousand square kilometers, and also in Guinea-Bissau (2,366 km^2), Guinea (2,039 km2), Senegal (1,690 km^2) and The Gambia (UNEP-WCMC,2000). The delta wetlands of the Senegal, The Gambia and the Geba-Corubal rivers are prominent feeding grounds for migrant birds on the East Atlantic Flyway (FEOW, 2009).

Reefs: Coral reefs occur only in the Cape Verde Islands. Recently published studies have identified Cape Verde as both a centre of endemism, because of its unique and rare species, and as a top 10 global hot spot for coral communities (UNEP, 2007).

Direct Threats to Marine Biodiversity Conservation in the WAMER

1. Overfishing: More than a 1,000,000 tons of fish are landed in the WAMER annually (WWF, WAMER, 2003), generating approximately US$400 million per year, with Mauritania, Ghana, Senegal and Nigeria the main producers. Fisheries are the single most important source of foreign exchange and a key source of revenue for economic and

social development.. The fishery sector is a source of foreign currency, jobs and food for more than 22 million people in the region (WWF-WARPO, 2003).
The industrial fishing effort both from West African national and from distant foreign fleets is a major threat. European fleets are highly subsidized and are guaranteed access to the waters of this region through agreements conducted with the European Union. All the countries in the eco-region, except The Gambia, have fisheries agreements with the European Union (EU). For instance, Mauratania, has agreed to allow 200 boats flying the flags of some 13 EU nations to catch many species of fish in Mauritanian waters. The EU pays Mauritania 86 million euros ($125.8 million US) a year, which represents almost a third of Mauritania's national revenue[1]. The impact of Asian fleets from China, Taiwan, Korea, Japan are not reported, but are estimated by fishery experts to be highly significant. Other important pressures are coming from former Soviet countries. Despite increasing catches by foreign fishing fleets, the economic growth and social benefits from marine resources have not been realized in many Western African countries where these fleets fish (UNEP, 2007).

Competition between foreign vessels and artisanal fishing boats cause problems of safety at sea. Stock scarcity and technological development have persuaded artisanal fishermen to go far offshore and fish in the same areas as the foreign vessels. Some of these foreign vessels (and national industrial fishing vessels) illegally fish in the coastal areas reserved for artisanal fishing (up to 6 miles offshore). This leads to collisions between these vessels and the pirogues, which cause serious material damage and even loss of life (WWF-WARPO, 2003). The intrusion of trawlers in the six mile zone also contributes to destruction of benthic habitats on the seabed.

Over the past three decades, artisanal fisheries in West Africa have expanded tremendously. Landings by artisanal fisheries in Senegal, for example, have increased 6-fold in the last 30 years. Now, 80% of the Senegal’s catch, some 400,000 tonnes per year, is landed by artisanal fishers (WWF-WAMER, 2003). This development has been encouraged by many factors, such as state subsidises, priority access to most of the coastal fishing areas, technological development including motorization of the pirogues (the local wooden fishing boats), and increased access to the more lucrative European, Asian and American markets..

Significant changes in species composition and fishery patterns have occurred, due to overfishing, as shown by a decline in CPUE and the taking of immature fish by artisanal fishers (NOAA, 2003). As more boats search for fewer and fewer fish, there is a dramatic increase in the use of destructive, habitat-destroying fishing techniques such as dynamite fishing, bottom trawling, fine meshed beach seining and turning seines (WWF-WAMER, 2003). Traditional methods of local management have largely broken down and present management regimes cannot cope with the new situation. Moreover, most of the countries in the ecoregion have no long-term policies with a clear vision of priority actions to be taken in order to maintain the productivity of marine and coastal resources (WWF-WAMER, 2003).

[1] (http://www.reuters.com/article/latestCrisis/idUSL18150522)

2. Bycatch of endangered species: Increased fishing has also led to increased capture of endangered marine turtles, juvenile fish, and a massive expansion of the trade in shark and ray fins. Threats to marine turtles include harvesting and overexploitation of eggs, meat, and other products; as by-catch in gill nets and trawlers; and habitat degradation and destruction seriously depleted in others (WWF-WAMER, 2003). Conservation actions are impeded by the lack of/incomplete information regarding turtle habitats and their population dynamics. The capture of sharks and rays, considered as 'keystone species', is considered particularly destructive because of their presence at the top of the marine food chain thereby stabilizing whole marine communities. They reproduce very slowly and have already disappeared from some areas and are seriously depleted in others (WWF-WAMER, 2003).

3. Coastal wetland habitat loss: Despite being among the most biologically-productive ecosystems in Africa, wetlands are often regarded locally either as wasteland, habitats for pests and threats to public health or as potential areas for agriculture. As a result many coastal wetlands are being lost (GE0-2000).In Mauritania and Northern Senegal most of the mangrove is dead due to hypersalinity and long time drought occurrence. In these areas only species such as *Avicennia africana* and *Laguncularia racemosa* are found. From southern Saloum to the Gulf of Guinea, the mangrove is relatively healthy with at least six species: *Rhizophora racemosa, Rhizophora mangle, Rizhophora harrisonii, Avicennia africana, Laguncularia racemosa* and *Conocarpus erectus*.

There are four major threats to mangrove biodiversity:(i) Natural such as drought, (ii) cutting for domestic use, (iii) human infrastructure and (iv) upland clearance. The long period of drought during 1970s and 1980s caused extensive death of mangroves in The Gambia and Senegal. Die off of mangrove in Tanbi was of regional concern during the 1990's.With the come back of rain, mangrove regeneration is underway.

Cutting of mangrove for domestic use has many facets, including fuel wood for domestic cooking, fuel for boiling and smoking of fish and bivalves, cutting of prop roots by oyster collectors, cutting for roofing poles. These uses are not threats if well managed but lack of management plans and massive cutting (for smoking in particular) damage the ecosystem. Lack of a clear management system is a major threat to the mangrove.

Buildin g of infrastructure such as roads and dikes are major threats to the mangrove, In many areas such as the northern Saloum delta, road construction has destroyed hundreds of hectares of mangrove forest. Roads not only fill the wetlands, but when constructed with out culverts, thay restrict water flow through the mangroves sometimes causing irreversible changes.This is occurring even in the wetlands designated for consetvation such as theTanbi wetland or the Bao Bolong Wetland Reserve.

Cleareance of upland vegetation is a another threat to the mangrove wetlands. Lower density of vegetaion results in rapid flow of water and high erosion, which in turn causes high siltation or erosion of the mudfalt base for Rhizophora species growth.

Indirect Threats to Marine Biodiversity Consrevaton in the WAMER

1. Overpopulation: Coastal resource degradation is exeracerbated by an expanding coastal population, urbanization and industrial development. (UNEP, 2007). The coastal region is where most of the people live and where most of the industrial infrastructure is located, historically because of access to port facilities. Coastal cities are likely to continue to be nodes of population growth for the near future, where it is perceived that there are opportunities over the longer term for people to improve their economic well-being. Coastal areas are intrinsically attractive for growing populations to take advantage of rich biodiversity and marine fisheries, and the extensive coastal and offshore oil and gas fields. Both are perceived as key assets with potential for boosting economic development and alleviating poverty (UNEP, 2007).

The continuing growth of coastal populations, and in particular the increasing urbanization along the coast, is placing severe stress on the living resources through physical disruption and pollution, resulting in the degradation or loss of habitats that have crucial value in ecosystem services and biodiversity.

2. Development of Oil and Gas resources: During the last few years, off-shore oil prospecting has been increasing in the sub-region (Mauritania, Guinea-Bissau). Some prospecting efforts are or were carried out in protected marine reserves where, because of inadequate technological development and surveillance, the risk of serious pollution is high (UNEP, 2007).

3. Coastal Erosion: Coastal erosion by wave action has long been an important issue on the high-energy coasts of Western Africa. Reductions in the discharge of sand from the rivers due to damming and human settlement, the disruption of longshore sand transport by coastal engineering and the mining of beach sand for building constructions have exacerbated this process (UNEP, 2007). Coastal erosion has resulted in the loss of sea turtle and marine bird habitat.

4. Global Climate Change: Climate change is the latest emerging threat to biodiversity in Africa. It has already been identified as a contributing cause in the decline of amphibian populations, due to drastic reductions in the volume of water bodies after persistent dry weather in combination with intensified human activities along the shorelines. The damming of rivers, reducing the amount of freshwater and sandy sediment being discharged at the coast, contributes to the degradation of coastal wetlands and increased coastal erosion (UNEP, 1999). The potential impacts of climate change and sea-level rise, particularly with regard to coastal erosion and the inundation of coastal lowlands are important forces in altering the biodiversity of coastal habitats. In addition, global climate change might alter the offshore currents which would dramatically impact the fisheries thereby affecting the economy and food security of the people in the region.

5. Weak governance: The main impediment to the sustainable management of marine resources in West Africa, and therefore a major threat to conservation of marine

biodiversity is weak governance capability. In a 2003 report, WWF-WARPO identified the following specific weaknesses:

- insufficient high quality information that can serve as the basis for fishery management and development;
- inappropriate legislation or weak enforcement
- little involvement in the decision-making process by the local populations;
- shortage of resources for administrative entities responsible for fishery sector management and for research;
- national level implementation of isolated sectoral policies some of which can be detrimental to marine resources conservation;
- lack of coordination between conservation efforts at the regional level to conserve marine animals that move throughout the region;
- poor marine resources allocation policy, especially with regard to enforcing the fisheries agreements;
- lack of transparency in policy formulation, decision making and enforcement,
- globalization, which facilitates access to the more profitable European and North American markets, and stimulates trade in the high value species, thereby, in some cases such as shark and skate, jeopardizing sustainable exploitation.

Current Prioirties and Actions for Marine Biodiversity Conservation in the WAMER

1. Establish regional fishing regulations for foreign fleets: Regional fisheries agreements and regulations are essential to save one of the world's richest marine environments from overfishing by distant water fishing fleets. However, there is inadequate political consensus across the eco-region. Some countries are in favor of stronger regionalization while others are reluctant.

European fishing fleets have purchased access to West African waters as a result of fishing agreements negotiated by the European Commission, and paid for by the European taxpayer (SUME, 2001). At a time when EU fisheries agreements are coming up for renewal in the four WAMER countries, WWF's Western Africa Program Office, European Program Office and their Global Marine Program Office are combining forces to highlight issues associated with fisheries subsidies and agreements. WWF's contribution includes development of a Handbook for Negotiating Fishing Access Agreements (SUME, 2001).

2. Manage the Marine Protected Areas in each Country Well: The region hosts diverse coastal ecosystems and started to create MPAs by the end of the 70s to protect some key sites. Mauritania decided to dedicate one fourth of its continental plateau to marine conservation and countries like Guinea Bissau started in the 90s to set up coastal planning processes, including the creation of MPAs. Currently, the eco-region comprises three Biosphere Reserves, including the trans-boundary Biosphere Reserve of the Senegal River delta, 8 national marine parks, 18 other MPAs among which are 2 community based MPAs. The total area is about 0.95 % of the EEZ of these countries, not counting

the Biosphere Reserves. Fisheries managers and other stakeholders are more and more aware that MPAs play a role in resource management and the fisheries (WCPA, 2007).

In 2002 a regional strategy for networking MPAs was endorsed by 10 ministers in charge of environment and fisheries in 6 countries. This network, known as RAMPAO, receives support from the MAVA foundation, the Oak Foundation and the Dutch to develop common plans of work and act as a service provider for all actions of research, capacity building, technical expertise, management strengthening and fund raising to support the members. Task forces were developed to build capacity on marine surveillance, management effectiveness assessment, participatory approaches and co management systems. Some strong efforts still need to be made to improve scientific research, ecological monitoring and long term monitoring of changes (WCPA, 2007).

As a member of The Regional Marine Conservation Program in West Africa (PRCM), the regional MPAs network (RAMPAO), is collaborating with various plans of action to conserve different species and habitats. It is included in a regional collaborative promoting the integrated management of the coastal zone. WWF is leading this project with IUCN, FIBA and Wetlands International. WWF's 2012 Protected Areas Programme is working to enable governments to meet internationally to set targets for creating a global network of comprehensive, well managed, and representative marine protected areas by 2012. This target was adopted in 2004 by the 190 Parties to the Convention on Biological Diversity. for strategic activities at the ecoregional level. Planning and coordination take place at the ecoregional level while implementation is carried out at the national level (WCPA, 2007).

3. Designate national parks to protect habitats of endangered species: In order to protect the largest green turtle nesting site on the Atlantic coast of Africa, the João Viera / Poilão 500 km^2 MPA area has been designated a national park. It is located in the southern part of the Bijagos Archipelago in Guinea Bissau and includes the Poilão Island turtle nesting site (SUME, 2001).

There are many designated coastal wetland protected areas, with some twenty Ramsar sites [IBAs], notably in Mauritania, Senegal, Gambia, Guinea, Côte d'Ivoire, Ghana and Benin. Banc d'Arguin, in Mauritania, is a UNESCO World Heritage site; a 12,000 km^2 coastal wetland where the desert environment is juxtaposed with biodiverse coastal habitats along more than 180 km of shoreline. In 2001, new legislation strengthened the protection of the Park, which is also Africa's second largest Marine MPA. No fishing is allowed in the park, with the exception of traditional, non-motorised fishing by the local communities (UNEP, 2007).

4. Improve regional coordination of conservation and research:

- **West Africa Regional Fisheries Project (World Bank/GEF).** This US$65 million program of the World Bank/Global Environment Facility will be implemented through the Commissión Sous-Régionale des Pêches (CSRP). It serves eight countries in the region (Gambia, Senegal, Guinea Bissau, Guinea,

Cape Verde, Mauritania, and Sierra Leone) and has three objectives (World Bank, 2009):

1. Provide support to efforts to eliminate illegal fishing activities; curtail damage to resources and the loss of economic rent from the fishing sector; and create the conditions for the implementation of access rights and fishing capacity control.
2. Implement the governance and management structures necessary to control the use of marine fish resources, and prepare for a transition to an economic approach or wealth-based fisheries management system.
3. Support the implementation of a system of fisheries management based on access rights, which would have value and could be capitalized; encourage investments to increase the domestic value-added to seafood products; create mechanisms to capture and utilize a greater share of the value generated to finance social and public benefits.

USAID/West Africa would like to see the Ba Nafaa project contribute to the WB/GEF project objectives and, influence the direction of some of the downstream investments of this multi-year project.

- **Canary Current Large Marine Ecosystem (LME**). This is a seven country GEF project (Cape Verde, Gambia, Guinea, Guinea-Bissau, Mauritania, Morocco, Senegal) with main office in Dakar, Senegal. The overall objective of the project is to secure global environmental benefits by reversing (over time) the depletion of fisheries and conserving nursery and reproductive habitat of the Canary Current Large Marine Ecosystem (GEF, 2005).

- **Regional Fisheries Commission and Ministerial Inter-Governmental Committee**.

- **World Bank/GEF GIRMAC I and II**. Girmac I was only Senegal.

- **Abidjan Convention**. The Abidjan Convention is the Regional Seas UNEP program for the West Coast of Africa.

- **PRCM**. The Regional Coastal and Marine Conservation Program (PRCM in French), a coalition initiated by WWF, IUCN, Wetlands International, and FIBA, started in 2004 as a way to better coordinate the NGO conservation community. It currently involves some 50-60 government and NGO groups. There is a Steering Committee and funding at $18 million Euros for 4 years. Website: www.prcmarine.org. The home office is Mauritania.

Recommendations for Marine Biodiversity Conservation in the WAMER

1. Adopt more sustainable fishery practices for artisanal fisheries:

WWF recommends the following: "It is important to understand the growing interaction and conflict between the industrial and artisanal fishing sectors of these countries. This interaction and conflict between artisanal and industrial fishers is likely to grow with increased efforts to move the offshore economy to an onshore economy—by improving the general investment climate and necessary infrastructure and services for the fishing sector. In order to sustain the social and economic benefits that the artisanal sector brings to the developing nations, it is essential they become more organized and competitive. At least three things must happen. Traditional fishers must (1) become increasingly business-like and be given the economic incentives to improve all aspects of their operations; (2) improve their product-stream (e.g., consistent supply, high-quality, value-added products); and (3) take self-responsibility for the sustainability of the natural resources upon which they, the fishers, depend". (WWF, 2009 b). It is vital for the EU and the governments of West Africa to support initiatives such as the one in Kayar (north of Dakar) that seek to set up a common resource and environment system that could regulate the fishing effort (WWF-WARPO, 2003).

2. Renegotiate international fisheries agreements for more sustainable practices :

Since they cannot exploit all the marine resources in the waters under their jurisdiction, the West African coastal states are authorizing foreign countries to fish in their waters, against essentially financial counterpart payments. For West African economies, which are often extremely short of foreign currency, this inflow is more than welcome. Negotiating as individual states puts the West African countries in a weak position. The ideal would be for member states of the Fisheries Sub-Regional Commission (FSRC) to negotiate fishing treaties and codes of conduct for the region with foreign fishing nations.

The WWF, the FSRC and their partners tried to promote en bloc negotiations but, for the time being, the diverging interests of the countries in the sub-region make this approach difficult to apply. At workshops in Senegal and Mauritania for representatives of the West African states, the WWF, the FSRC and their partners drew up a consensual list of bottom line conditions that the states should respect in fisheries agreement negotiations. The WWF and the FSRC are urging the adoption and application of these minimal conditions for the region (WWF-WARPO, 2003).

"Considering the numerous problems stemming from the fisheries agreements, future agreements should abide by the following guiding principles (WWF-WARPO, 2003):

- respect for international conventions and codes;
- existence of a surplus not to be exploited by fishermen of the coastal states;
- inclusion of the agreements in the fisheries development plans;

- respect of minimal regional conditions concerning access to fishing areas;
- good governance of fishery sectors (priority for sustainable resource conservation and exploitation in the interest of all the stakeholders; coherent, fair, credible and transparent process for allocating resources; joint decision-making);
- utilization of financial counterparts to strength the capacity for research, surveillance, control and monitoring and for management of protected marine reserves;
- equity for both parties to the agreements;
- scientific and technical cooperation at the regional and international levels;
- research into biological, economic and social sustainability;

The lack of transparency in the fisheries agreement negotiations, the inadequate control and surveillance of fishing by foreign vessels and the need to involve all the stakeholders, including the national experts and professionals, in the negotiations decision process are problems of great immediacy. It is clear that both the artisanal and the industrial fisheries sectors will suffer if management is not improved and if the present exploitation pattern is maintained. The effects can already be felt: lower yields, unstable production levels, insufficient supply of processing plants and national markets, and conflict of interest within the sector (WWF-WARPO, 2003).

The development of international trade is creating a strong, even alarming demand for certain species, e.g. shark, skate, cymbium, grouper, common sea bream, etc. For skate and shark, a sub-regional action plan is needed. For the other species, stricter regulations are required (WWF-WARPO, 2003).

3. Conduct fish stock assessments.

There is insufficient information about fishery exploitation and a need for periodic fish stock evaluation. Fishing cannot be sustainable if quotas are allocated without knowledge of the available potential (WWF-WARPO, 2003).

4. Nurture the regional network of MPA's

Marine Protected Areas are powerful biodiversity management tools. Every country in the ecoregion has established marine protected areas because of their recognized importance to fisheries, tourism, and biodiversity conservation. In February 2001 when WWF, IUCN, FIBA (Fondation Internationale du Banc d'Arguin), SRFC (Sub-Regional Fisheries Commissions: CSRP in French), and UNESCO co-sponsored a regional workshop of national experts. A Regional Strategy for West African Marine Protected Areas was agreed upon and is currently being implemented under the PCRM.. Success will depend on the use of several cross cutting tools, including communications, advocacy and lobbying, as well as the establishment of partnerships. Dialogue and consensus are the foundations of sustainable conservation and form the operational cornerstone of the key part of the project's work. Over the coming years

funds will be continuously sought to increase, the number of MPAs supported and established (WWF, 2009b).

Funding MPAs in Western Africa still remains very dependent on international support, although the state budgets are increasing in some countries. The donors are not numerous and almost all the regional system depends on a small group of institutions and organizations (WB, DGIS, AFD-FFEM, Spanish Cooperation, MAVA Foundation, BINGOs of the PRCM). Mechanisms for sustainable funding represent a major issue.

5. Protect endangered sea turtles:

Local communities may decide to reduce their traditional uses of turtles and turtle products once they become active participants in conservation initiatives. Fishery-related impacts can be minimized through awareness campaigns for artisanal fishermen, as has been demonstrated in the Sine Saloum (in Senegal) and the Banc d'Arguin National Park (in Mauritania). Destruction can be minimized by adapting deployment of nets to reduce drowning, and by encouraging the industrial fishery sector to install turtle excluder devices (TEDs) in trawls. Also, disturbance to nesting beaches can be reduced through integrated approaches to coastal planning, correct siting of structures, and controls on lighting.

In most of the WAMER countries, information concerning turtle habitats and population dynamics is incomplete. Regional collaboration in collecting and sharing of research data is needed to guide management actions and determine priorities. In addition, many of the marine turtle conservation issues are common throughout the region, and individual countries have much to gain from sharing experience concerning legislation and awareness raising activities at different levels (communities, fishermen, tourism sector).

Build capacity for marine turtle management at national and regional levels, address information needs for marine turtle management, strengthen regional collaboration, and to implement priority management actions (WWF, 2009 b).

6. Inventory Marine Biodiversity trends in the region:

Inventories are not complete and the status of the majority of the species is not up to date, not with standing the fact that some inventories are running and some others are being set up for key species (turtles, sharks, manatees, cetaceans, water birds) and a project of regional GIS is being developed. Support is needed for capacity building, research programs, science funding and linkage to global programs (WCPA, 2007).

7. Communicate the effects of Global Climate Change:

Effects of global climate change on marine biodiverstiy conservation are not well monitored in this part of the world.tral eastern. The RAMPAO will need to develop a

regional capacity building plan of action to set up reference sites for long term monitoring of global changes the central eastern Atlantic. Competencies are scarce and training well adapted to the local context even rarer. The existing and emerging task forces (marine surveillance, evaluation of management effectiveness, co management processes) are not yet strong enough to work at the scale of the whole RAMPAO. Other management functions such as planning, ecological monitoring, or conflict resolution need strengthening (WCPA, 2007).

8. Establish best practices for oil prospecting and extraction:

Because the countries in the sub-region are poor and need foreign currency, which can often be obtained from oil production., it is difficult to recommend bringing prospecting to a halt. There is a vital necessity to make oil prospecting and exploitation impact studies and take appropriate measures to ensure ecologically "clean" oil extraction. It would be advisable for the oil companies and the managers of the protected marine reserves to work together (WWF-WARPO, 2003).

THE GAMBIA

Introduction to Marine Biodiversity in the Gambia

The Gambia is the smallest country in continental Africa, situated in the Northwest coast of Africa along the Gambia River, The Gambia has an ocean coastline of 70 km and a relatively small continental shelf area of about 4000 km2 (Photius 1998). It is located where two major oceanic currents converge along the coast of West Africa; between the cold water Canary Current which moves offshore to the north and the warm water Guinea Current which flows toward the coast to the south. The effects of these currents together with the trade winds which blow dominantly from the Sahara Desert westerly out over the Atlantic create intermittent upwelling along the coast of The Gambia. These upwelling's, combined with the outflow of the Gambia River provide the nutrients that fuel a bountiful marine ecosystem of remarkable abundance and diversity of marine fish, mammals, turtles, and birds.

There are two different eco-regions of coastal Gambia: the river estuary and the ocean coastal upwelling areas.

1. The Gambia River Estuary: The Gambia River covers 20% of the country's total area and virtually splits the country into two equal halves (Figure 4). The River, with a catchment area of 78 000 km2 (Lesack 1986), originates in the Fouta Djalon plateau of northern Guinea, the "water tower" of west Africa, and flows west for 1200 km through southern Senegal and The Gambia to the Atlantic Ocean.

The Gambia River Estuary is the only large estuary in the West African sub region not to have been affected by extensive human disturbance. Mangrove forests line the salt and

brackish areas of the river and rice fields along the tidal fresh portion are irrigated tidally. The Gambia River still has a natural flood regime with no dams or weirs. As a consequence, it has been less affected by the succession of drought periods experienced by the Sahel region since 1970. Although there have been many proposed development projects including a dam on the main stem in Senegal to generate hydropower for Senegal, Guinea and The Gambia, none are yet under construction (pers communication, NEA, The Gambia, June 2009).

Figure 4. Map of The Gambia

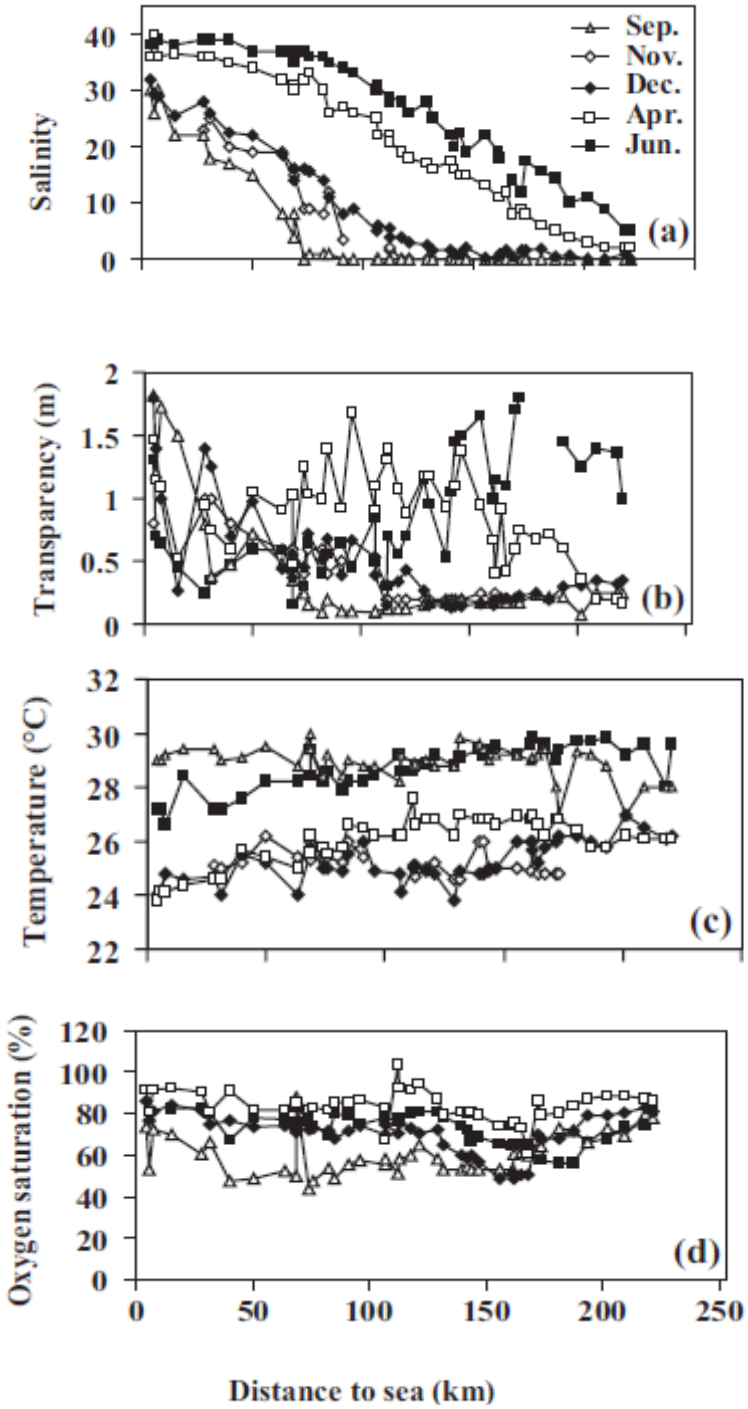
Since most of the river in The Gambia has a level gradient from the ocean to 500 km inland; tidal effects are perceptible up to Yarboutenda at the border with Senegal. The lower 180 km are generally brackish. Salinity ranges from full seawater at Banjul to freshwater at Georgetown. Yet despite this longitudinal gradient, the estuary appears to be well mixed vertically, not heavily stratified and plenty of dissolved oxygen for fish and shellfish to thrive.

The flow of the Gambia River is typical of the tropics, with freshwater flooding the river and the lower estuary during the rainy season (July-Sept) while seawater moves long distances up river during the dry season (October-May). The highest precipitation occurs in August and the river responds with peak river discharge during September. River discharge then declines to almost nil from December to the beginning of July (Lesack et al. 1984).

According to a survey by Lesack (1986), the river is well mixed with differences between surface and bottom salinity generally less than 2 ppt. The brackish water zone shifts from about 80 km in length in September to more than 220 km in June.. In the rainy and flood seasons, at least two-thirds of the estuary is totally fresh or brackish (0.5 to 5) or

mesohaline (5 to 18) according to Por's classification (Por 1972). In the dry season, most of the estuary up to Elephant Island (162 km from mouth) becomes polyhaline (18 to 30) or mixoeuhaline (30 to 40). See Figure 5.

Figure 5. Salinity, transparency, temperature and oxygen saturation in the River Gambia. Source: Albaret et al. (2004)



In general, water is very turbid in the Gambia Estuary. During the wet season, transparency decreases from the estuary mouth upstream, reaching values of approximately 0.2 m in the upper parts of the estuary. During the dry season, however, the estuary becomes less turbid with transparency a mean value of 1.2 m in the upper estuary. Turbidity is known to have a major influence on estuarine fish and shellfish occurrence and distribution.
Turbidity may afford greater protection for juvenile fish from predators; it is generally associated with areas where there is an abundance of food; and it may provide an orientation mechanism for migration to and from the estuary (Blaber 2000). However, excessively high water turbidity has been shown to negatively affect fish egg survival, hatching success, feeding efficiency (mainly of filter feeders), growth rate and population size (Whitfield 1998).

The surface temperature of the Gambia Estuary is generally less than 1˚C higher than the bottom temperature (mean surface temperature 27.4˚C, mean bottom temperature 26.9˚C.

Dissolved oxygen was never a limiting factor for fish in the Gambia Estuary even in the bottom water layer. Oxygen values were lower during the peak flood in September in the intermediate parts of the estuary and higher in April, during the dry and cool season (Albaret et al., 2004).

2. Gambia Coastal Ocean – Upwelling: The 200 mile Exclusive Economic Zone of The Gambia is located near the warm equatorial counter current (Guinea Current) and the cool Canary current. Seasonal upwelling of cool deep ocean water off the coast of The Gambia is important for fish production. Seasonal variations in water temperature, determine the patterns of fish migrations (Mendy 1999).

The productivity of this region is further enhanced by influxes of nutrients from the adjoining rivers/estuaries in the sub-region which are transported throughout the water column due to the very active upwelling system prevailing in the area. The Gambia Estuary is a well-mixed (no thermal or saline spatial or temporal vertical stratification) and oxygenated system. Considerable seasonal variation in river flow results in marked changes to the aquatic environment.

Marine Biodiversity Assets of the Gambia

Gambia River Estuary

Fin Fish : The upper reach of the river has a freshwater regime where *Tilapia nilotica* and *Clarias luzerra* are important fish species. The most important crustaceans in the river fishery are shrimps (*Paneaus notialis*)caught by artisanal fishermen in the estuary (Mendy, 1996). These species are caught and sold to industrial companies which usually provide nets, engines and ice to these fishermen as an agreement for them to sell their products to these companies. The riverine artisanal fishery is considered non-industrial

operation, employs traditional methods, and is under-exploited due to low levels of fisheries technologies. About 80% of artisanal catches are bonga or shad (*Ethmalosa fimbriata*). Some of the marine fish species caught in the river include threadfins (*Polynemidae sp.*), marine catfish (*Arius sp.*) and solefish (*Cynoglossidae sp.*). Other abundant species are African bonytongue (*Heterotis niloticus*), upsidedown catfish (*Synodontis gambensis*), bagrid catfish *Auchenoglanis occidentalis*), *Labeo senegalensis* and *Chrysichthus furcayus (IRD 2004).*

The 2004 study of fish populations in the Gambia River by the French Institute for Research and Development (IRD) in collaboration with the Fisheries Department dentified about 70 fish species within the river system and several of them, especially those belonging to Carangidae, Drepaneidae, Clupidae, Haemulidae, Polynemidae, Cichlidae, Scianidae, Cynoglossidae, etc, are of commercial significance. It is strongly believed that the fish resources of the River Gambia are still under exploited and improvements in fishing technology and techniques will allow for increased fish landings.

Seventy fish species, belonging to 32 families, have been recorded for the Gambia River Estuary (Table 2). The average number of species per family was low (2.18). This ratio was the lowest during November and highest in the dry season (April). The families with the highest species diversity were Carangidae and Sciaenidae (6 species each), Mugilidae (5 species), Clupeidae and Haemulidae (4 species each). With the exception of June when only 40 taxa were recorded, the species richness per survey remained relatively stable throughout the seasonal cycle between
49 (November) and 52 species (April). Family richness was also lower in June (22) and never exceeded 28 (November).

The Gambia Estuary fish fauna is dominated by the sciaenid Pseudotolithus elongatus (Table 2). The next three most abundant species were the clupeids Ethmalosa fimbriata, Ilisha africana and Sardinella maderensis. Synodontis gambiensis, the first continental species, was the fifth most abundant and fourth in terms of biomass. Two other Siluriforms, S. batensoda and Schilbe intermedius, were also in the ten most abundant species.

There are a high number (15) of “estuarine of marine origin” species (Em), i.e. permanent inhabitants of estuarine communities that can complete their entire life cycle within estuaries. The clupeid *Ethmalosa fimbriata* and the sciaenid *Pseudotolithus elongatus* were the best representatives of the Em category in the Gambia Estuary. Though less numerous than the ME, the Em species were much more abundant in terms of individual numbers (Fig. 6) and biomass (The top three dominant species in numbers, biomass and occurrence (*P. elongatus, E. fimbriata, Ilisha africana*, belong to this category.

The sciaenid *P. elongatus* was the dominant species in the fish community, in numbers (19 336 fish caught) and biomass (1224 kg). It had a remarkably wide spatio-temporal distribution in the estuary (96.6% occurrence). It was abundant in every season and at all sites, from the estuary mouth to the upper reaches and was captured in large numbers in relatively clear as well as in the more turbid waters and in all salinities from sea water to totally fresh water (Fig. 6). Even during

Table 2. List of the 70 fish species listed by order and family. Cat.: bioecological category (Co: continental species, occasional in estuaries; Ce: estuarine species from continental origin; Ec: estuarine species from continental origin; Es: strictly estuarine species; Em: estuarine species from marine origin; ME: marine-estuarine species; Ma: marine species accessory in estuaries; Mo: marine species occasional in estuaries), Occ.: occurrence (number of samples where the species was present), %Occ.: percentage of occurrence, Numbers: total number of individuals, and Biomass (g).

Order	Family	Name	Cat.	Occ.	%Occ.	Numbers	Biomass
Anguilliformes	Ophichthyidae	*Pisonodophis semicinctus*	Mo	3	1.4	3	609
Batrachoidiformes	Batrachoididae	*Batrachoides liberiensis*	Ma	6	2.9	6	261
Beloniformes	Belonidae	*Strongylura senegalensis*	Em	4	1.9	4	210
		Tylosurus acus rafale	Mo	1	0.5	1	242
Characiformes	Alestiidae	*Alestes baremoze*	Co	8	3.8	13	487
		Brycinus nurse	Co	6	2.9	8	309
		Hydrocynus brevis	Co	1	0.5	1	386
Clupeiformes	Clupeidae	*Ethmalosa fimbriata*	Em	97	46.6	12 583	503 141
		Ilisha africana	Em	93	44.7	6760	107 393
		Pellonula leonensis	Ec	30	14.4	79	918
		Sardinella maderensis	ME	60	28.8	3819	66 180
Elopiformes	Elopidae	*Elops lacerta*	ME	61	29.3	141	10 161
Osteoglossiformes	Mormyridae	*Hyperopisus bebe*	Co	4	1.9	6	1549
		Mormyrops anguilloides	Ce	2	1.0	3	556
Perciformes	Carangidae	*Caranx hippos*	ME	5	2.4	16	1262
		Caranx senegallus	ME	17	8.2	79	6664
		Chloroscombrus chrysurus	ME	20	9.6	169	5140
		Hemicaranx bicolor	Mo	14	6.7	40	2563
		Lichia amia	Ma	1	0.5	1	54
		Trachinotus teraia	Em	13	6.3	21	35 369
	Cichlidae	*Sarotherodon melanotheron*	Es	4	1.9	6	520
		Tilapia guineensis	Es	4	1.9	4	417
		Tylochromis jentinki	Es	2	1.0	2	483
	Drepaneidae	*Drepane africana*	ME	11	5.3	29	1616
	Eleotridae	*Bostrychus africanus*	Es	1	0.5	1	28
	Ephippidae	*Chaetodipterus lippei*	Ma	3	1.4	6	273
	Gerreidae	*Eucinostomus melanopterus*	ME	5	2.4	10	336
		Gerres nigri	Es	4	1.9	43	2524
	Gobiidae	*Nematogobius maindroni*	Es	1	0.5	1	1
		Porogobius schlegelii	Es	3	1.4	3	5
	Haemulidae	*Brachydeuterus auritus*	ME	9	4.3	18	269
		Plectorhinchus macrolepis	Em	2	1.0	2	2552
		Pomadasys jubelini	Em	11	5.3	33	2416
		Pomadasys perotaei	Em	5	2.4	14	622
	Monodactylidae	*Monodactylus sebae*	Es	45	21.6	150	10 685
	Mugilidae	*Liza dumerili*	Em	1	0.5	1	45
		Liza falcipinnis	Em	39	18.8	259	14 503
		Liza grandisquamis	Em	67	32.2	851	53 373
		Mugil bananensis	ME	1	0.5	1	73
		Mugil cephalus	ME	1	0.5	2	186
	Polynemidae	*Galeoides decadactylus*	ME	31	14.9	236	7676
		Pentanemus quinquarius	Ma	49	23.6	445	17 027
		Polydactylus quadrifilis	ME	81	38.9	162	74 808

Order	Family	Name	Cat.	Occ.	%Occ.	Numbers	Biomass
	Sciaenidae	*Pseudotolithus brachygnathus*	ME	48	23.1	142	16 849
		Pseudotolithus elongatus	Em	201	96.6	19 336	1 223 993
		Pseudotolithus senegalensis	Ma	34	16.3	180	6107
		Pseudotolithus typus	ME	15	7.2	55	7766
		Pteroscion peli	ME	10	4.8	83	744
		Umbrina ronchus	Mo	1	0.5	1	15
	Sphyraenidae	*Sphyraena afra*	ME	11	5.3	16	2177
		Sphyraena guachancho	ME	5	2.4	7	552
	Trichiuridae	*Trichiurus lepturus*	ME	13	6.3	25	4909
Pleuronectiformes	Cynoglossidae	*Cynoglossus senegalensis*	Em	97	46.6	216	30 294
	Paralichthyidae	*Citharichthys stampflii*	Em	17	8.2	23	374
	Soleidae	*Synaptura cadenati*	Mo	2	1.0	2	13
Rajiformes	Dasyatidae	*Dasyatis margarita*	Em	7	3.4	11	9875
		Dasyatis margaritella	Em	3	1.4	5	2700
		Dasyatis ukpam	Mo	2	1.0	2	15 500
	Gymnuridae	*Gymnura micrura*	Mo	2	1.0	3	7838
Siluriformes	Ariidae	*Arius heudelotii*	ME	15	7.2	52	10 114
		Arius latiscutatus	ME	73	35.1	489	63 875
		Arius parkii	ME	37	17.8	115	10 557
	Bagridae	*Chrysichthys johnelsi*	Ce	14	6.7	15	502
		Chrysichthys maurus	Ec	46	22.1	109	6940
		Chrysichthys nigrodigitatus	Ec	60	28.8	113	28 662
	Clariidae	*Clarias anguillaris*	Co	1	0.5	2	4400
	Mochokidae	*Synodontis batensoda*	Co	25	12.0	617	27 929
		Synodontis gambiensis	Ce	89	42.8	1980	101 591
	Schilbeidae	*Schilbe intermedius*	Ce	43	20.7	266	5638
Tetraodontiformes	Tetraodontidae	*Ephippion guttifer*	ME	15	7.2	37	2588

Source: Albaret et al., 2004

the maximum flood period (September), this marine species was abundant in the upper reaches of the estuary. In addition, it breeds in the Gambia Estuary and all stages of the life cycle were represented in the system.

E. fimbriata, was second in terms of total fish numbers, biomass and occurrence, with biomass and occurrence less than half that of *P. elongatus*. Both juveniles and adults were recorded in seine net samples throughout the estuary. However, *E. fimbriata* shows a clear seasonal pattern: present in the lower reaches all year round and moving upstream only during the dry season. By December, a few subadult *Ethmalosa* were captured in the most upstream site (more than 220 km from the Ocean) in totally fresh water, but it was only in April, in a mesohaline environment (about 5 to 20) that the species became abundant in the middle and upper part of the estuary.

S. gambiensis and *S. batensoda* (Mochokidae) had different distribution patterns in the Gambia Estuary. *S. gambiensis* is a species of continental origin with a strong estuarine affinity (Ce). It is the first species from this category in the Gambia Estuary. It does not reproduce in the estuary but had a wide spatio-temporal distribution and was one of the more abundant species. It came in fourth place in biomass and ranked fifth in numbers and occurrence (43%). During the wet season (September) *S. gambiensis* followed the river flood as far downstream as Mootah Point (69 km from the sea). By December the species had started moving back upstream and was confined to the upper reaches during the dry season.

All the West African estuarine ecological categories are represented in the fish fauna of the Gambia River Estuary. Similarly, all of the main fish families likely to be found in tropical estuaries are represented in the Gambia system (Albaret 1999). In terms of the ecological categories and life cycles it has a biodiversity close to or greater than that of many other estuarine systems in West Africa.

Figure 6. Distribution of fish assemblages in the River Gambia (Albaret et al. 2004)

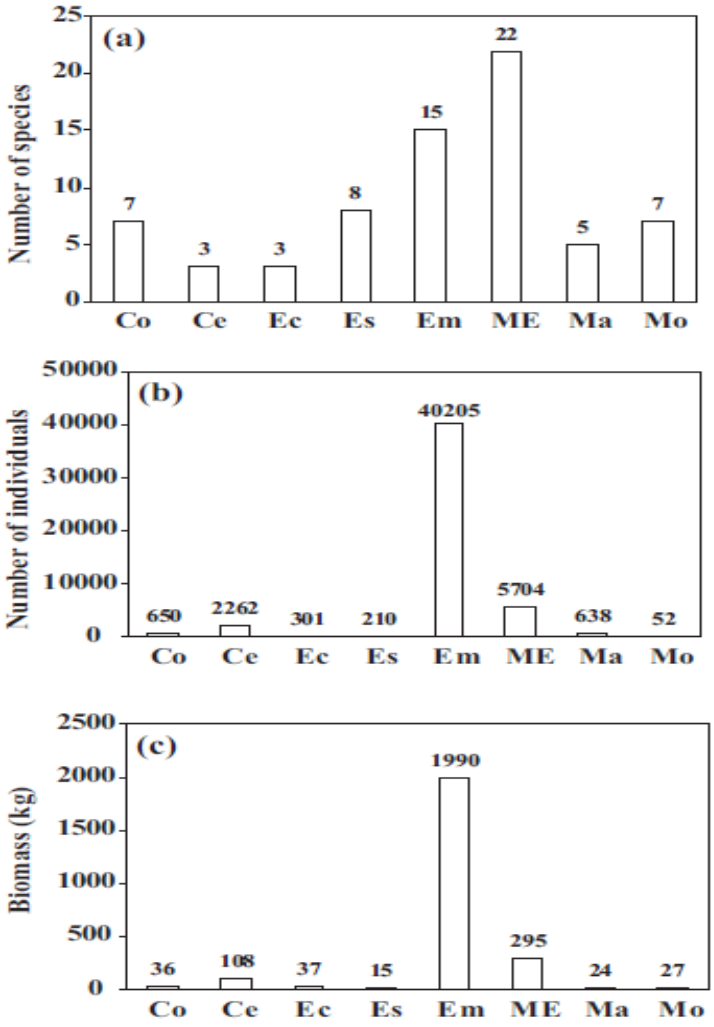


Fig. 3. Distribution of fish assemblages per bioecological category (Co: continental species, occasional in estuaries; Ce: estuarine species from continental origin; Ec: estuarine species from continental origin; Es: strictly estuarine species; Em: estuarine species from marine origin; ME: marine-estuarine species; Ma: marine species accessory in estuaries; Mo: marine species occasional in estuaries): (a) number of species, (b) number of individuals, (c) biomass (kg).

Figure 7. Fish abundance patterns vary with season in the River Gambia. (Albaret et al. 2004)

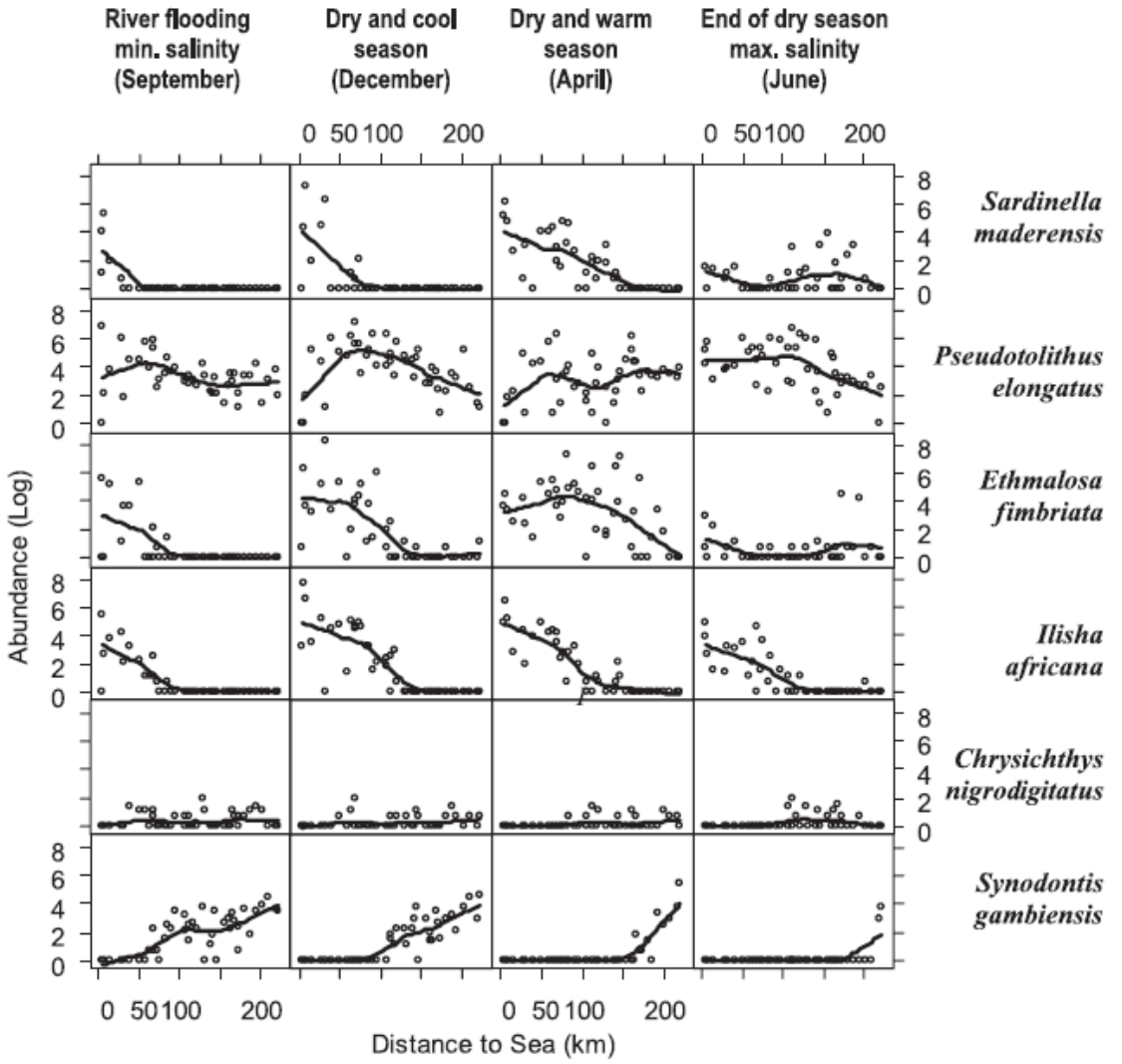


Fig. 5. Spatial (distance to sea in km) and seasonal (periods of the hydrological cycle) distribution of abundances of *Sardinella maderensis*, *Pseudotolithus elongatus*, *Ethmalosa fimbriata*, *Ilisha africana*, *Chrysichthys nigrodigitatus* and *Synodontis gambiensis*. The periods of the hydrological cycle are (from left to right): the rainy season (river flooding and minimum estuary salinity), the dry and cool season, the dry and warm season, the end of the dry season (maximum estuary salinity). Each point represents the log-transformed value of the fish abundance in relation to the distance to the sea. The smooth curve is the locally weighted regression (Lowess) with a span value of 0.5.

Gambian pink shrimp (*Farfantepenaeus notialis*). Southern pink shrimp is found from the Ivory Coast through Benin. As is true for most penaid shrimp, the pink shrimp's breeds and spawns at sea and then larvae and post-larvae inshore move into estuarine environments—remaining there for three months depending on water salinity and currents. In the Gambia River estuary, shrimp abundance is highest near the mouth of the river year round and lowest upstream (except during dry months when shrimp are

abundant even here). During the wet season, little shrimp fishing occurs in the upstream areas.

There are over 225 shrimp fishermen using two types of gear (stow nets and drift nets). Because of the small mesh sizes used (18 mm stow net), the bycatch rate of small fish is estimated to be in the realm of 5-10:1 (Lae et al. 2004). Existing regulations on minimum mesh size (25 mm) and minimum total length of the shrimp (35 mm) are not yet enforced. Most of the shrimping occurs in remote inaccessible areas so regulations can only be enforced locally. Problems with the fishery include a decline of shrimp processing facilities, restricted markets, poorly equipped shrimp landing sites, low financial capacity of shrimp fishers, and a lack of knowledge on the Gambia River shrimp population life-cycle. In the past, this fishery supported an export market. As a result of competition from farmed shrimp, however, shrimps are mostly sold to local hotels, markets, etc., and exported *only* within the region. Bycatch of juvenile fish and non-target species is a major problem and can represent 80-90% of a haul

Mollusks: Oysters and Cockles (*Crassostrea gasar and Anadara spp. Murex spp. Cymbium spp.*). Oyster harvesting is popular along both the north and south banks of the Gambia River. Wild oysters are gathered at low tide and from the roots of mangrove trees. The oyster harvesters also collect cockles from mud banks and mud areas between mangrove tree roots .The Department of Fisheries has noted a decline in the size and number of oysters harvested—a situation that has lead many Banjul-based harvesters to move to the North Bank, where the resource has been less exploited. Marketing and processing techniques for the oysters are simple—most are simply shucked, boiled and sold locally.

The Gambia oyster market chain and value-added processing is less developed than in Senegal. Currently in The Gambia, the only management measure in place is a closed season during the rainy season. There is no overall management plan specifically for oysters or cockles. Key issues in expanding markets are the need to: (1) better manage wild harvests, and (2) assess seafood sanitation issues. The latter includes looking at potential contamination of growing waters from human pathogens and at post-harvest sanitary processing practices.

Marine Mammals: Bottlenose is the most commonly sighted dolphin in Gambia waters and there may be a resident population in the river– being resident makes it more vulnerable to local impacts on the environment and thus a much greater responsibility. The West African manatee (*Trichechus senegalensis*) is a rare, elusive and endangered aquatic mammal widely distributed along coastal creeks, mangroves, brackish and fresh waters from Mauritania to Angola; it is a fresh water species that can live in brackish waters where fresh water holes exist. Fewer than 10,000 individuals are thought to remain, however, and this number is known to be declining from direct hunting pressure, indirect take in fishing operations, habitat conversion, loss of mangroves, dams and pollution (IUCN 2007). Compounding this is the species' low growth rate; usually only one calf is produced and a single generation may take upwards of 30 years to complete.

The African Clawless otter (*Aonyx capensis*) as well as the Western Red Colobus *Piliocolobus badius temminckii* (EN according to IUCN Red List) occur in the Gambia River Estuary too.

Turtles/Reptiles: Bell's hinged Tortoise *Kinixys belliana* has been recorded on the coastal strip, as well as the Nile crocodile *Crocodylus niloticus* in the Gambia River.

Birds/ Waterfowl: numerous migratory bird species – especially Western Reef-egret (*Egretta gularis*), Black-winged Stilt (*Himantopus himantopus*), Black-tailed Godwit (*Limosa limosa*), Grey-headed Gull (*Larus cirrocephalus*), Slender-billed Gull (*Larus genei*), Caspian Tern (*Sterna caspia*), and Royal Tern (*Sterna maxima*) stop on their seasonal migration. (Birdlife International 2007). An ecological survey in 1997 counted 362 species from 66 families of birds. A perimeter survey of TWC in December 2006 tabulated 85 species of birds and more than 7800 individuals. Eurasian species winter in the area and the tidal mudflats are crucial for their feeding before returning home to reproduce.

Mangrove Wetlands: These habitats occur well up the Gambia River, where the tidal influence extends as far as 460 km upstream.. A recent review of mangrove extent, found a reduction in Gambian mangrove extent from 66,500 ha in 1968 to 59,100 ha in 2000, a decrease of 11% in 32 years (FAO 2003).

There are seven mangrove species known in The Gambia River Estuary. Tall galleries of red mangrove (*Rhizophora racemosa*) border most saline waterways to the limits of daily tidal flooding. Mangrove woodlands composed primarily of black mangrove (*Avicennia africana*) are found beyond this frontage of tall trees, up to the mean limits of inundation by high "spring" season tides. The mangrove species *Rhizophora harrisonii* and *R. mangle* occur at the boundary between the *R. racemosa* and *A. africana* stands. *Rhizophora racemosa* appears to be the primary "pioneer" successional species and in time is replaced by *A. africana* (Giglioli and Thornton 1965). White mangrove (*Laguncularia racemosa*) is also present, albeit less common than the other species. Mangrove forests and related wetland habitats support a large number of important wildlife species, including West African manatee (*Trichechus senegalensis*), several dolphin species and numerous migratory bird species.

Endangered and Protected Species:

Endangered species in the Gambia River Estuary include:

- The West African manatee, which is listed as vulnerable by IUCN (2007).Both the Wildlife Conservation Act 1977 and the Biodiversity/Wildlife Act of 2003 mandate the protection of the species..
- The Western Red Colobus *Piliocolobus badius temminckii* (EN according to IUCN Red List).
- The Tortoise *Kinixys belliana*(CITES App. II),
- the Nile crocodile *Crocodylus niloticus* (CITES App. II)

Coastal/ Ocean

Fin Fish: There are over 500 marine fish species in Gambian waters. Fish species are usually classed as demersal and pelagic. The most important marine fish species are pelagic species, including shad or bonga (*Ethmalosa* spp.) and sardinellas (*Sardinella* spp.), but there are also appreciable stocks of both demersal and semi-pelagic species, such as carangids (Carangidae); barracudas (Sphyreanidae); croakers and drums (Sciaenidae); porgies and seabreams (Sparidae); groupers and seabasses (Serranidae); threadfins and tasslefishes (Polynemidae); and grunts (Pomadasysidae). The demersal fish group has a wide and diverse range of species and this include, cephalopods (cuttlefish and octopus), shrimps and lobsters, groupers, sea breams. Grunts, croakers are demersal fish species. The small pelagics group consists of the two sardinellas (*Saridnella aurita* and *Sardinella maderensis),* horse mackerels (*Trachurus trecae, Trachurus trachurus* and *Caranx rhoncus*) and mackerel (*Scomber japonicas*).

Mammals: Coastal waters of The Gambia and Senegal are clearly important for at least seven species of cetaceans: short-beaked common dolphin (*Delphinus delphis*), long-beaked common dolphin (*Delphinus capensis*), bottlenose dolphins (*Tursiops truncatus*), Atlantic humpback dolphin (*Sousa teuszii*), Clymene dolphin (*Stenella clymene*), harbour porpoise (*Phocoena phocoena*), and Bryde's whale (*Balaenoptera brydei*) (Van Waerebeek 2003).

Turtles: At least four species of marine turtles occur in The Gambia including green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and olive ridley (*Lepidochelys olivacea*). Green turtles are by far the most common and abundant; the latter three turtles are rarely recorded. While loggerhead turtle (*Caretta caretta*) may also occur; its presence was not decisively confirmed in a recent study (Barnett et al. 2004). Unfortunately, at present little is known about the biology and conservation status of marine turtle populations in The Gambia.

Birds/ Waterfowl: the coastal mangroves, wetlands and associated ecosystems of The Gambia provide extremely critical habitats for a wide variety of migratory and non-migratory bird species. Bird Life International has identified no fewer than 13 "Important Bird Areas" in the country, of which ten fall within the coastal zone. Bird watching is becoming an increasingly important part of the tourist trade in The Gambia, providing solid economic incentive for conserving the habitats and species upon which this trade depends.

Endangered and Protected Species: Marine turtles are protected by Gambian laws including the Wildlife Conservation Act of 1977 and Biodiversity/Wildlife Policy and Regulation of 1999 and 2003. Green, Loggerhead and Olive ridley turtles are categorized as Endangered on the IUCN Red List, and hawksbill and leatherback turtles as Critically Endangered (IUCN 2007). All of the above species of cetaceans are currently on the IUCN red list (IUCN 2007). Cetaceans have been fully protected by Gambian national legislation since 1977. There are currently 16 threatened bird species7 listed in The Gambia, a relatively large number for a small country (IUCN 2007).

Direct Threats to Marine Biodiversity in the Gambia

Overfishing

The unregulated and excessive removal of finfish from the coastal ocean of the Gambia is a major threat to marine finfish biodiversity.

Figure 8. Status of main stocks of fish in Gambian Coastal Waters

Species/Stock	Status	Year of assessment	Reference
Small Pelagic Fish			
Sardinella aurita/NW Africa	O	2008	FAO SPWG NWA (2008)
Sardinella maderensis	N A	2008	FAO SPWG NWA (2008)
Ethmalosa fimbriata	N A	2008	FAO SPWG NWA (2008)
Scomber japonicus	O	2008	FAO SPWG NWA (2008)
Trachurus trecae	F	2008	FAO SPWG NWA (2008)
Caranx rhoncus	O	2008	FAO SPWG NWA (2008)
Demersal Fish			
Pagellus belottii	O	2007	FAO/CECAF DEM_WG (FAO, 2008)
Arius spp	O	2007	FAO/CECAF DEM_WG (FAO, 2008)
Pseudotolithus spp	F	2007	FAO/CECAF DEM_WG (FAO, 2008)
Epinephelus aeneus	O	2007	FAO/CECAF DEM_WG (FAO, 2008)
Penaeus notialis	F	2007	FAO/CECAF DEM_WG (FAO, 2008)
Octopus vulgaris	O	2007	FAO/CECAF DEM_WG (FAO, 2008)

O – over-exploited ; F – fully exploited; NA – inconclusive assessment

Population growth, poverty, coastal development, government bureaucracy and commercial fishing are threatening the marine resources off the coast of The Gambia. Several species that are caught as by-catch have become extremely rare (eg.: hammerhead and tiger sharks). The human threats on marine turtles are both direct

(deliberate and incidental catch by gillnets, trawlers and other fishing gears, over-exploitation of turtle eggs and meat), and indirect (pollution, destruction or degradation of the nesting and foraging habitats). Artisanal fishermen have been known to purposefully capture adult turtles in known foraging grounds on days when their fishing captures are low.

Sardinella (*Sardinella spp*). Two species comprise the sardinella fishery—the round sardinella (*Sardinella aurita*) and the flat sardine (*Sardinella maderensis*). Although both are migratory, the flat sardine is found closest to shore and is more vulnerable to capture by the artisanal fleet. In 2006, over 3,685,178 kg of flat sardine were landed in the Atlantic stratum while only 933,013 kg of round sardine were landed (Department of Fisheries 2006 Catch Assessment survey report). Most of the round sardines are captured by the industrial fishermen and there is little infrastructure to handle processing on shore, so few boats land their catch in The Gambia. The last stock assessment performed by the working group of the FAO-CECAF (2008) lists the sardinella species as overexploited. However, the poor data quality affects the certainty of this conclusion. Abundance and distribution of sardinellas are primarily controlled by environmental factors affecting oceanographic conditions with upwelling and water retention over the Northwest African shelf (Zeeberg et al., 2008). The FAO working committee recommended that catches for *sardinella spp*. in the sub-region (Morocco to Senegal) should not exceed 200,000 tons (200,000,000 kg) and that fishing effort be reduced by 50%.

The flat sardine is mostly harvested by artisanal fishermen using surround gill nets and purse seines (purse seine specifications are: length 600-700 m; depth 45-50 m; mesh sizes—belly of 24-26 mm and bunt of 30-40 mm). The Gambian management plan proposes a minimum mesh size in the bunt of no smaller than 40 mm. An estimated 50% of catch is bycatch (small fish), which is often discarded or sold to fish dryers. The Department of Fisheries proposes efforts to limit the amount of bycatch to no more than 5% of total landed catch.

At present, there are 12 permanent purse seine operators at Tanji and seven at Gunjur. However up to 80 migratory operators from neighboring countries frequent the fishing grounds and may land their catch in The Gambia. Each vessel has the capacity to land 5 tons of sardinella per trip. Other regulatory actions proposed include: limit to a day-time fishery only on a daily basis; a maximum limit of five migratory boats allowed to operate in any one of the sites.

Gambian Sole: (*Cynoglossus senegalensis)*. Gambian sole (Senegalese tongue sole) is harvested by approximately 475 artisanal fishermen. The fishermen operate less than 1 nm from shore—where the sea floor is flat, sandy or muddy. Sole is harvested year-long with bottom-set gill nets (length 600-700 m; depth 1-1.5 m; in segments of 40 m each; with 20 kg of lead on ground ropes set with anchors; mesh size of 80 mm). Other fishermen use drift nets, hook and line, long-line and traps to harvest the sole.

Other fish captured in this fishery include sand sole, wedge sole, croakers, cuttlefish, threadfins, grunts and groupers. The last assessment of the biomass of demersal fish

species was made in 1986. However, the CPUE of sole declined noticeably in 2006 and 2007, pointing to a clear need to control fishing effort.

Sole is a high value product and is primarily destined for export to the EU. Recently (2008), the Marine Stewardship Council (through Food Certification International Limited) conducted an assessment for certification. This is being done under a new category called Small-scale/Data Deficient fisheries. This assessment utilizes a risk based precautionary approach intended to compensate for little or no data being available. This initial audit pointed to a number of improvements that need to be made before the fishery can be certified as fished sustainably. The Program will support implementation of management actions proposed by the Gambian government: (1) a proposed reference point of 25 cm minimum length until more data is generated, (2) a minimum mesh size of 80 mm, and (3) a prohibition on the use of drift nets.

By-catch

By catch of marine turtles, sharks (for fins), cetaceans, and undersized fin fish is occurring in the Gambia . Shrimp and other "good quality" fish are sold to hotels and restaurants by prior arrangement, sole and cuttlefish are of particular interest to some middlemen and most of the fin fish catch is sold direct to consumers or through middlemen on the beach. (Jallow 1995; Van Waerebeek, 2003). See Figure 9.

Figure 9. Species in shrimp trawler catch in Gambia. (Source: Jallow 1995)

Scientific name	**English name**
Pseudotolithus typus	Long neck croaker
Pseudotolithus brachynathus	Law croaker
Pseudotolithus senegalensis	Cassava croaker
Fonticulus elongates	Bobo croaker
Plectorhyncus mediterraneus	Rubberlip grunt
Pomadasys jubelini	Sompat grunt
Epinephelus aeneus	White grouper
Epinephelus guaza	Dusky grouper
Polydactylus quadrifilis	Giant African threadfin
Galeoides decadactylus	Lesser African threadfin
Sepia spp	Cuttlefish
Arius latiscutatus	Rough head sea catfish

Arius heudeloti	Smooth mouth sea catfish
Sphyraena spp	Barracuda
Penaeus notialis	Shrimps
Drepane Africana	African sickle fish
Cynoglossus senegalensis	Sole fish
Cybium spp	Snail

Data provided by Jallow suggests that of the non-shrimp catch the African threadfins, croakers, grunts, sole fish and African sickle fish make up the major part of the by-catch. Barracuda and cuttle fish are relatively rare and seasonal. The *Cybium* spp have become the subject of specialized processors being fermented and exported to Senegal where they are in high demand.

Harvesting of Mangroves:

Mangroves are harvested for fuel wood supplies, construction materials, food production and other needs. Cutting down of mangroves for social and economic purposes culminate into loss of habitat; nursery and refuge area for important fish species and other fauna. The mangrove systems provide important revenue in terms of oyster and shrimp culture.

Sand Mining and beach development

Mining of beach sand occurs constantly by the dump truck load and taken to communities for construction of houses, walls, roads. Tourism development along the beach with the resultant lights at night and increase in people on the beach is reputedly denying sea turtles access to nesting sites. With the result that sea turtles now only nest on the off-shore bird island sanctuaries.

Indirect Threats to Marine Biodiversity in the Gambia

Human Population Growth

The Gambia is one of the most densely populated countries in West Africa (see table 1). The years 1973-1983 and 1983-1993 were characterized by a tremendous increase in the population of the coastal areas and The Gambia as a whole (State of Environment, 2002 in press). This was a time when considerable expansions were made in various sectors of the economy, attracting population masses from all levels of society into the urban cities. Agricultural encroachment, construction activities and habitat destruction contribute to habitat loss and fragmentation on the coastal environment.

Biodiversity resources in the region face considerable and increasing pressure from a human population expected to grow at an annual rate 3-4% into the foreseeable future (FAO 2001, DPWM 1998) and nearly double to 2 million people by the year 2025 (WRI 2007).Coastal systems are under particular threat: 91% of The Gambia's population lives within 100 km of the coast (WRI 2007), and these coastal populations are increasing in number and density (Manneh et al. 1994). Urban encroachment, industrial development, increasing agricultural activities, fuel-wood extraction and over-harvesting have all been cited as threats to the Tanbi Wetland Complex, a recently designated Ramsar Site within the vicinity of Banjul in the Western Division (Cham et al. 2002, BirdLife International 2007, Hirani 2005).

Global Climate Change:

The Gambia River is one of the last aquatic ecosystems in West Africa that has not yet been affected by strong environmental changes and human disturbances**.** Yet a dam is being proposed on the main stem of the Gambia River in Guinea to ensure fresh water for agriculture and hydropower as global warming puts stresses on these resources. The dam will have major impacts on the river ecosystem and species in it. Shrimps, Grouper, and Ladyfish are found in depths of less than 100m, cannot tolerate low oxygen in waters of below 20% oxygen saturation with maximum temperature of 35oC. Warming of more than 3oC to 5oC will have negative impact on their productivity.

Coastal fish that are classified as high valued species may also be negatively impacted by increases in temperature. These bring better returns to the fishermen as exports/livelihood diversification and their loss will threaten food security as well. Therefore, there is need to adopt climate change adaptation measures in order to obtain and maintain a healthy fishery stock.

Accelerated sea-level rise resulting from global warming (IPCC 2001) has important implications that increase the threats to marine biodiversity in the Gambia.. As well as the increasing desertification of the Sahel (which may lead to further increases in coastal populations), there is likely to be an increase in coastal erosion and inundation of what are now densely populated low-lying areas, such as the Victoria Island beaches in Lagos, Nigeria, and the Greater Banjul Area in Gambia (Jallow and others 1996, UNEP 1999).

Weak Governance Capacity

There is a general lack of consistency in sectoral policies as well as a general weakness in implementation capacity in line Departments in Government. It was observed that most institutions lack the capacity to effectively enforce existing regulations due manpower, technical capacities and logistical shortfalls. For example, Department of Parks and Wildlife Management cited inability to effectively operationalize and manage protected areas due to manpower shortage, lack of adequately trained personnel and mobility problems. "*The various institutions assigned the responsibilities of ensuring good coastal and environmental management, are on the whole weak, operate independently and in*

isolation rather than adopting a holistic approach in formulating and implementing policies. Even in the event where these institutions have formulated appropriate policies to address existing problems, there has always been the big problem of enforcement as a result of either shortage of the required manpower or resources".

The overall situation is that most NGOs, Civil Societies and National Institutions have weak capacities and require assistance in capacity building. The situation is more critical for those small NGOs and national institutions who are often constrained by lack of financial and human resources. As key stakeholders in the natural resources management, NGOs and civil society organizations could greatly contribute to the country's overall development if their capacities are enhanced.

Official Priorities for Conservation of Marine Biodiversity in the Gambia

The principal institutions involved in the conservation and the management of the coastal environment in the Gambia are: i) National Environment Agency, ii) Department of Fisheries, iii) Department of Forestry, iv) Department of Parks and Wildlife Management and v) the Department of Tourism. These institutions by way of their mandate are very active in the coastal zone. Although sectorally fragmented, these public institutions have promulgated into laws, environmental protection and management along the coastline of the Gambia.

The GEAP provides a framework for national environmental policy and, planning and decision making for natural resources management. The policy objectives of the GEAP directly support the conservation and sustainable use of biodiversity. Correspondingly, different sectors have set different sector specific policy goals and objectives and long-term sector strategies that are relevant to the conservation and sustainable use of biological diversity. Some of the relevant sectoral policy objectives for the management of the coastal environment include the following:

- **Environment Sector:** To control environmental degradation and pollution in both natural and human ecosystems through firm regulations and application of Environment Impact Assessment (EIA).

- **Wildlife Sector:** To establish national parks and nature reserves covering at least 5% of the national land area for the conservation, protection and management of the fauna and flora with a view to improving the management capacity of the DPWM and increase revenue generation from wildlife resources.

- **Forestry Sector**: To reserve maintain, develop and manage 30% of the total land area under forest with a view to enhancing environment protection, through minimizing soil degradation and erosion, maintaining river bank stability, protecting wetlands and improving, conserving and preserving biodiversity.

- **Fisheries Sector:** To promote efficient conservation, management and development of inland and marine fisheries, with a view to ensuring the optimum and sustainable utilization of the fisheries resources for The benefit of the people of the Gambia.

- **Water Resources:** To provide an information base pertaining to water resources and Climate monitoring so as to enhance conservation of biological resources and address the requirement of the Convention on Biological Diversity

- **Tourism Sector:** The Tourism Department has authority over the land ward coastline and all development on it. It is not well coordinated with the natural resource departments.

- **Energy Sector:** This sector is responsible for setting rates for the use of electricity and decisions about water release from the proposed dam on the Gambia River. It is also not well integrated at the policy level with the other sectors.

Biodiversity Conservation Policy Objectives (from Mendy, 2008)

Environmental Policy Framework: The ultimate goal of the GEAP is to ensure sustainable development. Consistent with the Government's commitment to this goal and the set environmental priorities, the policy objectives to provide the operational guidelines for the environmental protection and natural resource management intervention:

- To conserve and promote the rational use of natural resources for the benefit of the present and future generations;
- To protect and improve the health and quality of life of all Gambians through sound environmental management;
- To preserve and restore the equilibrium of ecological processes;
- To strengthen the institutional framework for the environmental coordination and management at the national, regional and global levels;
- To increase the environmental awareness and understanding of the public and bring about effective public participation and community involvement in environmental management
- To ensure the integration of environmental considerations in all development strategies and related activities;
- And, to accelerate the adoption of alternate source of renewable energy.

Parks and Wildlife Management: Due to the rapid rate of loss of wildlife habitats, the Gambian Government initiated a strategy to set up a system of protected areas and thus a total of six national parks were established. The new policy objective is to increase national parks to 5% of the total land area, and to put emphasis on community

conservation and sustainable use of biodiversity among others. Other biodiversity-related sectoral laws include the Wildlife Conservation Act, 1977, the Wildlife Regulations, 1978, and the National Environment Management Act, 1994.

Fisheries: The current policy objectives contained in the first (ever written) Fisheries Policy Document (2008), stipulated as adopted by the Government of The Gambia are as follows:

- To effect a rational and long-term utilization of the marine and inland fisheries resources;
- To use fish as a means of improving nutritional standards of the population;
- To increase employment opportunities in the sector;
- To increase the net foreign exchange earnings;
- To increase and expand the participation of Gambians in the fisheries sector ;
- To develop aquaculture; and,
- To improve the institutional capacity and legal framework for the management of the fisheries sector.

In adopting this policy document, the Government recognizes that responsible fisheries management is essential for the sustained development of the fisheries sector and its economic benefits as well as the welfare of its stakeholders. To achieve these goals the following should be addressed:

1. National Fisheries Planning for economic development to be based on principles of responsible fisheries and sustainable livelihoods.
2. Maintenance and enhancement of fisheries ecosystem, to conserve the variety and richness of the marine and fresh water resources.
3. Conservation and enhancement of the quality of natural heritage of the country including wildlife, wetlands, biotic diversity, river, estuary, and beaches.
4. Cooperating with international organizations for global protection of the marine and fresh water ecosystems.
5. Training facilities and research in fisheries matters including studies pertaining to socio-economic, cultural and legal aspects and to provide adequately trained professionals and technical capacity.
6. Improvement of access to financial resources by promoting the review of financial and micro-finance policies/regulations to take into account the special characteristics of fisheries.

Current Actions/ Governance/ Legislation

Multilateral Agreements on Environment (from Mendy, 2008)

In fulfillment of its international obligations, the Gambian government has signed, ratified and or is a party to the following Conventions on environment:

- The Convention on Biological Diversity was ratified in June 1994 and the National Biodiversity Strategy and Action Plan (NBSAP) concluded in 1999. In 2001, work was initiated on the Bio-safety Protocol as a priority area of activity to build capacities in-country for the management of modified organism and exotics.

- The UN Framework Convention on Climate Change was also ratified in 1994 and the action plan for adaptation to climate change started in 1997.

- The UN Convention to Combat Desertification was ratified in June 1996 and the National Action Plan to combat Desertification (NAP) completed in 2000.

- The Gambia is a signatory to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES),

- Convention covering the protection of the World Cultural and Natural Heritage was ratified on 1 October 1987

- It is also a signatory to the Ramsar Convention on Wetlands of International Importance (1996), Convention on Migratory Species (CMS) and The International Conservation Union (IUCN).

- The Gambia has signed and ratified Conventions such as the Montreal (1997), Bamako, POPs, Lome and participated in African Ministerial Conference on the Environment (AMCEN). It has been collaborating with the United Nations Environment Programme (UNEP) on Clean Production (CP) and other environmentally related programmes e.g. UNEP Chemical and all those integrated preventive environmental strategies so as to increase efficiency and reduce risks on human and the environment.

- The Gambia adheres to the provisions and objectives of the UN Convention on the Law of the Sea, the United Nations' Food and Agriculture Organization (FAO) Code of Conduct for Responsible Fisheries (CCRF), Kyoto Protocol on Climate Change and the Convention for Cooperation in the Protection, Millenium Development Goals (MDG) and Development of the Marine and Coastal Environment of the West and Central Africa Region (WACAF).

In The Gambia, seven biodiversity "hot spots" require special attention. These include: Bao Bolon, Niumi National Park, Tanbi Wetland Complex, Tanji/Bijol Reserve, Bintang Bolong, Kiang West National Park and Abuko Nature Reserve (Personal communication-A. Jallow). These spots are considered biologically rich with ecological functions such as refuge/habitat, spawning and nursery grounds for important fish species, other aquatic animals and avifauna with social and economic value. The stabilizing effect of mangroves in most of the complexes is imperative in the maintenance of ecosystem

balances. Parks and Wildlife Management have management plans for almost all the hot spots.

Several projects such as the Global Environment Facility (GEF) funded "Integrated Coastal and Marine Biodiversity Management", which concerns the conservation and sustainable management of globally significant biodiversity including mangroves, sea turtles, West African manatees and dolphins; the Gunjur Stay Green projects are being implemented in The Gambia.

The Integrated Coastal and Marine Biodiversity Management Project (ICAM): ICAM, jointly funded by GEF/World Bank and WWF is designed with the primary objective of strengthening coastal and marine protected area system and in-situ conservation of globally significant species and habitats in The Gambia. These include: strengthening of DPWM and training and awareness raising activities targeting local resource users, local government partners, and to a lesser extent, the general public. The project will also support the strengthening of the national conservation system/network and development of participatory conservation area management models.

AEWA Project: The project is funded by the Global Environmental Facility and being implemented by Wetlands International West Africa Program as demonstration project in the framework of UNEP/GEF "Wings Over Wetlands". It is being implemented in the Salou-Niumi Complex of Senegal/The Gambia. It supports a number of important activities including: designation of trans-boundary Ramsar Site; develop an integrated trans-boundary management plan; strengthen surveillance of water bird breeding colonies; Capacity-building; awareness campaign (policy-makers); Promote sustainable use of natural resources; public awareness (of wetland values); and sub-regional workshop & exchange program

Operational Management of Existing Marine Protected Areas Project: This project is a pilot project funded by FIBA, WWF and IUCN and is intervening in the Nium National Park, Tanji/Bijo Island and Tanbi Wetland Complex. The project supports the following activities: increasing areas under protection; strengthening capacity to manage conservation areas; collection of information needed for the management marine protected areas; preparation and implementation of national/local level action plans for conservation of turtles, manatees, dolphins, migratory birds etc.; development and testing replicable models for participatory biodiversity conservation and management through revising/preparing and implementing integrated conservation area and buffer zone management plans; and, capacity building of local communities and stakeholders and production of communication materials.

The Banjul Declaration of 1997 led to the preparation of an environment action plan which calls for a strong commitment to the principle of broad-based participation at all levels of planning and implementation of environmental policies. Although the GEAP was prepared with the collaboration of all key players in the environmental sector of the Gambia, NGOs, Civil Societies and public interventions to address environmental problems remain sectoral in perception and uncoordinated in terms of policy objectives.

Limited linkages exist between key actors in the coastal environment. While the NEMA has the exclusive responsibility for the management, control and regulation of the Coast Zone, it established a policy making body- National Environment Council (NEMC) and an implementing and coordinating body, National Environment Agency (NEA).

An advisory body, the Coastal and Marine Environmental Working Group (CMEWG) established by the NEMA and under the aegis of NEA advises on matters related to coastal environment. The CMEWG is a technical body with a multisectoral membership; central government institutions with stake on the coastal environment. The NGOs and Civil Societies Organisations are co-opted as and when necessary. Nonetheless, it provides an ideal forum and institutional arrangement for integrated coastal zone management. As a technical body, the working group deals with matters related to planning and implementation of programmes including capacity building.

The 2008 Policy Document states that the Government shall take cognizance of a policy framework which would recognize that responsible fisheries management is essential for the sustained development of the Fisheries Sector and its economic benefits as well as the welfare of its stakeholders. The 2007 Fisheries Act also clearly stipulates management framework for fisheries resources of The Gambia. The implementation of fisheries legislation rests on the Secretary of State responsible for fisheries and the Director of fisheries advised by a Fisheries Advisory Committee comprising of all stakeholders.

The Fisheries Department is involved in investigating improved fish processing methods and techniques, and in fish stock assessment. There is a pilot project on the culture of freshwater catfish and tilapia along the river. Also ongoing are trials in the culture of tilapia by the women community in Central River Division, under the Household Food Security component of the poverty alleviation program, funded by UNDP. The Fishing Gear Technology Unit of the Department of Fisheries is responsible for the training of artisanal fishermen in the use of modern fishing gear, methods and techniques. The call for action to address environmental and natural resources management issues by The Banjul Declaration in 1977 resulted in the establishment of a Department of State Environment Unit in 1982 to coordinate environmental matters and monitor the impact of various projects and to provide advice to Government and Non-Governmental Organisations (NGO). The enactment of the National Environmental Management Act (NEMA) by Government in 1987 and the establishment of the National Environmental Management Council (NEMC) chaired by The President provided both the legal framework for environmental planning, management and decision-making. The Gambia is signatory to and has ratified several conventions resting on environmental and natural resources conservation and protection.

The existing Central Government development management framework consists of the National Assembly, the Cabinet, thirteen line Departments of State and NGOs. The efforts of these public agencies are complemented by a host of bilateral and multilateral development partners, non-governmental organizations (NGOs) and Community-Based Organizations (CBOs) (MEA, 2007).

The implementation of the Conventions to Combat Desertification (CCD), Biological Diversity (BD) and Climate Change (UNFCC) is carried out by five line Departments of State and their technical departments play a key role. These are:

- The Department of State for Agriculture and its four Technical Departments and the National Agricultural Research Institute (NARI);
- The Department of State for Fisheries, Water Resources and NAM and its Technical Departments
- The Department of State for Natural Resources and the Environment and its Technical Department and National Environment Agency;
- The Department of State for Local Government and Lands and its Technical Department of Community Development, and Department of Physical Planning and Surveys, and Non-Governmental Affairs Agency;
- The Department of State for Trade, Industry and Employment and its Technical Agency, and the Gambia Renewable Energy Centre (GREC).

The National Environment Agency (NEA), which was created in 1993, is mandated by the National Environment Management Act to coordinate the implementation of the Gambia Environmental Action Plan (GEAP) and all environment related technical issues at the national level. The Agency discharges its coordinator functions through eight working groups (including Coastal and Marine Environment), which together with the Agency constitute the elements of the GEAP process, refer to GEAP for further information. The membership of the working Groups are drawn from Governmental, Non-Governmental Organizations and private sector institutions.

The Non - Governmental Organizations and Civil Organizations actively participating in coastal environment management in the country are few. These organizations implement projects in the agriculture and natural resources sector and thus impact directly on natural resource management. Local NGOs include:

(a) Stay Green Foundation
(b) West African Bird Study Association
(c) National Association of Artisanal Fisheries Operators
(d) Gunjur Environment Protect and Development Group
(e) Makasutu Wildlife Trust

International NGO's such as World Wildlife Fund and UNDP are also actively engaged in coastal issues especially fisheries in The Gambia

National Legislation

The relevant Acts are grouped as follows (from Sallah-Njie 2004):

1. Environment and Nature
    - NEMA 1994 and related environmental action plans
    - Continental Shelf Act cap 26:01, Territorial Sea and Contiguous Zone Act
    - Environmental Protection (Preventin Dumping) Act cap 72:02
2. Natural Resources Use
    - Wildlife Biodiversity Act, 2003

- Fisheries Act 2007
- Forestry Act, 1998
- National Tourism Act/Tourism Master Plan
- Minerals Act Cap: 64

3. Land Tenure, Planning and management
    - State Lands Act 1991
    - Physical Planning and Development Control Act
4. Transportation, Roads and Infrastructure
    - Ports Act cap 68:01
    - The Gambia Roads and Technical Services Authority Act 2003
5. Local Government Authorities
    - Local Government Act 2002

The following Articles of the 2007 Fisheries Act provide for the rational and sustainable use of resources:
Article 11 (1) of Part III- Fisheries conservation, management and development of the 2007 Fisheries Act makes provision for the Director to prepare and keep under continual review plans for the management and development of fisheries and aquaculture. In doing so, he should consult with stakeholders and fisheries authorities in the region.

In Article 13 (1) The Secretary of State responsible for fisheries may, in consultation with the Committee, in the interest of conservation, management and sustainable utilization of fisheries resources by Notice published in the *Gazette*, declare any area of the fisheries waters and corresponding subjacent areas, including marine protected areas or reserves established under any other laws, to be a Special Management Area for purposes of community-based fisheries management, application of certain conservation and management measures, artisanal or subsistence fishing operations or for any combination of the foregoing purposes or other specified purpose.

In Article 15 (1), the Secretary may, in particular where there is a need to take immediate conservation and management action, by Notice in the *Gazette* –

(a) establish open or closed seasons for any specified area, for any fish stock and any period of time;

(b) regulate the taking, from any area, of fish that are less or greater than a specified size, weight or dimension;

(c) regulate the taking of fish from any area:

i. by a specified method, gear, equipment or instrument;
ii. by a specified class of persons;
iii. by a specified class of vessels;

(d) regulate the landing, sale, display or offering for sale, transporting, receiving or possession of fish.

Article 16 (1) empowers the Secretary of State responsible for fisheries to, by way of Notice in the *Gazette*, declare any fish as protected which he considers is endangered or which are designated as endangered by international agreement.

The control and management of coastal resources is entrusted to several key Departments of State. The institutions involved include the Departments of State for Local Government and Lands, Agriculture, Tourism and Culture, Fisheries, Water Resources and National Assembly Matters, Natural Resources, Forestry and Environment, and Trade Industry and Employment. The importance attached to the coastal area has led the government to formulate policies, enacted legislation, initiated projects and programmes to realize its overall national objective of sustainable development through the various sectoral approaches. At the global front the country is signatory to a number of International and Regional Conventions and Protocols, all geared towards better management and prevention of the damage and loss of the coastal ecosystems.

Protected areas

Several Governmental institutions together with Non-Governmental Organizations and Civil Society Organizations (CSO) including fisheries associations are actively engaged in coastal and marine environment protection. The Gambia Government declared its intention to encourage the protecti**o**n of the remaining wildlife species (fauna and flora**)** by sett**i**ng aside protected natural habitats for them and simultaneously promote conservation education to increase public awareness about wildlife and general environmental issues. Since 1916, six wildlife protected areas with a total land area of approximately 37,777 ha (i.e about 3.5% **o**f The Gambia's land area) have been designated (Table 3). In the Gambia, four marine and coastal Protected Areas (PA) have been gazetted as follows: Niumi national park (1986); Tanbi wetland complex (2003); Tanji bird reserve (1993); Bao bolon wetland reserve (1996). Bao Bolon Wetland Reserve, Nuimi National Park and Tanbi Wetland Complex are designated as Ramsar sites since the country ratified the Ramsar Convention in 1996.

Table 3: **National Parks and Nature Reserves in the Gambia** (Mendy, 2008)

Name	**Date**	**Area (ha)**
Abuko Nature Reserve River Gambia Nuimi National Park KiangmWest National Park Tanji Coastal Park Bao-bolon Wetland	1968 1976 1986 1987 1993	105 589 4940 11526 612 20000
Total Area		37,769

The Niumi/Sine Saloum National Park established in 1987has an area of approximately of 4,940 ha. The park is contiguous with Senegal's Delta du Saloum

National Park and Biosphere Reserve. Apart from being an important fish breeding ground, the area constitutes one of the last untouched mangrove areas on the West African coast north of Equator. This complex of mangrove, bolongs (tributaries) and adjoining habitats is a veritable magnet for many thousands over-wintering migrant birds (Land use…). Recent surveys indicate that at peak population periods, a good number of the world's known osprey are to be found in this region. Although the mammal population of this area is by no means as rich or as obvious as its avifauna population, one of the world's rarer mammal species is found here - the West African Manatee. The endangered cape clawless otter is also found here.

Baobolon Wetland Reserve is about 35 km^2 in area. It is a valley stretching over a length of more than 140 km from the Senegalese border south of the Ferlo towards the River Gambia. This valley crosses several regions in Senegal and penetrates the Gambian Province of Illiassa. It is entirely dry during 8 months of the year (except for the bottom of the valley), but during the rainy season it is more or less like an immense creek where the waters are full of large seaweeds and fish without any large exit to the river. Presently the area is not being used for agriculture because of salt water intrusion. However, the area still remains a wetland of great significance not only for weatherboards, but for the local communities as well because of its importance as a source of fish (Tilapia), fencing materials and thatch grass. The Baobolon Wetland Reserve is the first Ramsar site to be designated in the Gambia.

Tanji Bird Reserve incorporating the Bijol Islands This is the estuary and adjacent land at Bald Cape (the Promontory between Ghana Town and Tanji) together with the Bijol Islands. It has an area of about 136.87 ha. This area has been declared a bird reserve with species emphasis on the remarkable bird faunas that are to be found there. Tanji bird reserve has a high diversity of African and Palaearctic bird species; approximately 300 species. It has a significant numbers of migrants: Intra-African migrants 32 species (11%), palaearctic migrants 82 species (27%) and resident species 181 (61%). This constitutes 295 species from 61 families out of 515 species and 75 families nationally.

The Bijol Islands are a major offshore roosting area for very large number of seabirds, migrants ospreys, shorebirds, etc. Also found in the Bijol islands are Dolphins, upside down jelly fish, fiddler crabs, Ghost crabs, sand crabs, mud skipper, etc; and the list of mammals include but not limited to the following: Senegal bush baby, Bushbuck, clawless otter and Gambian mongoose.

The Abuko Nature Reserve holds a substantial population of Nile Crocodiles and attracts a wide variety of birds and mammals especially during the dry season. It has a total of 23 species of mammals, 37 reptiles and over 270 bird species. It is also an important Gallery Forest.Abuko Nature Reserve has one of the most representative samples of Guinea woodland which harbors a number of species of very local distribution within The Gambia, including the dwarf crocodile (Osteolaemus tetraspis), Ahanta Francolin (Francolinus ahantensis), White-spotted Flufftail (Sarothrura Pulchra) and African Goshawk (Accipiter tachiro macrosceliders).

The inclusion of Bijol Islands as part of Tanji Bird Reserve is a major asset to the status of the reserve. The Reserve, although small, is critically placed on prominent point of coastline (3700 m) not including estuary thus, the main reason for the importance of the site to migrants. It has very high habitat diversity in small area: marine, estuary, freshwater swamp, coastal dune, wood-land, thicker. Most of these are not represented in the other existing resources. Most importantly, it is close to the centre of population as well as the TDA. There is a limited utilization of the reserve for firewood extraction, clam gathering in the lagoon, some grazing and access for fishing pirogues. . There is an annual water bird census conducted by the DPWM with financial support from Wetlands International.

RECOMMENDATIONS

Foster a more sustainable marine fishery

Given that demersal fish resources are over-exploited, the fisheries strategic and management plan calls for stricter control of the exploitation of resources. This will require

- A reduction in the number of fishing licenses issued to foreign vessels
- Improved surveillance of the fisheries waters, and an increase in licensing fees for demersal trawlers.
- Closed seasons during spawning

Sound knowledge of the state of the fish resources is a pre-requisite for effective planning development and management of the fish resources. Therefore, it is important to increase research activities on the fisheries resources by studying the abundance and distribution of fish.

1. Monitor Fish Stocks

In order to reduce the possibility of decline in fishery productivity, strict biological monitoring of fish stocks is essential. Monitoring of fish stocks can ascertain the extent of the resource base, and establish optimum margins for sustainable exploitation. This strategy can help develop the commercial potential of high valued fish species such as shrimps and lobsters.

2. Create Participatory Co Management

The rational exploitation and utilization of fish resources can contribute towards food security and foreign exchange earnings. Public interventions to address environmental problems remain sectoral in perception and uncoordinated in terms of policy objectives. The Government recognizes the fact that policy alone cannot remedy this situation. To correct this requires a strong commitment to the principle of broad-based participation at all levels of planning and implementation of environmental policies.

3. Fisheries Education

To achieve the measures outlined above will require the collective effort of the government, fish producers as well as other stakeholders. All stakeholders should be invited to take part in public educational and awareness programs relative to the conservation of fisheries resources.

4. Climate Change Adaptation

The capacity to adapt to adverse effects of climate change especially in fisheries is low in The Gambia due to scarce financial resources, and limited institutional and technological capability. It is important to have a set of proposed adaptation measures that will assist the country in achieving national adaptation goals in meeting commitments to the UNFCCC. It is hoped that the measures put forward will form a basis for conservation and the monitoring of stock levels and their sustainable utilization in the face of physical stress caused by climate change and other environmental phenomena, while still meeting the growing demand for food fish.

5. Involve NGOs

The 2003 Biodiversity/Wildlife Policy and Legislation provided for Community and Civil Society involvement in biodiversity management. Although this call is recent, the coordinated participation of NGOs and CBOs with specialized experiences at the grassroot level will improve and strengthen institutional framework for environmental management at local level; especially for sustainable management and protection of the coastal zones and its resources as envisaged by PRSP II.

CONCLUSIONS

The coast of The Gambia, including the Gambia River estuary and the Atlantic Coast between the Casamance River mouth and the Saloum estuary in Senegal is clearly a region of marine biodiversity significance. Moreover, the entire Gambia River ecosystem can be considered of biodiversity significance since it is the only natural riverine estuary in the West African Marine region, undammed, not hyper-saline, with largely intact mangrove forests and several endemic species.

The Ba Nafaa project should address the following threats to marine biodiversity as a priority:

- Sustainable fishery ecosystem integrity. The project should focus on reducing the impact of fishing on the diversity of the marine ecosystem by 1) preventing overfishing 2) reducing by catch of juvenile fish of all types and 3) preventing by catch of threatened species of marine animals, especially sea turtles and sharks.
- Sustain freshwater flows to The Gambia River. The Gambia River is the basis for many of the rich fisheries in the region. Therefore, the project should understand

the effects of climate change and the potential impacts of a proposed dam on the river on fin and shellfish populations.

- High population growth rates and immigration into the fishing communities are indirect threats to the marine biodiversity of the region. The project should consider incorporating activities that raise awareness about this threat and consider activities that manage or reduce population growth rates more effectively.

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