Food and Agriculture Organization of the United Nations

MINISTRY OF FISHERIES, WATER RESOURCESAND NATIONAL ASSEMBLY MATTERS

IDENTIFICATION OF FISH SPAWNING SITES, THE GAMBIA

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November 2016

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ACCRONYMS/ABBREVIATIONS

ADB	African Development Bank
CRR	Central River Region
FAO	Food and Agriculture Organization of the United Nations
DoFish	Department of Fisheries
DWR	Department of Water Resources, Gambia
DPWM	Department of Parks and Wildlife Management
GBA	Greater Banjul
GOTG	Government of The Gambia
LECRDS	Low Emissions Climate Resilient Development Strategies
LRR	Lower River Region
MOU	Memorandum of Understanding
NBR	North Bank Region
NAPA	National Adaptation Programme and Action Plan on Climate Change
NBSAP	National Biodiversity Strategy and Action Plan
NEA	National Environnent Agency
OMVG	Gambia River Basin Development Organisation
REPAO	Réseau sur les Politiques de Pêche en Afrique de l'Ouest
TWNP	Tanbi Wetlands National Park
URR	Upper River Region
USA	United States of America
WCR	West Coast Region

1. INTRODUCTION

The Gambia, since 2016 officially the Islamic Republic of The Gambia, lies between latitudes 13°N and 14°N on the West Coast of Africa bordering the Republic of Senegal and the Atlantic Ocean with a total land area of approximately 11,420 Km², a population of about 1.4 million and a population growth rate of 4.2% per annum. The coastline of The Gambia is about 80 km long, 25 km of which lies in the bay-shaped mouth of the River Gambia and the rest facing the Atlantic Ocean. The country is divided into five administrative regions namely: West Coast Region (WCR), Lower River Region (LRR), North Bank Region (NBR), Central River Region (CRR) and Upper River Region (URR). The capital Banjul is situated within the area called the Greater Banjul Area (GBA).

The fisheries waters of the Gambia are characterised by marine waters, brackish waters and fresh water regimes which correspond with the three (3) Fishery Administrative Areas of the country namely: the Atlantic/Marine coast Stratum, the Lower River Stratum and the Upper River Stratum. The estuarine areas have a dense mangrove forest of 67,000 hectares (UNEP /UNDP 1996), stretching up to 200 km inland from the mouth of the River Gambia, which provides breeding and nursery grounds for commercial marine fish species , shrimps and other valuable aquatic animals (Mendy, A. 2009).

The Gambia's fisheries sector consists of two subsectors: the artisanal fisheries subsector and the industrial subsector.

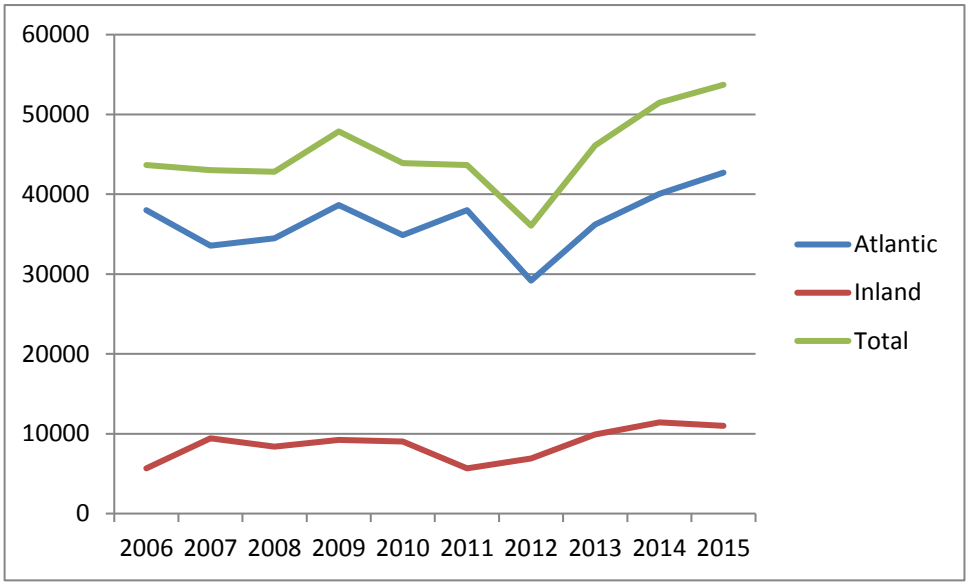
The Gambia is believed to be particularly rich in terms of fish species abundance and diversity. This rich resource base offers great potential to make substantial contribution to The Gambia's socio-economic development, if fish resources are managed sustainably. Fish provides the main source of animal protein for the average rural family in the sub-region, where annual fish consumption can be as much as 25kg per capita. In many rural areas, fishing serves as a "social safety net" when farming turns unproductive due to depleted soil, drought, disease, or other factors (USAID/BaNafaa, 2013).

The Gambia's marine fish and shrimp species are usually classified as demersals and pelagics. The demersals include shrimps, groupers, sea breams, grunts, croakers, snappers, etc. and the small pelagics group include the two sardinellas (*Sardinella aurita* and *Sardinella maderensis*),thebonga/shad (*Ethmalosa fimbriata*), horse mackerels (*Trachurustrecae, Trachurustrachurus*and *Caranxrhonchus)* and mackerel (*Scomberjaponicus*).

In the inland sector fish resources are found within the Gambia River system which runs through the entire length of the country. They comprise mainly fresh water species such as the freshwater catfish, (*Clarias* spp.), tilapia,*Tilapia* sp.), the bony tongue (*Heterotis niloticus*), Gymnarchus *(Gymnarchus niloticus*), etc. It is important to note that the river and its ecology also serve as a transitional phase for many marine fish species, where they spend part of their life cycle to reproduce, feed or grow up on nursery grounds. Such species include the shrimps, the croaker, the thread fins and other high value pelagic species such as the barracuda, whoseJuveniles occur

among mangroves and the estuaries in the nutrient-rich mangrove areas (Fisheries Department, 2013).
Analysis of available Time Series data on marine Atlantic coast and inland catches (Figure 1) indicates that production in the inland sub-sector is much lower even as marine catches appear to be increasing (Fisheries Department, 2016).

Figure 1: Artisanal Sub-Sector Fisheries Production (Kilogram) 2006-2015



Data Source: Fisheries Department, GOTG, 2016

The Gambia's fisheries sector operates under the authority of the Minister of Fisheries, through the Department of Fisheries (DoFish). The policy, legal and management framework for fisheries in The Gambia is provided by the 2007 Fisheries Act and the 2008 Fisheries Regulations.

The policy objectives of the fisheries sector as articulated in policy documents include:

- Rational and long-term utilization of the marine and inland fisheries resources
- Improved nutritional standards of the population
- Increased employment opportunities in the sector
- Increased foreign exchange earnings
- Increased and expanded participation of Gambians in the fisheries sector
- Improved institutional capacity and legal framework for the management of the fisheries sector

Of the above-listed objectives, the first and the last ones are of particular relevance to the objective and potential use of the results of this consultancy. In order to ensure attainment of the above objectives, the Gambia Government has recognised the necessity of formulating and implementing a number of strategic and legislative documents. Amongst these document is a Fisheries and Aquaculture Strategy and Action Plan.

1.1 Context

The Gambia Fisheries Strategy and Action Plan 2017 – 2021 has been developed and is being implemented to ensure that development of the fisheries sector is conducted in a sustainable manner for the benefit of present and future generations. In this regard, management and conservation of the fisheries resources are indispensable for achieving sustainable development.

However, a number of economic, social, institutional, physical and technical constraints are impeding the sustainable, growth and development of the fisheries and aquaculture sectors. Furthermore, there has been an increase in non-sustainable capture fishing practices that are threatening the sustainability of fisheries sector development.

In this regard, the Gambia Government recognized the need for a coherent strategy and associated action-plan to address these challenges and to support informed decision making for policy, investments and programmes in the fisheries sector.

Over the years, the FAO through the office of the Representative in The Gambia has been providing support to the fisheries sector. FAO has provided assistance to the Gambian Government by elaborating legislative and policy documents such as the Fisheries Act 2007 the Fisheries Policy and Fisheries Regulations 2008. The artisanal fisheries sector has benefited from several projects funded through the FAO's Telefood initiative. It has also been complementing Government's efforts to develop the aquaculture sub-sector.

It is against this background that government requested for FAO's technical and financial support for the formulation of a Fisheries and Aquaculture Strategy and Action Plan 2017-2021.

As part of its continuing support to the Government's implementation of the strategy, FAO is supporting the Ministry of Fisheries to conduct an exercise through a consultancy in the identification of fish spawning sites in the country.

The present report is the outcome of a consultancy conducted to identify fish spawning sites in the country. The specific terms of reference for this consultancy are presented in appendix 1.

2. MATERIALS AND METHODS

The consultant was able to acquire information for this report through a review of existing documents made available to the consultant by technical departments in charge of fisheries, the environment, forestry and other experts. The Consultant also searched information relating to the task in World Wide Web.

The consultant also conducted a field work spreading over a twenty days period during which he visited several sites along the River Gambia meeting and consulting experienced fishermen and other stakeholders in the fisheries sector in all the administrative regions of the Gambia. The information gathered during the field visit was used to verify the information gathered from the desk-study regarding the River Gambia ecosystem and its role as spawning site for fish and molluscs of fisheries importance.

A physical map of The Gambia (see appendix 3) was used to obtain an overview of the River Gambia and its numerous tributaries (bolongs) in order to appreciate areas that are likely to be spawning sites. This exercise was necessary as the entire River could be considered as a spawning (including nursery) site for many finfish, shrimps and molluscs.

In order to acquire the specific location of sites identified as potential fish spawning sites, a GPS was used to obtain the coordinates of the sites.

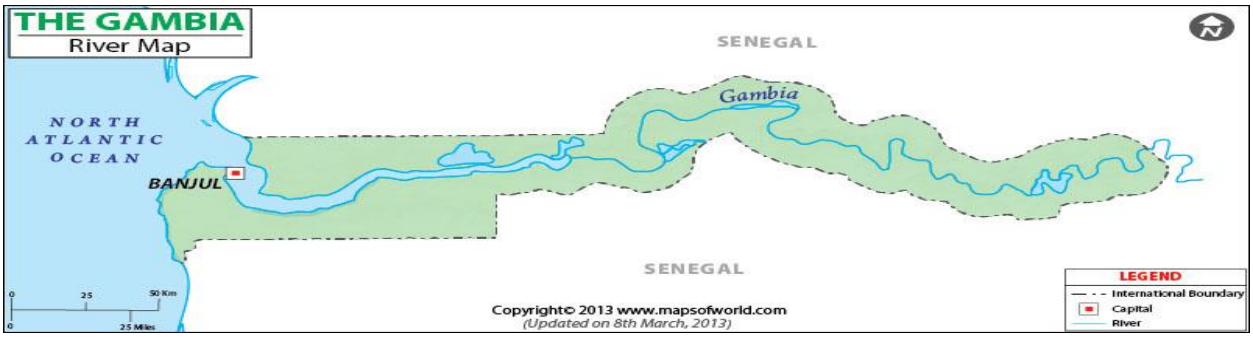
Thus the content of this report is based on a review of available relevant earlier reports and documents and on the outcome of consultations with fishermen and other stakeholders conducted during field visits countrywide to several selected sites along the River Gambia.

3. CURRENT SITUATION – BASELINE

3.1 River Gambia Ecosystem

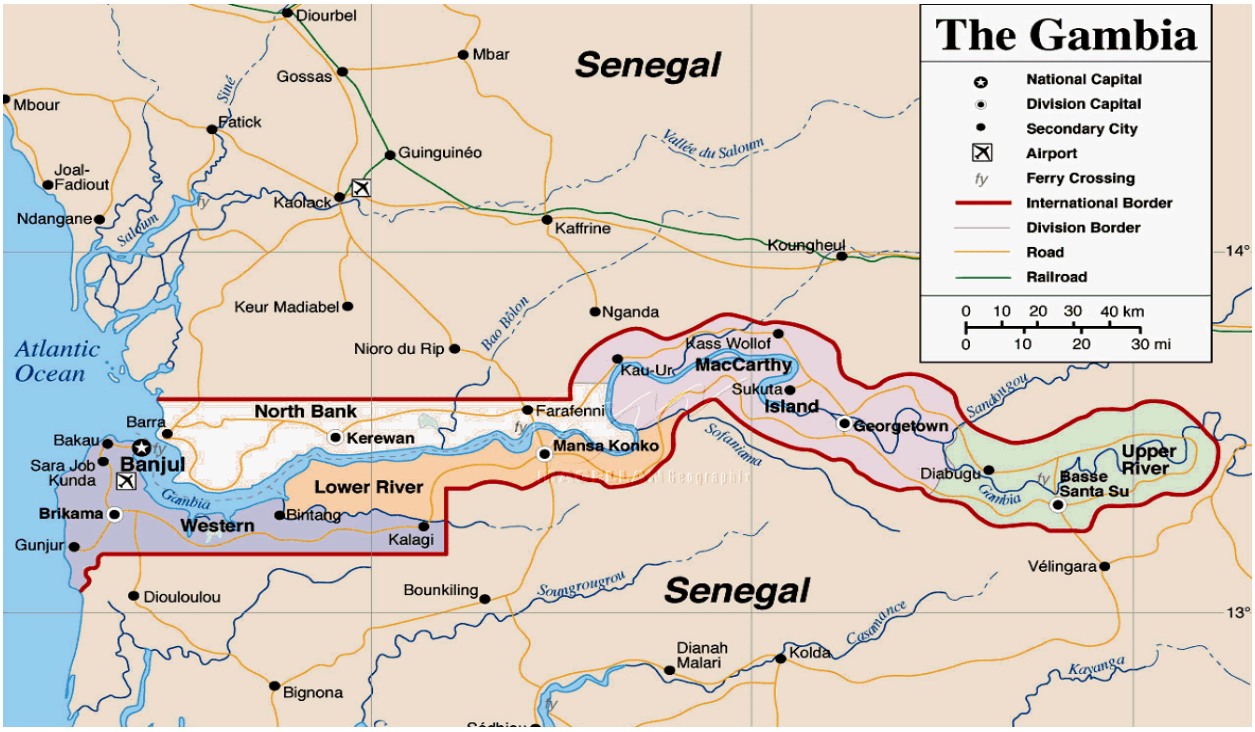
The River Gambia, being the dominant natural feature of the country, has a major significance for the economy and ecology of the nation. It constitutes the major inland water ecosystem in the country. The river is approximately 700 miles (1,130 km) long, rising in the Fouta Djallon plateau in Northern Guinea, flowing generally northwest through South East Senegal then west, dissecting The Gambia, to the Atlantic Ocean at Banjul. The river is navigable for most of its length. The tide intrudes up to 460 km upstream from Banjul and thus defines the estuary. Locally, the River Gambia is referred to, by some, as the Gambia Bolong.

Fig 1: Map (a) River Gambia



Source: Maps of world

Fig 2: Map (b) River Gambia



The River Gambia's course can be divided into four reaches with different morphological characteristics (ADB et al. 2013):

- Estuary mouth (0-20 km upstream) – river course narrows at the mouth defined by Banjul and Dog Island where it is approximately 5 km wide
- Lower estuary (20-150 km upstream) – river is 8-10 km wide with tidal flats covered with shallow water. Mangroves are found over a distance of up to 10 km from the tidal flats
- Upper estuary (150-300 km upstream) 5-6 km wide and is characterized by many meanders and the presence of islands. Mangrove zones approximately 3 km wide are present and behind these swamps are flood zones
- Upper reach (300-530 km upstream) 200-300 m wide and depth is 3-7 m

The River Gambia and its associated inland water bodies, flood plains and wetlands are considered to be rich in terms of species abundance and diversity of freshwater species. This is due to the fact that the productivity of the waters is enhanced by the high level of nutrients in its tributaries.

The major tributaries are all typical of tidal rivers with meandering courses over swampy mangrove areas and responding to the ebb and the flood of the tide. Amongst the most renowned tributaries are; the Bao bolong, the Mini Miniyang Bolong, the Nianija Bolong and the Sandougou Bolong. The Sandougou Bolong however is a substantial river with a catchment area of approximately 12,000 km².

3.2 Ecological zones of the River Gambia

The ecology of the River Gambia could be divided into two different zones, estuarine and freshwater, which in turn largely determine the peripheral vegetation pattern. From information gathered from experts of the Hydrology Division, Department of Water Resources, salt water sneaks in some 150km upstream, as far as Kuntaur in the dry season (November to June). In the lower estuary, mangroves dominate the riverside, with extensive reed belts in the in-between zone, where the water is fresh.

a. Permanent Freshwater Zones

According to sources at the Department of Water Resources the permanent fresh water zone extends from Kuntaur to Fatoto.

The most common fish species in the freshwater ecosystems of The Gambia are the riverine fish species which are mostly found in the River Gambia, its tributaries and wetlands. These include catfish (*Clarias* spp.), Osteoglossids (particularly *Heterotis niloticus*), Cichlids (*Tilapia* spp.) and *Gymnarchus niloticus*.

b. Permanent Brackish water Zones

The permanent saline water zone extends from the estuary mouth at Banjul and the lower estuary defined above, that is, from Banjul to Kemoto inland. The intrusion of fresh water from the upper reaches of the River Gambia during the latter part of the rainy season stops beyond Kemoto.

The stretch from Kemoto to Kuntaur is subjected to seasonal fluctuations. Fresh water starts to reach the Kaur-Kuntaur area from June to July and mixes with the saline water till the end of September/October. Up to May/June, the water in this zone is saline (Personal Communication, DWR, 2016).

c. River Tributaries/Creeks

There are literally hundreds of tributaries (bolongs) and creeks draining into the River Gambia throughout its length. These tributaries can be found in the area extending from the estuarine areas up to the Central River Region forming delta-like area and becoming fewer from the Upper River Region as the River gets narrower towards its source.

3.3 Aquatic River Vegetation Supportive of Spawning Fish

Gambian mangroves are among the most biologically productive ecosystems in the country and their leaves are crucial to the food web and mangroves help to regulate water flow and provide essential breeding habitats for many species of fish and shellfish.

The estuarine parts of the River Gambia defined above have a rich population of mangroves. All of the six species of mangroves found in West Africa occur in The Gambia and have been recorded (NBSAP 2015-2020). These include *Avicennia africana*, *Conocarpus erectus*, *Laguncularia racemosa*, *Rhizophora harrisonii*, *Rhizophora mangle* and *Rhizophora racemosa*.

The mangrove vegetation of the River Gambia includes a variety of trees and shrubs growing along the river bank. Four mangrove community types have been observed as follows (Sukardjo, 1995):

- ► fringe mangrove forests, dominated by ***Rhizophora mangle***, occur along the shoreline of bays and lagoons that have fairly constant annual salinity
- ► riverine mangrove forests occur along most of the riverine banks, except for near the mouth of the estuary and up in some adjacent bolongs (tributaries) and represent the dominant type of mangroves. These forests comprise all three ***Rhizophora*** species.
- ► basin mangrove forests are frequently flooded by tides (spring tides only); these are dominated by ***Avicennia*** and are found inland of the riverine forests.
- ► scrub mangroves occur in the same place as fringe mangroves and are dominated by ***Avicennia*** with minor occurrence of ***Rhizophora***and ***Laguncularia***

In many areas, only the fringe mangroves are present, forming a thin strip of mangroves along the estuary. The mangroves in the Gambia River estuary provide a natural habitat for oysters.

The upper limit of the geographic distribution as far as mangroves are concerned is found around the Jarreng-Yellitenda area, and there is evidence, here, that the presence of non-mangrove

species (*Cordia* sp., *Crinum* sp., *Desmodium* sp.) is related to lower salinity. Further up the river, the lower salinity condition in the river has changed biological activity on the banks (Sukardjo, 1995).

Despite their ecological significance, mangroves are threatened by both natural and anthropogenic factors, uncontrolled sand mining, destructive mangrove cutting, random inappropriate methods of shrimp fishing and oyster harvesting, contamination of marine ecosystems by domestic and industrial waste and solid waste disposal.

1. Existing available information on fish spawning sites

The consultant was not able to find any reports on studies or investigations relating to fish spawning sites. However, mangrove forests along the River Gambia, wetlands and swamps have been referred to as habitats that provide shelter, nursery and feeding grounds for fish, shrimps and shellfish. The Consultant is aware that OMVG commissioned a comprehensive study of the River Gambia within the framework of OMVG member states' decision to construct a bridge across the River Gambia. This study was conducted in the mid1980s. The Consultant has however not been able to secure any copy of those reports. The reports acquired by the Consultant are those listed in the bibliography/references and these related mainly to the engineering design of the bridge and the environmental impact assessment and related proposed mitigation actions or measures.

2. Existing legislation related to spawning sites

Tanbi Wetland Reserve, Nuimi National Park, Bao Bolong Wetland National Park and River Gambia National Park are all protected areas under the Wildlife Conservation Act. The Fisheries Act 2007 also prohibits or restricts fishing in certain areas including areas in the vicinity of Dog Island. These and similar areas declared as protected areas in The Gambia undoubtedly provide sanctuary to spawning/breeding fish, shrimps, molluscs and other aquatic organisms.

The provisions of the Fisheries Regulations 2008 include conservation measures and restricted zones have been more clearly defined, giving latitudes and longitudes; and fishing gear restrictions are also defined, including a ban on the use of the beach seine, setting of gill nets around Dog Island, and maintaining minimum mesh sizes for industrial operations, in order to conserve the fish resources.

4. RESULT

4.1 What is Spawning?

It is the opinion of the consultant that this question needs to be addressed and put into perspective.

The task of the consultant was to identify fish spawning sites. But it is my opinion that before proceeding with the presentation of the results of the consultations and field visits, the above question needs to be put into perspective.

As a verb, to spawn refers to the process of releasing the eggs and sperm, and the act of both sexes simultaneously is called spawning. Most aquatic animals, except for aquatic mammals and reptiles, reproduce through the process of spawning. This is an external method of reproduction where the female releases many unfertilised eggs into the water. At the same time a male or many males release their sperm into the water which fertilises most of these eggs. Spawn is the eggs and sperm released or deposited into water by aquatic animals. Where fish lay eggs, however, depends on the species. Some deposit eggs on rocks, others on weeds or flooded brush, although there are also other ways of reproduction.

It is pertinent to underscore the fact the subject that is to be addressed by the consultancy is broader than just spawning. The suitability of the sites for the reproduction or breeding of fish and shellfish including shelter and feeding of the juveniles is what needs to be evaluated or assessed.

4.2 Identified Fish Spawning Sites

On the basis of information obtained through desk study, consultations and observations during field visits it could be concluded that the entire length and width of the River Gambia is a spawning ground for fish and other organisms of fisheries interest. The River Gambia provides sanctuary for spawning, feeding and shelter for many marine animals including fish and shrimps.

However, the results of field investigations and consultations indicate that several sites along the River Gambia definitely serve as spawning sites for fish and molluscs. These sites meet many of the conditions, such as those listed later on (criteria or characterisation in section II below) in this report, required for successful fish spawning and survival of eggs and juveniles.

The following sites have been identified as serving as spawning sites along the River Gambia:

1. Mouth of the River Gambia Estuary
2. *Tanbi Wetlands National Park*
3. Mandinaring –Lamin creeks
4. Pirang Bolong
5. *Nuimi National Park (Jinack – Barra)*
6. Bintang
7. Tendaba
8. Kerewan Bridge area
9. *Bao Bolong Wetlands Reserve*
10. Bamba Tenda/Yellitenda
11. Kanikunda Tenda
12. Dankunku Tenda
13. Kuntaur Tenda
14. *River Gambia National Park*
15. Brikama Ba Tenda
16. Janjangbureh Tenda
17. Diabougou/Kossemar Tenda
18. Basse Tenda

But amongst these sites, there are some that have been identified as important and critical sites in terms of direct fisheries resource management. With the exception of the designated national parks/reserves/protected areas and Janjangbureh Tenda, all the sites listed above are critical sites

requiring direct fisheries resources management action by the national institutions responsible for fisheries particularly the Ministry of Fisheries and the Fisheries Department.

Any management initiative to be undertaken for the sustainable and rational use of the fisheries resources in these sites by the national institutions needs to be done in consultation and partnership and close collaboration with all stakeholders including civil society organizations having vested interest in natural resources management.

It is pertinent to emphasize that all the reserves/protected areas including the*Tanbi Wetlands National Park, Nuimi National Park (Jinack – Barra), Bao Bolong Wetlands Reserve and the River Gambia National Park* are spawning/breeding sites of fish and molluscs according to the reports and official documents of the Department of Parks and Wildlife Management. It should be noted that the Mandinaring-Lamin complex is located within the Tanbi Wetlands National Park.

4.3 Information of Identified Fish Spawning Sites

Information and images of some of some of the identified spawning / breeding sites is summarized below.

a) River Gambia Estuary

The importance of estuaries in the reproduction of fishes and/or the nursery role they perform for early recruited juveniles are well-known (Day and Deegan 1988; Laegdsgaard and Johnson 2001; Potter et al. 1990; Ross and Epperly, Sasekumar et al. 1992, Whitfield 1999 *in* G. Vidy et al. 2004).

Fig. 3: Map of Gambia River Estuary (adapted from G. Vidy et al. 2004)

Although juvenile fishes do enter estuaries in search of food and shelter, there are limitations according to prevailing environmental conditions (especially salinity) and individual species tolerances (Vidy et al. 2004). According to the study report by the latter authors, reproduction

occurs mainly during the rainy season within the Gambia estuary, as indicated by the recruitment of numerous juveniles during this period. Sea spawning species are probably influenced by other factors, such as the time and strength of marine upwelling. Nevertheless, recruitment of juveniles of sea spawning species indicates that the spawning season begins just before the rainy season (May-June) and lasts until November for most species.

It is known that the River Gambia and its estuary are about 270 km²in surface and provide spawning and nursery grounds for many fish and shrimp species.The shrimp stock found in the Gambia has its spawning grounds in the estuary/river. After hatching and metamorphosis to various larval stages in the river, juvenile shrimps migrate upstream in shallow areas of the river Gambia for feeding and growth in the nutrient-rich mangrove areas. Three months later, adult shrimp migrate to sea and later on back for spawning in the central and deepest part of the estuary (Bah et al., 2010).

It is reported that some portion of the life cycle of shrimps is spent in the ocean, resulting in the development of two fisheries: an artisanal fishery, which centres on the capture of penaeids within estuaries and during migrations from the estuaries to the sea, and a larger-scale commercial trawl fishery in the deeper waters offshore (King, 1995 in Adelugba Taiwo, Edah Bernard, 2014). In The Gambia the principal penaeid species targeted by the shrimp fishery consist of *Penaeus notialis* which aremost abundant during the rainy season (July to September). During this period, shrimp fishermen from Senegal, Mali and Guinea migrate to The Gambia to exploit the shrimps in the estuary (Mbye,E.2005). It is worth mentioning that another species of shrimp (*Parapenaeus longirostris*) is found in the deeper waters (100 to 400 m) and is targeted by large shrimp fishing vessels (more than 250 gross tons) (Bah et. al., 2010). The Pink spiny lobster, *Palinurus mauritanicus*, a demersal subtropical climate species is also found in the marine waters of the River Gambia and it inhabits sandy, rocky and coral bottoms. It reproduces in late summer and fall (rainy season) (Gabis, et. al., 2012) and catches are sold to mainly luxury tourism industry and restauration sectors.

In late 1980's the Giant Tiger Shrimp, *Penaeus monodon*, was introduced to the Gambia from Asia, mainly Malaysia and Sri Lanka, by the defunct Scan-Gambia Shrimp Company within the framework of its shrimp aquaculture project. The hatchery was based at Sanyang and the grow-out farm was situated at Pirang. A large number of juvenile *P. monodon* stocked in the 4-hectare ponds escaped into the Pirang bolong and then into the River Gambia estuary when some of the ponds' bunds collapsed during the rainy season. Many of the escaped juveniles survived and a stock of *P. monodon* has developed in the region extending apparently as far south of the Gambia as Ghana and is being exploited by the artisanal fishery. This species is easily confused with *Penaeuskerathurus* (Gabis, et. al., 2012) also found in Gambian waters.

In the past, it was known that shrimps spawned when salinity in the river was high. This occurred during the dry season when salinity levels were high due to evaporation and lack of rain. This pattern has changed over time as rainfall patterns have changed since the 1960s. Now it seems that shrimps manage two spawning cycles: one before the salinity increases too much and a second, smaller, peak in the fishery in February-March (Bah et al., 2010).

b) Pirang Bolong

Figure 4: Pirang Fish landing site

The Pirang landing site is situated on the banks of the Pirang Bolong which is tributary of the River Gambia. Rich in mangroves mainly of the *Rhizophora* species, the bolong is known to be a breeding/spawning site for fish and shrimps. The water here is permanently saline, this condition being the primary reason why the shrimp farm is situated here. Before the shrimp farm the area was a salt production site.

The landing site is mainly a shrimp landing site.

c) BintangBolong

Figure 5: Bintang Bolong landing site

During the rainy season, fresh water comes up to BintangBolong (August to September) causing the salinity to drop. The vegetation along the banks of the Bolong comprises of mangroves, *Rhizophora*sp, providing the suitable environment for fish spawning.

Figure 6: Bintang, Processing of oysters harvested from the mangroves

From discussion with fishermen, the consultant gathered that spawning (breeding) occurs from April to July and fingerlings or juveniles are observed during this period.

There seems to be abundant oyster populations due to the healthy mangroves forests and oyster harvesting is a full-time activity undertaken by women. Oyster harvesting takes place from December to June and a close season is observed annually from July to the end of November.

d) Tendaba

At Tendaba, from the month of April gravid fish are observed entering the waters of this part of the bolong and spawning occurs during the period April to July and juvenile fish exit the waters in August/September as fresh water enters and salinity decreases.

The characteristics of spawning sites in this area seem to be the dense mangroves forests, holes, grassy sandy substrate, and the saline waters.

Figure 7: Tendaba, Mangrove forest along the banks of the River Gambia

The bolongs (tributaries) draining into this part of the River Gambia include: On the western side: Manyoka Bolong, Kissi Bolong, Tunku Bolong, Miniminiyang Bolong, JaliBolong, Katchang Bolong (linked to the BaoBolong) and on the eastern side: Jirroff Bolong and Kajang

Bolong, Sofa Nyama Bolong, Bunting hole, Wurangbang and Dungbaly bolongs in Bintang. All these bolongs serve as fish spawning sites.

The fishermen have observed a decline of salt water fishes here which they attributed to overfishing in the marine zone as Bonga and shrimp landings have been declining in recent years. According to them, the gravid fish are caught by the industrial vessels, thus preventing them from entering the estuary and spawning. However, it is important to underscore here that the impact of Climate Change including global warming and the anomalies of rainfall pattern in recent years could also be contributing factors to this decline in fish and shrimp landings.

Also according to The Gambia National Adaptation Programme and Plan of Action (NAPA) in Climate Change (2007) and various reports by Norton, et al. (1989);Anyadike(1993) cited in Jaiteh and Sarr, (2011), mean annual rainfall and the length of the rainy season have decreased over a 35 years period (1950 – 1985) across the country.

The fish species usually caught here, according to the fishermen, include some marine species especially during the period May to July (see tables in appendix 2). The scientific and local names of fish species in this report including the tables in Appendix 2 were derived from a USAID/Ba Nafaa Project document (Gabis et al., 2012), a Fisheries Department document (Ministry of Fisheries/Department of Fisheries, 2015) and an FAO report (Van der Knaap and Llyod-Evans, 1986) and the Consultant's knowledge.

e) Bamba Tenda-Yellitenda

This is the site for construction of the Trans-Gambia Bridge and the Environmental and Social Impact Assessment report has identified the impact on the weak natural environment during construction and operation phase. In this regard, the importance of the mangrove ecology on each side of the Gambia River with loss of flora and topsoil was highlighted.

The period April/May coincides with the shrimp fishing season. Fresh water starts entering this zone in June and from August to November the area is entirely fresh water and there is reduced fishing activity.

There are several bolongs in this part of the River Gambia including the Kayama Bolong, DumbalingBolong and the SoolooBolong which goes up to Soma. There are no oysters due to the quasi-permanent fresh water.

The vegetation cover comprises of mainly mangroves, *Rhizophora*sp and *Avicennia* sp. whose presence makes the environment conducive for fish spawning.

The fish species caught here, according to the fishermen operating here are listed in the tables in appendix 2.

According to the fishermen, Illegal Unreported and Unregulated (IUU) fishing vessels operating at or close to the estuarine part of the mouth of the Gambia River catch gravid fish that are swimming to the upper parts of the river to spawn. This activity is detrimental to the replenishment of the country's fish stocks.

Figure 8: Mangroves at Yellitenda ferry crossing site (South Bank, Trans-Gambia Bridge site)

f) Kerewan Bridge Area

Consultations (discussions) with the fishermen at the site (mainly shrimpers) revealed the period April/May is the spawning period in this part of the River Gambia and its bolongs.

Fish caught are mainly marine species with a few fresh water species such as KonoKono (*Clarias*sp. as these parts of the River Gambia permanently saline, although the salinity level can vary with the season (rainy and dry seasons).

Figure 9: Kerewan Bridge area

Oyster harvesting is undertaken here on a large scale indicating the abundance of oysters that are breeding and growing on the mangroves which are abundant and lush here. This is evidenced by the heaps of oyster shell as seen in the figure below.

Figure 10: Kerewan Bridge area: Heaps of Oyster shells

g) Kanikunda Tenda

Figure 11: Kanikunda landing site (bolong)

Situated in the North Bank Region, Kanikunda landing site has GPS coordinate readings GPS N13°35' W15°.21'.

At the time of the field visit, the salinity of the Kanikunda Bolong was low. The water of the Bolong and this part of the River Gambia becomes entirely fresh water from August to September annually.

The vegetation cover along the banks of the Bolong is mainly mangrove, *Rhizophoraspp*. and there is also phragmites (Elephant grass) along parts of the KanikundaBolong.

The fish Species caught here are listed in the tables in Appendix 2.

h) Kuntaur Wharf Town Tenda

At the time of the field visit (May); the water at Kuntaur was fresh. But we learnt that the river at this point becomes saline from June through to September. The tidal regime is similar to that existing in other parts of the river in the Central River Region.

There are several bolongs (tributaries) draining into this part of the River Gambia at Kuntaur including WassuBolong (on the side of the river flowing towards Basse), KuntaurBolong and ToubaBolong (on the side of the river flowing towards Banjul)

The vegetation fringing the banks of the river include a few mangroves, elephant grass, bamboo trees, shrubs, and some palm trees some distance from the river bank.

According to the fishermen, breeding or Spawning occurs here during the rainy season inside the rice fields (farros), creeks and bolongs along the river bank.

The fish species normally caught and landed here include those in Appendix 2. There are no oysters here due, amongst other factors, to the paucity or absence of mangroves and the low salinity in this part of the River Gambia.

Figure 12: Kuntaur wharf town landing site

i) Brikama Ba Tenda

This landing site neighbouring WalyKunda is situated behind the Jahally rice fields and has been in existence for more than 50 years. The water in this area is permanently fresh water as the saline water stops at Kaur.

Figure 13: Brikama Ba landing site

We gathered from the fishermen that fish spawn in the rice fields (farros) and the vegetation in the bolong during the rainy season. The fish species caught here are listed in the tables in appendix 2.

j) Basse

The water in these parts of the River Gambia is permanent fresh water and thus the fish caught here according to the fishermen consist almost entirely of fresh water species (see table in Appendix 2). WalyNyabaa is a species found amongst the rocks in the water, whilst Fantango (*Chrysichthys*spp). are abundant. Marine species such as Kujeli (*Polydactylusquadrifilis*) and Feta (*Caranx hippos*) are also caught in the middle of the dry season. The fish found at the market, mainly Konokono, *Clariasanguillaris* (fresh water catfish) were caught in the farros (rice fields) at Dampha Kunda.

Figure 14: Basse Fish Market, Sample of fish caught in the rice fields (farros)

Figure 15: Basse Fish Market, Freshwater catfish (Clarias spp.) caught in the rice fields (farros)

The fish spawn in the river bolong amongst the rocks and stones and in the farros from the first rains in June and throughout the rainy season.

Figure 16: Basse landing site

k) Bansang

The Spawning period coincides with the months of March, April and May and it can be observed that river banks here are lined with mangroves forests which provide habitats for spawning fish.
Figure 17: Mangroves and other vegetation at Bansang landing site

The main fish species caught and landed here include those listed in the tables in appendix 2. Adult marine species do reach these parts of the river and one fisherman caught and sold D8000 worth of Kujeli (*Polydactylusquadrifilis*) in one night alone, during the month of April. The fish were probably adult fish that had come into the river to spawn and kept moving further upriver for some reason.

l) Tan-Bi Wetlands National Park

The central coordinates of Tanbi Wetlands National Park (TWNP) are 13°26' North and 16°38' west. TNWP is a mangrove swamp, 6,304 hectares area that fronts the Atlantic Ocean to the North and the River Gambia to the East. Situated at the mouth of the River Gambia, it is an estuarine and intertidal forested wetland of primarily mangrove forest, mainly *Rhizophora* spp. The TWNP serves as a fish breeding site and cockle and oyster harvesting site. It is subjected to full salinities on the northern fringes during the flood tides and there are numerous freshwater flushes around the periphery during the rainy season. Hypersaline conditions do develop in some of the coastal lagoons and in the upper reaches of the bolongs (tributaries in the mangrove system). The vegetation varies with the degree of salinity (DPWM, Gambia Government, Ministry of Fisheries, 2012).

The TWNP is bordered by 12 villages as well as major towns such Mandinaring, Lamin and Abuko in the Greater Banjul Area and Banjul City area, Kanifing Municipality and Brikama. Thus human activity/encroachment, destruction of mangroves, drought and floods have had some negative impacts on the ecology of the Park.

The numerous bolongs, creeks and lagoons within the TWNP are known to serve as spawning, nursery and feeding for fish, molluscs and other aquatic animals. Fishing activities are conducted in many of the villages within the TWNP.

m) Nuimi National Park

The Nuimi National Park, which is a protected marine delta, in the North Bank Region of the Lower Nuimi District of The Gambia covers the northern section of the River Gambia, the southern section of the Saloum Delta National Park, in Senegal, and locally covers an area of 49Km². The nature reserve also includes a broad section of the Atlantic Ocean (Http/:accesgambia.com/information/map-jinack-island.html, 2016).

Near the centre of the park is the MassarinkoBolon, a creek bordered by a large expanse of mangroves dominated by laterite boulder escarpments. MassarinkoBolon joins with a smaller creek, the NijiBolon, which courses roughly north-south. To the west of the NijiBolon and to the right of the Atlantic Ocean is Jinack Island, an elongated, bowed 1km wide strip of land.

The aquatic invertebrate fauna is comprised mainly of mollusks and crustaceans. Abundant species include mangrove oysters. The delta waters are important nurseries for fish fry and juveniles. Among species of fish found here most are in their developmental stages; such as the Giant African Threadfin (*Polydactylusquadrifilis*), African Red Snapper (*Lutjanusagennes*), Flagfin, Senegalese Sompatgrunt (*Pomadasysjubelini),* Mullet (*Mugil*sp)., and *Tilapia*sp (NBSAP, 2015).

Mangrove forest dominates the bolong fringes within the Nuimi National Park and is found along the Niji and Massarinko. In the coastal area the mangroves are comparatively shorter, but further inland they can be up to 20 metres high, dominated by *Avicennianitida*. Six woody species are found within the mangrove belt, i.e. *Rhizophora mangle, Rhizophoraharissionii, Conocarpus erectus, Lagunculariaracemosa, Rhizophoraracemosa* and *Avicennianitida* (DPWM, 2015)

n) BaoBolong

The vast 22,000 hectares of the reserve is located on the south bank of the river, and lies to the east of Salikene village and south of the villages of Mandory, Marong Kunda, N'jabbaKunda, Minteh, Burangya, No Kunda and KontehKundaNiji. The terrain is generally flat, with the highest elevation being 11.6 metres above mean sea level.

The nature park is named after the BaoBolon, a tributary of the River Gambia, which courses south from northern Senegal to join the river in a wide low valley on the north bank, facing Tendaba. The valley enters Senegalese territory at Kayemore, Ndiao, Marlene, and passes through the south-east of Niorro and crosses into Gambian territory through Illiassa. Between the villages of Katchang and Salikene there are a further 5 tributaries that supply water to the wetlands. The effect of this is a pristine riverine area that's a network of brackish creeks fringed by tall stands of mangrove forest. A little further north of the mangroves and aquatic weeds the terrain is elevated, rising into a laterite escarpment. Beyond this are mudflats and lightly wooded areas.

Bao Bolong's 3 distinct ecosystems of mangrove swamp, closed-canopy savanna woodland, and saltmarsh, are all within close proximity of each other, and abundant in vegetation, mammals, birds, reptiles, amphibians and invertebrates.

Figure 18: BaoBolong: flood plain containing water

For about half the year, water in the nature reserve remains brackish. However, during the rainy season, which runs from about July to October, rain water is retained by dikes for rice irrigation. This situation continues until December when the water level starts to drop again, turning brackish once more (Http/:accesgambia.com/information/map-jinack-island.html, 2016).

Figure 19: Baobolong: Dried up side of floodplains

The inter-tidal mangrove forests, which grow as high as 20 metres, are characterised by stands of Red mangroves (*Rhizophora mangle*, *Rhizophoraracemosa*), and Black mangroves (*Avicenniaafricana*).

The BaoBolong Wetland Reserve has a rich patchwork of habitat types which broadly follow a gradient starting with the high mangroves of the River Gambia, through permanent salt marsh, bare tannes and seasonal freshwater marshes, grading finally into wooded grassland. The BaoBolong Wetland Reserve has a rich patchwork of habitat types which broadly follow a

gradient starting with the high mangroves of the River Gambia, through permanent salt marsh, bare tannes and seasonal freshwater marshes, grading finally into wooded grassland

Due to the extensive network of waterways and mangroves the area is an important breeding ground for fish fry and juveniles, with 6 families of fish having been recorded here. Among the various fish species found within the mangrove creeks, tributaries, and the riverside are Barracuda (*Sphyraena* sp.), Bobo Croaker (*Fonticuluselongatus*), Mullets (Mugilidae, Tilapia (*Tilapia*spp), Bonga Shad (*Ethmalosafimbriata*), Giant African Threadfin (*Polydactylusquadrifilis*), Catfish (*Arius* sp.), *Pseudotolithusbracygnathus*, *Pomadasysperoteti* (Cuvier, 1830). There are also molluscs such as Mangrove Oysters (*Crassostreagasar*), and crustaceans such as Blue Crabs (*Callinectes*sp.) (Http/:accesgambia.com/information/map-jinack-island.html, 2016).

As can be observed from figures 18 and 19, the road running through the BaoBolong Wetland Reserve has separated the coastal part of the reserve from the inland part. The result is that the inland part dries up during the dry season period in the Gambia. This is bound to have some negative impacts on the Reserve's ecosystem.

4.4 Criteria used (characterization)

The criteria used for identification of the sites in terms of suitability for fish spawning are related to the general environmental qualities of the sites including but not limited to the following depending on the specific of the River Gambia:

- ✓ Salinity
- ✓ Substrate
- ✓ Vegetation, particularly the presence of mangroves
- ✓ Signs of presence of gravid fish and juveniles
- ✓ For oysters, the presence of mangrove forests with oysters and oyster harvesting activities
- ✓ The presence of mangroves is particularly critical for spawning of some fish and oysters. The roots, leaves and debris from mangroves provide the ideal environment for spawning fish and their juveniles.

Water salinity is critical for the presence and reproduction of most fish and shellfish (oysters).The presence of marine species which spawn in the estuarine parts of the River Gambia, oysters and juveniles is determined by the level of salinity. On the other hand, the presence of strictly fresh water species is limited to the fresh water parts of the River. Euryhaline species, such as tilapia, however have been encountered in both brackish water and fresh water parts of the River and its tributaries.

The presence of mangroves is also critical for spawning of some fish and oysters. The roots, rleaves and debris from mangroves provide the ideal environment for spawning fish and their juveniles.

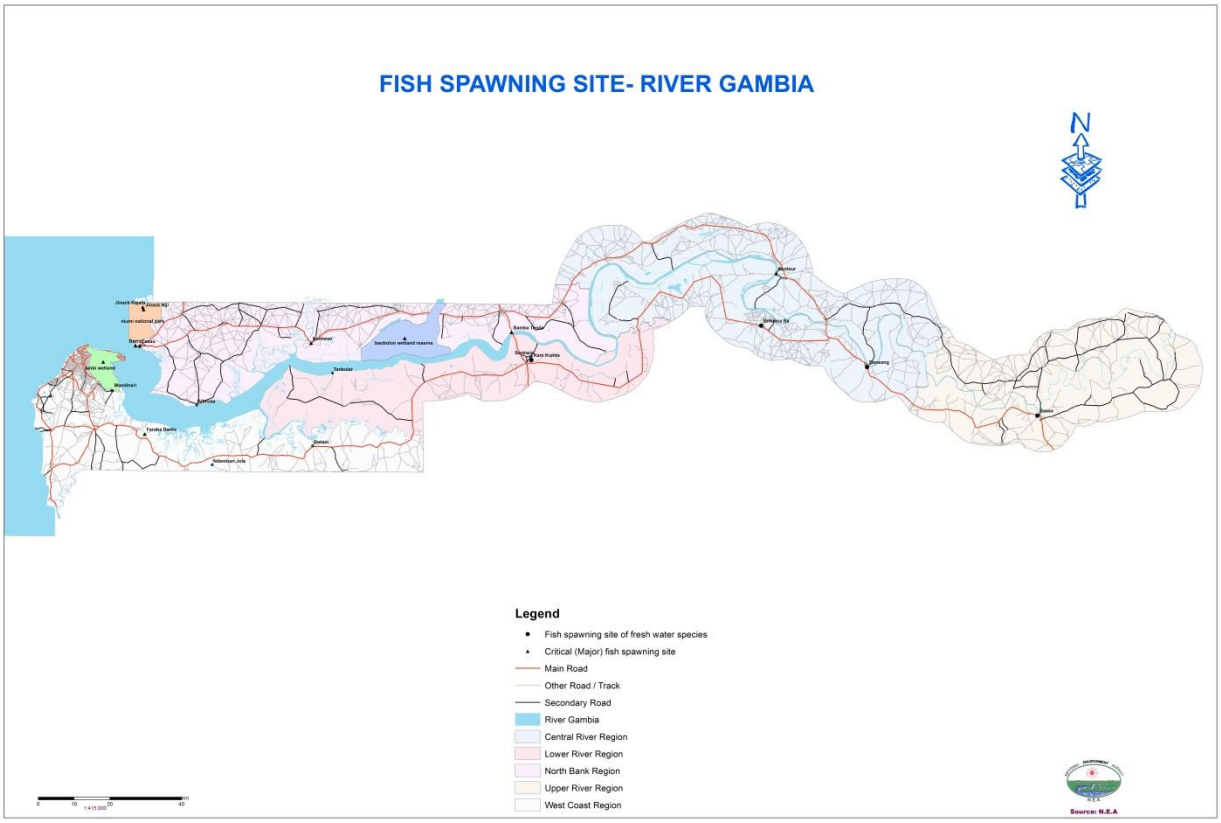
Individual adults of five (5) fish species considered as marine species normally inhabiting marine high saline waters have been found in the freshwater parts of the River. These fish species include

the Sole fish (*Cynoglossus*sp), *Pseudotolithus (Fonticulus) elongatus*, Bobo croaker or Jortoh, *Caranx hippos*, Jack or Feta ,*Liza falcipinnis*, Mullet or Tambajang, *Sphyraenaafra* (Peters, 1844), Barracuda or Seda and the Giant African Threadfin, Kujeli*Polydactylusquadrifilis.*

4.5 Information on all selected identified sites

A digital map of the identified fish spawning sites prepared using GPS coordinates obtained during the field visits is shown in the below figure.

Figure 20: Map showing identified fish spawning sites in the River Gambia



From the distribution of the identified fish spawning it can be observed that there is a concentration of sites in the estuarine and brackish water parts of the River Gambia and becoming sparsely distributed in the fresh water parts of the River in the CRR and URR of the country.

The identified sites have been classified into two categories as marked in the legend: ▲ Critical fish spawning sites which include brackish water and freshwater zones, and ● for fish spawning sites of fresh water species. The presence of fish species (either caught or observed in these waters by the local fisherfolks) whose habitats are normally considered to be in the marine zones can be understood based on available information on the biology and distribution of these species.

The five species or groups of species (mentioned above), reported by the local fisherfolks as forming part of the catch composition in the exclusively freshwater zones of the River and whose synopsis are presented below in the text boxes (appendix 3) are worth highlighting. These species

include: the Cynoglossidae (Sole fishes), Sciaenidae (Drums, Croakers), Mugilidae (Mullets), the Polynemidae (Threadfins) and the Carangidae (Jacks). Fish species belonging to these families are known to enter and sometimes temporarily inhabit brackish and/or freshwater parts of certain water bodies such as rivers and lagoons (www.fishbase.org, Akinrotimi et al., 2010).

5. CONCLUSION

It can be deduced from the information gathered during the course of the consultations and the field visits undertaken within the framework of this consultancy that indeed the River Gambia has many sites suitable for fish spawning. The entire length and width of the River serve as spawning sites for fish and molluscs but some specific sites are considered more prominent and important (refer to the section on identified sites). The fact that adult marine species are caught in the upper reaches of the River (refer to tables in appendix 2) is a strong indication that the reports in reports consulted (referenced in the bibliography) and the statements of fisherfolks that the sites serve as spawning are somewhat accurate.

Regarding transformation of the river ecosystem in relation to baseline information, the OMVG'S Environmental and Social Management Plan for the Trans-Gambia Bridge at Bamba Tenda/Yellitenda crossing has highlighted a number of negative social and environmental impacts of the bridge. The Plan indicates that transformation of the river banks, such as construction of the bridge is likely to disrupt the fragile ecology of the mangroves, other flora and fauna of this part of the River ecosystem (OMVG, 2015). The Consultant mindful of the fact the University of Michigan, USA, undertook a comprehensive study of the River Gambia in the 1980s whose results were to be utilized by the OMVG, searched for and could not obtain any documents related to that study.

Baseline information on spawning sites was available in documents related to protected areas such as national parks, wetland reserves and protected areas. The disparate information contained in documents related to the protected areas, reserves and national parks was not specific to fisheries species only. Only passing mention is made of the existence of fish in these protected areas and their role as breeding, feeding and shelter sites for fish and shellfish. Characterization that makes these reserves and parks suitable for fish spawning includes the presence of mangroves, quasi-permanent water bodies or wetlands.

Potential threats to the identified spawning sites could be contemplated in terms of human actions and natural events. The most important threat to the identified sites includes the destruction of mangroves particularly by oyster harvesters. This could be attributed to the fact that mangroves are universally acknowledged as playing critical roles in providing the suitable environment for fish breeding, growth and development of oysters and the feeding and growth and survival of juvenile fish, shrimps and other animals of fisheries importance. Impacts associated with Climate change that affect the aquatic vegetation and the coastline or stability of the river banks could also negatively affect these sites.

The OMVG's Environmental and Social Management Plan for The Gambia River Bridge cited above acknowledges that pollution and human activity in the area during construction and operation of the bridge would negatively impact on the ecosystem in the vicinity (OMVG, 2008, 2015).

The question as to whether there is any evidence, indication or sign of shifting of spawning sites or their transformation, the answers could be deduced from activities of populations exploiting mangrove resources, such as oyster using destructive methods (cutting off mangroves roots and branches) and the use of mangrove trunks and branches for firewood and construction. Although

the mangrove forest remain relatively dense despite die-backs observed in some areas such as in the LRR (in the vicinity of the Kalaji Bridge in Foni/Kiang frontier), mangroves forests are fragile ecosystems, which means that they are highly sensitive to drastic environmental changes due to, for example, sea level rise and significant drop in salinity resulting from fresh water intrusion. According to fishermen and fisheries stakeholders who have been operating in these areas (environs of the identified fish spawning sites) for many decades, there was no observable shifting of the spawning sites. Of course, human activities including fishing and infrastructure development have transformed the natural environment in these sites but the sites remain suitable for spawning fish and other organisms.

The Impact of climate change on the river ecosystem, particularly relating to spawning sites deserves consideration at this time when Climate Change and its associated effects are being granted universal attention. The Gambia is a low-lying coastal nation making it one of five most susceptible to climate-change induced sea level rise and erosion (Dr. – Ing. Yves M. Lamour& B. P. Jallow, 2013)According to the report of Yves and Jallow, due to the water stress, increase in saline intrusion, reduction in arable land and other factors, food crop production is expected to decrease by about 21% to 44% and fish productivity of the River Gambia will decrease to about 4% by 2100.

REPAO's (Réseausur les Politiques de Pêche en Afrique de l'Ouest) report on **Fisheries and Climate Change** reached a similar conclusion regarding the impact of climate change and sea level rise on coastal and estuarine fisheries resources. REPAO's study concluded that as a result of sea level rise, there would be increased penetration of sea water into the estuaries thus reducing the zones of reproduction by reducing mangroves which are sources of trophic enrichment of the waters, zones of refuge and nurseries for fish and other fisheries resources (REPAO, 2010).

6. WAY FORWARD

6.1 Spawning sites and Fish Resources Protection, Conservation and Management in The Gambia

Identification of the spawning sites is an important part of the Government's efforts to manage the resources. This is because these sites contribute to the replenishment of fish stocks as they are areas for recruitment of fish into the population. This is particularly important considering the fact that the marine fisheries resources have been declining over the years

Thus identification of the spawning sites will enable Government to take informed decisions on areas or fishing sites that need special regulation such as closed seasons, restricted fishing or areas where fishing should be prohibited. Management decisions can be taken to close certain sites during periods when spawning takes place or gravid or juvenile fish are known to be present.

Thus identification of the spawning sites will enable Government to take informed decisions on areas or fishing sites that need special regulation such as closed seasons, restricted fishing or areas where fishing should be prohibited. Management decisions can be taken to close certain sites during periods when spawning takes place or gravid or juvenile fish and crustaceans are known to be present.

7. RECOMMENDATIONS

The results of this identification mission indicate that sites along the River Gambia and its tributaries and other inland water bodies and wetlands serve as critical sites for breeding/reproduction/spawning of fish and molluscs. However, some sites are more sensitive than other and there is a need to institute management measures to protect these sites. Such measures could include regulations ranging from restriction on fishing activities to total prohibition of fishing in the vicinity of the sites. The period from March to June is the sp awning period along most sites in the River Gambia and its tributaries.

a. The fisherfolks, Fisheries Department staff and other fisheries stakeholders have knowledge of many of the sites where fish spawning occurs during the rainy season. Close season could be instituted covering this period. This is particularly relevant to the inland fisheries where spawning fish seek refuge within mangroves and other vegetation in the tributaries (bolongs) during the rains; It is pertinent to note that for several years now a moratorium (close season) on catfish (*Clarias* sp.) fishing is imposed at a specific time every year in the Central River Region.

b. Where closed seasons cannot be applied, mesh size of fishing gear should be set and strictly enforced

c. Landing of gravid fish and juveniles should be prohibited. Such a measure already applies to the lobster fishery

d. The fisheries surveillance mechanism including mainly the navy and the security services should be strengthened. The areas around the Mandinaring/Lamin area, waters off Nuimi National Park (entrance of the River Ganbia estuary around Barra – Jinack) need to be protected.

e. The Department of Fisheries should collaborate with the Department of Parks and Wildlife Management so as to ensure that the spawning sites within the Protected Areas are accorded special protection.

f. The Navy could conduct surveillance and protection of the identified spawning and feeding sites. The Ministry of Fisheries has an MOU with the Gambia Navy with provision for joint surveillance of the fisheries waters, both coastal marine and inland sectors.

Appendix 1: Tables listing (by Fishery Administrative Areas) of some species caught at the visited landing sites as provided by fishermen met on site

Lower River Stratum (Brackish Waters)

Table 1: Some fish species landed at Tendaba landing site

Site	Species caught		
Tendaba	Local Name	English/Common Name	Scientific name
	Wass/Furo	Tilapia	*Tilapia* spp.
	Kung Keleng	Catfish	*Arius latiscutatus*
	Kong	Catfish	*Arius latiscutatus.*
	Fotta	Cassava croaker	*Pseudotholitussenegalensis*
	Kosso	Mullet	*Chrysichthys* sp.
	Tambajang	Tiger shrimp	*Mugilcephalus*
	Sipa sipa	Bobo Croaker	*Penaeusmonodon*
	Jortoh	Barracuda	*Pseudotolithus (Fonticulus) elongatus*
	Seda		*Sphyraenaafra.*

Table 2: Some fish species landed at the Yellitenda Bamba Tenda landing site

Site	Species caught		
Bambatenda-Yellitenda (Trans-Gambia Bridge site)	Local Name	English/Common Name	Scientific name
	Kono Kono	Fresh water catfish	*Clarias anguillaris*
	Catfish	Catfish	*Arius latiscutatus*
	Kong	Catfish	*Arius latiscutatus*
	Kujeli	Threadfin	*Polydactylusquadrifilis*
	Kosso		*Chrysichthys*sp.
	Tambajang	Mullet	*Liza falcipinnis*
	Seda	Barracuda	*Sphyraenaafra*

Table 3: Some fish species landed at Kerewan Bridge area landing site

Site	Species caught		
Kerewan Bridge Area	Local Name	English/Common Name	Scientific name
	KonoKono	Freshwater Catfish	*Clarias anguillaris*
	Catfish	Catfish	*Arius latiscutatus*
	Kong	Rough-head sea Catfish	*Arius latiscutatus*
	Kung Keleng	Rough-head sea Catfish	*Arius latiscutatus*
	Kujeli	Giant African Threadfin	*Polydactylusquadrifilis*
	Furo/Wass	Tilapia	*Tilapia* sp.
	Tambajang	Mullet	*Liza falcipinnis*
	Sipasipa	Shrimp	*Penaeusnotialis*
	Yohoss/Sosso	Oyster	*Crassosstreagasar*

Upper River Stratum (Fresh Waters)

Table 4: Some fish species landed at Brikama Ba landing site

Site	Species caught		
Brikama Baa	Local Name	English/Common Name	Scientific name
	KonoKono	Freshwater catfish	*Clariasanguillaris*
	Wass/Furo	Tilapia	*Tilapia* sp.
	WalyNyabaa		*Chrysichthysmaurus*
	Kosso		*Chrysichthys*sp.
	Fantango		*Chrysichthys*sp.
	Suweyo		*Polypterusbichir*

Table 5: Some fish species landed at the Basse landing site

Site	Species caught		
Basse	Local Name	English/Common Name	Scientific name
	Kono Kono	Freshwater catfish	*Clarias anguillaris*
	Sokoro		*Hydrocynusbrevis*
	Waly Nyabaa		*Chrysichthysmaurus*
	Fantango		*Chrysichthys*sp.
	Feta (marine species)	Cravelle jack	*Caranx hippos*
	Kujeli (marine species)	Giant African Threadfin	*Polydactylusquadrifilis*

Table 6: Some fish species landed at Bansang landing site

Site	**Species caught**		
Bansang	Local Name	English/Common Name	Scientific name
	Wass/Furo	Tilapia	*Tilapia* spp
	KonoKono	Freshwater catfish	*Clarias anguillaris*
	Kujeli	Giant African Threadfin	*Polydactylusquadrifilis*
	Suyo		*Gymnarchusniloticus*
	Sokoro		*Hydrocynusbrevis*
	Tambajang	Mullet	*Liza falcipinnis*
	Feta	Cravelle jack	*Caranx hippos*

Table 7: Some fish species landed at Kuntaur Wharf Town landing site

Site	Species caught		
Kuntaur Wharf Town Tenda	Local Name	English/Common Name	Scientific name
	Wass/Furo	Tilapia	*Tilapia*spp.
	Solefish	Solefish	*Cynoglossussenegalensis*
	Fantang		*Heterotisniloticus*
	LambaLeefa		*Papyrocranusafer*
	Kokriko		*Synodontiselongatus*
	WalyNyabaa		*Chrysichthysmaurus*
	Jortoh	Bobo croaker	*Pseudotolithus (Fonticulus) elongatus*
	Seda	Barracuda	*Sphyraenaafra*
	Tambajang	Mullet	*Liza falcipinnis*
	Kujeli	Giant African Threadfin	*Polydactylusquadrifilis*
	KonoKono	Freshwater catfish	*Clarias anguillaris*

Appendix 2: Briefs on adult marine species caught in the freshwater zones of the River Gambia

Cynoglossussenegalensis (Kaup, 1858), Senegalese Tonguesole
Family: Cynoglossidae
Sub-family: Cynoglossinae
Genus: ***Cynoglossus***
They are found in marine/brackish or Continent (freshwater), also on sand and mud bottoms of coastal waters. Feed on mollusks, shrimps, crabs and fish (*www.fishbase.org*). There are four major families of flatfish with representative species found in the Gambian nearshore waters: Soleidae, Cynoglossidae, Psettododae and Paralichthyidae. The species have been confirmed through literature review, and through discussions with local fishermen, processors and the Gambian Department of Fisheries. Many of them are similar in appearance and can be easily misidentified (Coastal Resources Center. 2011).

Pseudotolithus(Fonticulus) elongatus (Bowdich, 1825), Bobo croaker, Jortoh (Local Name)
Family: Sciaenidae (Drums or croakers)
Genus: *Pseudotolithus*
Marine; brackish; demersal, Eastern Atlantic: west coast of Africa, from Senegal to southern Angola. Also enters estuaries and coastal lagoons, where reproduction takes place. Moves farther offshore to about 100 m for spawning during rainy season from December to February (tropical West Africa); Feeds on fish and shrimps.
Habitat: over mud, sandy mud or rock bottoms in coastal waters from the shoreline to 70 m depth, rarely entering estuaries, smaller individuals often found in shallow waters; *Distribution*: along the West African coast from Morocco to Angola, but rarely north of Senegal. (www.fishbase.org).

Liza falcipinnis(Valenciennes, 1836), Tambajang (Local name)
Family: Mugilidae (Mullets)
Genus: Liza
This species inhabits marine, freshwater, brackish water. It is demersal, catadromous and very common in coastal lagoons and estuaries and hypersaline environments. It feeds on plankton and detritus

Many species of mullets enter fresh water and they swim in shoals (Edwards et al., 2001 in Akinrotimi et al. 2010) and according to an FAO report 2007 cited by Akinrotimi et al. 2010, adult mullets have been found in waters of salinity ranging from 0-75%, while juveniles can only tolerate such wide salinity ranges after they reach lengths of 47cm. (www.fishbase.org)

Giant African Threadfin, Kujeli (Local Name)
Name:***Polydactylusquadrifilis*** (Cuvier, 1829), Kujeli
Family: Polynemidae
Genus: Polydactylus
Threadfins are usually encountered near the coast, often in river mouths or brackish mangrove estuaries. Their diet consists of shrimps, crabs, polychaete worms, and other benthic invertebrates. The family is worldwide and contains about 33 species divisible into seven genera, occurring in all tropical and subtropical seas (www.fishbase.org).

Caranx hippos,*Cravelle*,,Jack, Fetta (Local Name)
Family: Carangidae
Genus: *Caranx*
Generally found over the continental shelf where it is common on shallow flats, to offshore waters. Adults ascend rivers and juveniles are abundant in brackish estuaries with muddy bottoms, near sandy beaches and on seagrass beds, entering lagoons and lower courses of rivers. They form fast-moving schools, although larger fish may be solitary. They feed on smaller fish, shrimp, and other invertebrates. Often grunts or croaks are heard when caught. Eggs are pelagic (www.fishbase.org).

Appendix 3: Persons met/consulted

Some of the individual professionals and experts consulted during the desk study and field visits include:

1. Matarr Bah, Director, Fisheries Department
2. Momodou Suwareh, Director, Intersectoral Network, NEA
3. Bai Lamin Sillah, Senior Hydrologist, Department of Water Resources
4. Landing Bojang, Senior Hydrologist, Department of Water Resources
5. Abdoulaye Sawo, Department of Parks and Wildlife, Abuko
6. Salmina Jobe, NEA
7. Saloum Jatta, Senior Fisheries Officer, Fisheries Department
8. Pa Joof, Fisheries Field Assistant, Bintang
9. Ansumana Isatou, Vice Chairman, Fishermen Association, Bintang
10. Ba Kebba Marong, Retired Fisherman, Tendaba
11. Mrs. Fatou Yarbo, Fisheries Field Assistant, Tendaba
12. Faye Jammeh, Fisherman, Tendaba
13. Ousainou Gaye, Fisherman, Tankular
14. Fabakary Drammeh (Bojang), Fisheries Field Assistant, Tankular
15. Demba Sowe, Shrimp Fisherman, Yellitenda
16. Nancy Samateh, Fisheries Field Assistant, Albreda
17. Assan Gajo, President, Fishermen Association, Bansang
18. Yusupha Baldeh, Fisherman, Bansang
19. Bory Marong, Fisheries Field assistant, Jahally Fish Hatchery
20. Sana Sama, Fisheries Field Assistant, Bansang
21. Ebrima Faal, Head Fisherman (retired), Brikama Ba
22. Samba Nyang, Fisherman, Kuntaur
23. Amadou Gai, Fisherman, Kuntaur
24. Yusupha Sarr, Fisherman, Basse

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