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Co-management of the small pelagic fisheries in Sierra Leone

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Introduction

Sierra Leone lies between latitudes 7° and 10° N and longitudes 10° and 14° W on the west coast of Africa, covering an area of 71 740 km². The country is bounded on the north and east by Guinea, on the southeast by Liberia and on the southwest and west by the Atlantic Ocean. Sierra Leone has a coastline of approximately 560 km, a continental shelf area of about 30,000 km² and an EEZ of about 155,700 km². The Exclusive Economic Zone (EEZ) has a total area of about 155700km². The coastline is about 500 km long with a 200 nautical miles territorial sea limit and 5 to 6 nautical miles inshore exclusion zone (IEZ).

The Climate of Sierra Leone is hot and humid with a maximum temperature around 30°C. The climatic regime supports two seasons: the dry season, which last from November-April and the moonsonal rainy season which last from May-October. The rainy season is characterized by heavy rainfall, usually lasting from July to September. The average annual rainfall is about 311 cm. The moonsonal wet season is characterized by high river discharges, reduced surface water salinities, lowered solar radiation and a dip in mixed layer temperatures (Coutin and Payne, 1988). Strong south westerly winds and light north-easterly winds blow during the dry season. This hydroclimate and the current systems (the Guinea Current, the Canary current and the equatorial counter current) affect the oceanographic conditions and the fisheries. The dominant current system is the Guinea Current and the offshoot of the Canary Current (February to April)- which flows eastward along the coast meeting the westward flowing South Equatorial Current(May – July) of the coast of Liberia. The influence of the Canary Current is characterized by the north-south migration of the 25 °C isotherm (Coutin and Payne, 1988). This cold Canary

Current, flows towards the Equator with greater effect during February to April when it flows southward bringing cold, nutrient-rich water from the upwelling areas, with a well defined thermocline occurring at 'mid-shelf' (10m inshore and 20m offshore) supporting a large quantity of commercially important small pelagic fish stocks.

Commercially important pelagic species in Sierra Leone include: the sardinella (*Sardinella aurita* and *Sardinella maderensis*), the bonga (*Ethmalosa fimbriata*), the horse mackerel (*Trachurus trecae*, *Trachurus trachurus*, *Decapterus rhonchus*, *Decapterus punctatus*) and the Chub mackerel (*Scomber japonicus*.)

Several countries share these highly productive pelagic stocks which migrate along the Northwest African coast where they are exploited by the artisanal and industrial sectors including local fleets as well as foreign fishing vessels from Europe and Asia. The industrial sub-sector involves the use of purse seiners, pelagic longliners and trawlers, mostly foreign vessels operating through fishing agreements, while the artisanal sub-sector is carried out with motorized and non-motorized canoes using different types of fishing gears. The pelagic stock abundance is also highly sensitive to changes in hydroclimatic conditions. The shared nature of the resources, the multiple "users" and potential variability adds further challenges to their fisheries management.

Fisheries Management Mandate: legal framework

- The Ministry of Fisheries and Marine Resources has the statutory responsibility for the management of fisheries in Sierra Leone territorial waters
- The 1994 Fisheries Management and Development ACT provides the legal management mandate, complimented by the 1995 fisheries regulations
- The 2003 National Fisheries Policy also provides support to the legal provision

Co-Management framework

The co-management framework for the small pelagics in Sierra Leone falls under two sectors: the artisanal fisheries and the industrial fisheries. Each sector has a unique institutional arrangement. The Ministry of Fisheries and Marine Resources (MFMR) collaborates with other institutions for management of small pelagic fish resources with each institution having a clearly defined mandate.

i. The artisanal fisheries

Institutional arrangement

Local councils

Although MFMR has the overall responsibility for the management of the artisanal fisheries, the Ministry is currently implementing a territorial use right fisheries (TURF) arrangement where in the function of licensing of artisanal fishing crafts have been devolved to the Local Councils under the 2004 Local Government ACT. This ACT gives

powers to the local councils in six coastal districts of Sierra Leone (Western Area, Portloko District, Kambia District, Moyamba District, Bonthe District and Pujehun District) to issue license to fishing canoes and attendant fishing gears. The license will give access right to fishers and the economic rent will be used to develop these local communities by complimenting government support for basic livelihood amenities such as hospitals, schools, and drinking water and toilet facilities. It is hoped that the devolution of this function will enhance co-management of the small pelagic fisheries by promoting resource stewardship. The Local Councils are now being trained by staff of MFMR in various aspect of licensing of fishing canoes as stipulated in the third and fourth schedules of the 1995 fisheries regulations.

Fisherfolk's organizations

There are two recognized fishers unions that represent the interest of the artisanal fishers:

- a. Sierra Leone Artisanal Fishermen Union (SLAFU)
- b. Sierra Leone Amalgamated Artisanal Fishermen Union (SLAAFU)

The two unions collaborate with the Local Councils in the licensing of artisanal fishing crafts and with the Ministry in the promotion of responsible fishing practices in the artisanal fisheries sector. The Union has become very instrumental in enforcing fishing gear regulations, which will contribute towards the reduction of IUU fishing.

Through the assistance donor funded projects, e.g. EU 'Institutional Support for Fisheries Management' (ISFM) project, the Ministry is conducting studies with a viewing of reviewing the 1994 Fisheries ACT for institutionalizing the role of fisherfolks in the co-management of the fisheries.

Research

The Ministry now has in place a Memorandum of Understanding, 2008, with the Institute of Marine Biology and Oceanography (IMBO) of the University of Sierra Leone to conduct fisheries research on all fisheries, including the small pelagics. Through support from donor projects, e.g. GCLME (Guinea Current Large Marine Ecosystem), EU funded Institutional Support for Fisheries management (ISFM) project. Research is conducted primarily to determine the biomass of fish stocks, including small pelagics.

Surveillance

The Ministry has a Memorandum of Understanding with the Sierra Leone Navy to conduct joint surveillance/patrol in Sierra Leone waters. This is contributing towards the reduction of incursion of fishing trawlers into the IEZ, reserved for the artisanal fishers. This has reduced conflicts and competition for fishing access areas in the artisanal sector.

ii. Industrial fisheries

The Ministry has the overall responsibility for the Management of the industrial fisheries but this is being shared with other stake-holders in the co-management of the resources.

The licensing of industrial fishing vessels, including mid-water trawlers for semi-pelagics, is carried out by the Ministry but other Government institutions are involved:

Vessel registration and tonnage determination

The Sierra Leone Maritime Administration (SLMA) in collaboration with Sierra Leone Ports Authority has the legal mandate for the registration of industrial fishing vessels, under the 2003 SLMA ACT.

There is also an association of industrial fishing companies that seek the interest of fishing companies in negotiating with government for license fees and other tax requirements.

Fish health certification

The 2007 Fish Health Product Regulations give the Mandate for fish health certification to the Ministry of Health as the competent authority in driving Sierra Leone to meeting the requirements of the EU for the export of fish and fishery products to the EU markets. Sierra Leone is currently under the EU ban for the export of fish products to the EU markets because the country has not met the sanitary requirements for fish export. This institutional arrangement is however under review, because the Ministry sees some difficulty in the sustainability of the activity under the Ministry of Health, noting their commitment and expertise in other human health related issues as opposed to fish health.

Fisheries advisory bodies

The 1994 Fisheries Management and Development ACT established the Scientific and Technical Committee (STC) to advise the Director of Fisheries on fisheries management matters. This body comprises of representatives of key stake-holders such as fishermen's unions, private sector, research institutions e.g. IMBO, retired Directors of Fisheries etc.

There is a proposal to establish another advisory body, named Fisheries Advisory Committee, that would be at a higher level than the STC and composition would include broad range of stake-holders.

Regional and international cooperation

In addition to several meetings and working groups (e.g. FAO/CECAF pelagic working group), fisheries surveys are also done under regional and international cooperation projects such as the Guinea Current Large Marine Ecosystem (GCLME) Project to estimate the acoustic abundance of pelagic resources and to evaluate the status of the fisheries. Identification of small pelagic schools in Sierra Leone is being gradually

studied under the ITAF Deme acoustic surveys and this will be useful for easy assessment of pelagic abundance.

Table 1. Current pelagic biomass* by species

| Pelagic species | May 2008 by ITAF DEME – metric tonnes | November 2008 by ITAF (MT) |
|---|---|----------------------------|
| | Sardinella aurita | 71,400 |
| Sardinella maderensis | 77,000 | 114,600 |
| Horse mackerel | 38,000 | 11,000 |
| Others: carangids, scombrids, baracuda and hairtail | 60,000 | 59,000 |

Table 2. Regional distribution of round herring (Sardinella aurita) during ITAF Deme acoustic survey, 2008

| Region | Biomass (1000tonnes) | Abundance (millions) |
|----------------|----------------------|----------------------|
| Northern Shelf | 71.4 | 2435 |
| Southern Shelf | - | - |
| Total | 71.4 | 2435 |

Table 3. Summary of pelagic biomass by Fridtjof Nansen and Itaf Deme

| Year | 2006* | 2007* | 2008 |
|---|----------------|----------------|----------------|
| Month | April/May | April/May | May/June |
| Sardinella | | | |
| <i>S. aurita</i> | - | 22080 | 71,400 |
| <i>S. maderensis</i> | - | 115920 | 77,500 |
| Total | 97,000 | 138,000 | 148,900 |
| Horse Mackerel | | | |
| Total | - | - | 38,000 |
| <i>Other carangids, scombrids, baracudas & hairtail</i> | | | |
| Total | 269,000 | 100,000 | 60,000 |

Source: Sierra Leone Resource Survey, 2008. *Fidtjof Nansen survey results

The largest acoustic densities of *S. aurita* were recorded in the mid-shore stratum along the wide shelf and accounted for over 66% of the total observed biomass. Medium to high density schools were observed during daylight hours both in close association to the bottom and as surface schools (Figure 1). Inshore areas were found to contain juveniles occurring as low density scattered registrations contributing 31% of the total biomass observed. The offshore stratum

contributed the remaining 3% of the total observed biomass (Report of Sierra Leone Resource surveys, 2008).

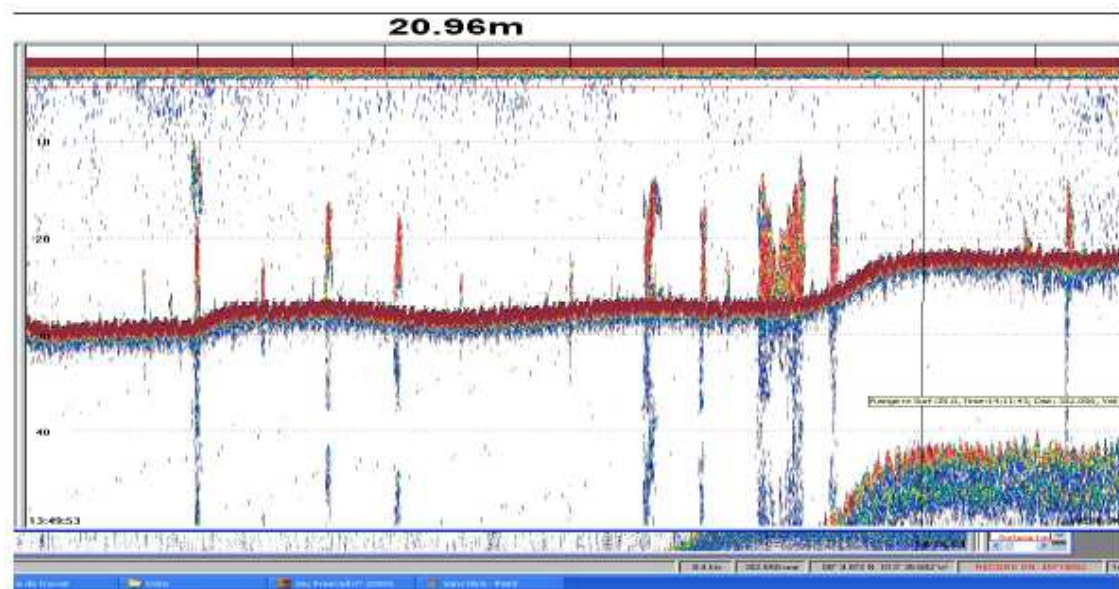


Fig. 1. High density schools of *Sardinella aurita* (round herring) in Sierra Leone waters

There is an on-going research programme under the ISFM project and will continue until the end of 2010. The research will assess the status of these resources twice every year (21 days per cruise) utilizing the Senegalese research vessel, ITAF DEME.

Also through the assistance of ISFM and ADB funded projects, IMBO is conducting research on commercial fisheries, including the small pelagic fisheries segments. This may be assessing the populations of *Ethmalosa fimbriata* as this species is not captured during the survey (in view of its inshore distribution). Recent total allowable catches will be estimated to obtain an idea on how much pelagic fish can be caught within a year. Previous estimate of potential yields (Fig 2) based on 2006 biomass estimated by Fridtjof Nansen shows a healthy pelagic resources, with higher estimates for the pelagic 2 (mainly carangids). Pelagic 1 (mainly clupeids) is fully exploited.

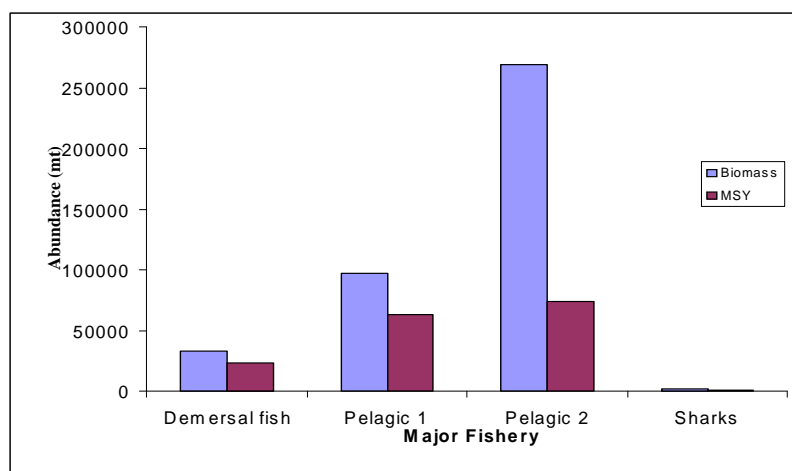


Fig.2. Potential yields of major fish stocks in Sierra Leone
Commercial fisheries

Table. 4 . Total landings of clupeids vs. total artisanal fisheries landings in Sierra Leone (metric tonnes)

| Year | Sardinella spp | Ethmalosa fimbriata | Total Artisanal fisheries production (all species) |
|------|----------------|---------------------|--|
| 2001 | 9849 | 24790 | 39950 |
| 2002 | 13251 | 31491 | 55659 |
| 2003 | 15447 | 28516 | 65458 |
| 2004 | 18211 | 51046 | 106216 |
| 2005 | 22061 | 52677 | 116614 |
| 2006 | 15173 | 60109 | 120490 |
| 2007 | 16574 | 52715 | 111939 |

One of the main fisheries management challenges in Sierra Leone artisanal is the high incidence of juvenile mortality of the clupeids. The juvenile *Sardinella spp* (Mina) constitutes over 5 % of total landings whilst the juvenile *Ethmalosa fimbriata* (Awefu) constitutes an average of about 24 % of total artisanal fish landings. There is attributed to the increasing number of illegal mesh sizes in the surface drift nets (estimated about 75 % being uses illegal mesh sizes i.e. less than 43 mm).

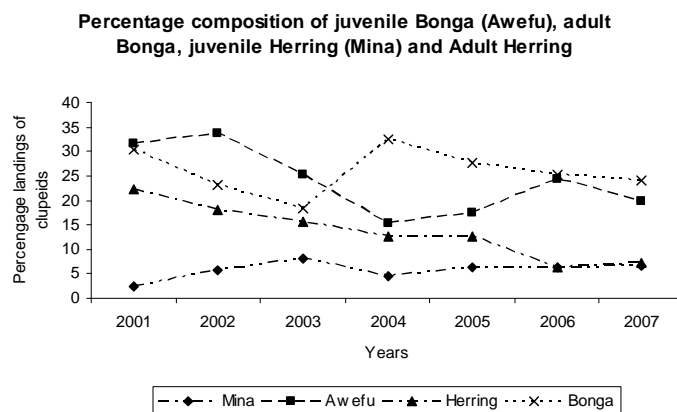


Fig. 3. Percentage composition of juvenile bonga and herring (2001-2007)

The other small pelagic fish species exploited in the artisanal fisheries are the anchovy, *Engraulis encrasicolus* and the carangids, *Chloroscombrus chrysurus*.

Other Species such as *Decapterus spp* and *Trachurus trecae*, are not exploited in the artisanal fisheries but taken as incidental catches in demersal finfish fishery. In recent times, the introduction of pair trawl fisheries has contributed to increased landings of these species since these vessels are capable of switching effort to mid-water trawl fishery.

Table 4. Total production (metric tons) of small pelagics: Horse Mackerel and Mackerel, in industrial trawl finfish fishery, 2000-2007

| Year | Decapterus spp (punctatus and rhoncus) | Mackerel: Scomberomeros tritor and Scomber japonicus |
|------|---|--|
| 2000 | 236.26 | 126.76 |
| 2001 | 433.03 | 333.57 |
| 2002 | 111.81 | 167.26 |
| 2003 | 195.92 | 154.41 |
| 2004 | 356.51 | 64.45 |
| 2005 | 731.32 | 120.33 |
| 2006 | 294.42 | 38.39 |
| 2007 | 951.40 | 119.74 |

Table5. RESULTS OF FAO/CECAF SMALL PELAGICS WORKING GROUPS (2006)

| | | | |
|-----------------------|------------------------------------|-----------------|---------------|
| Sardinella maderensis | Sierra Leone and Guinea Conakry | Over-exploited | FAO WG (2006) |
| Decapterus spp | Sierra Leone and Guinea Conakry | Fully exploited | FAO WG (2006) |
| Trachurus trecae | Sierra Leone and Guinea Conakry | Fully exploited | FAO WG (2006) |

For the most important commercial pelagic species, *Ethmalosa fimbriata*, the production model did not fit well to the data, therefore as a precautionary measure it was recommended not to increase catches above the average of the last 5 years (42 000 tonnes) for Guinea and Sierra Leone (FAO, 2006). Similarly, for the round herring, *Sardinella aurita*, as a precautionary measure, it was recommended that catch levels should not exceed the average of the last 5 years (4000 tonnes) in the two countries.

Fisheries Management Measures of Small-pelagic fisheries in Sierra Leone

Artisanal fisheries

Current Permissible mesh size for gill nets is 43 mm.

Proposed management measures, through stakeholder consultations

In order to promote co-management of the fisheries, stakeholder consultations are held at the national level to discuss fisheries management issues. The following recommendations have been agreed upon during two consultative for a:

a. Mesh size: 45 mm

b. MPA in Yawri Bay, Sierra Leone River Estuary, Sherbro River, Scarcies River

- c. Co-Management involving fisher's organizations, local councils, village headmen, MFMR extension staff, Sierra Leone Navy, Maritime police
- d. Re-classification and upgrading of selected artisanal fishing crafts to semi-industrial
- e. banning of beach seines
- d. Set-up participatory MCS involving fisher's organizations, local councils, village headmen, MFMR extension staff, Sierra Leone Navy, Maritime police

Biological Indicators for the establishment of Marine Protected Areas (MPAs)

Small pelagic are under heavy exploitation pressure in the artisanal fisheries sector. There is heavy target of juvenile stocks in our main river systems (the Sierra Leone River, the Scarcies River, the Sherbro River System and the Yawri Bay). Declining mean length of fish, smaller mesh sizes in use, emerging fishery for juvenile herring and bonga, maturity attained at smaller size and reduce number of adult spawners are indicators of growth and recruitment overfishing. The current declining number of coastal settlements and increased distance to fishing ground are quantitative ecosystem indicators which call for co-management of small pelagic resources.

The Ministry, under the support of ongoing EU funded institutional support project is currently undertaking the monitoring of sizes (Figs 1&2) for fish caught in the breeding grounds in our major river systems.

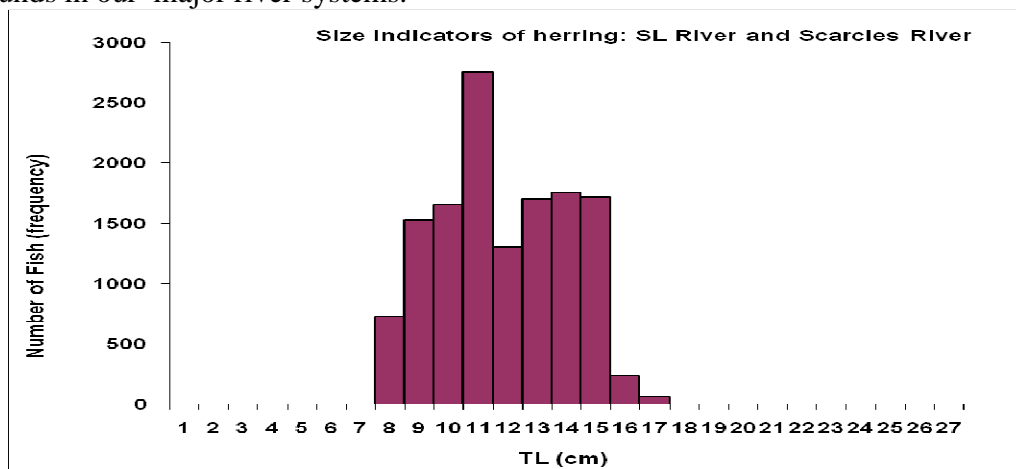


Fig 4. Size indicators of herring (Sardinella spp) in the Sierra Leone River and Scarcies River

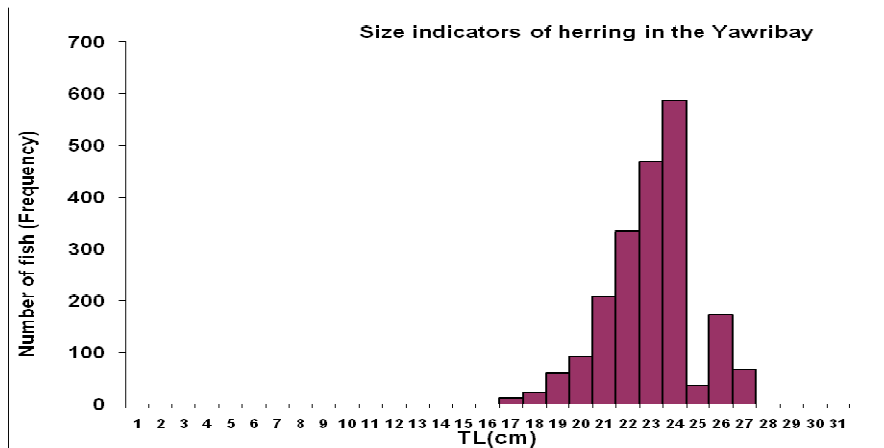


Fig.5. Size indicator of herring (*Sardinella* spp) in the Yawri Bay

These size indicators have recently been used as a reference for the proposed establishment of MPAs in small pelagic breeding grounds of the major rivers. It has been agreed in a stakeholder consultative forum (MFMR, 2009) that MPAs be established in the Sierra Leone River, the Sherbro River System, the Scarcies River, the Yawri Bay and the Kargboro Creek. Figs. 3, and 4, 5 and 6 shows the proposed MPA zones.



Fig. 6. Zones for MPAs in the Scarcies River, major breeding grounds for herring: M = presence of manatee

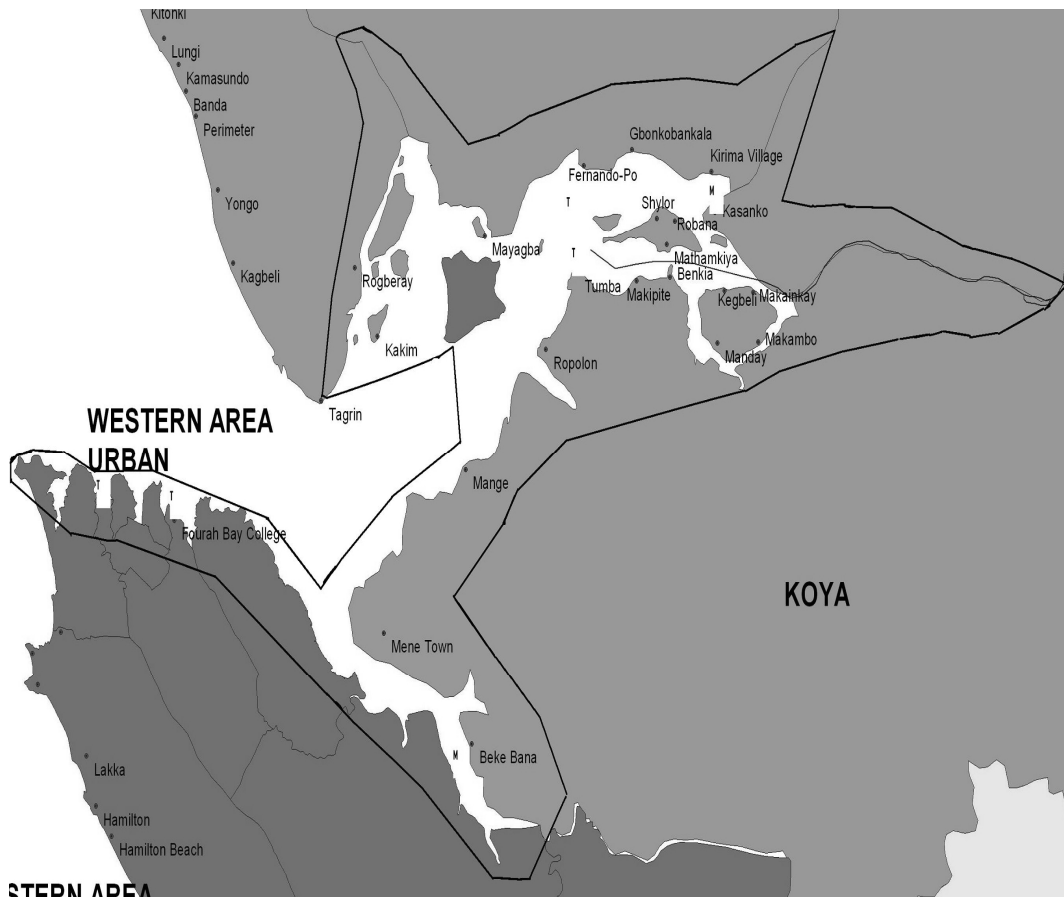


Fig 7. Zones for MPAs in the Sierra Leone River: Major spawning grounds for bonga and other commercially exploited fish stocks. T = presence of sea turtles

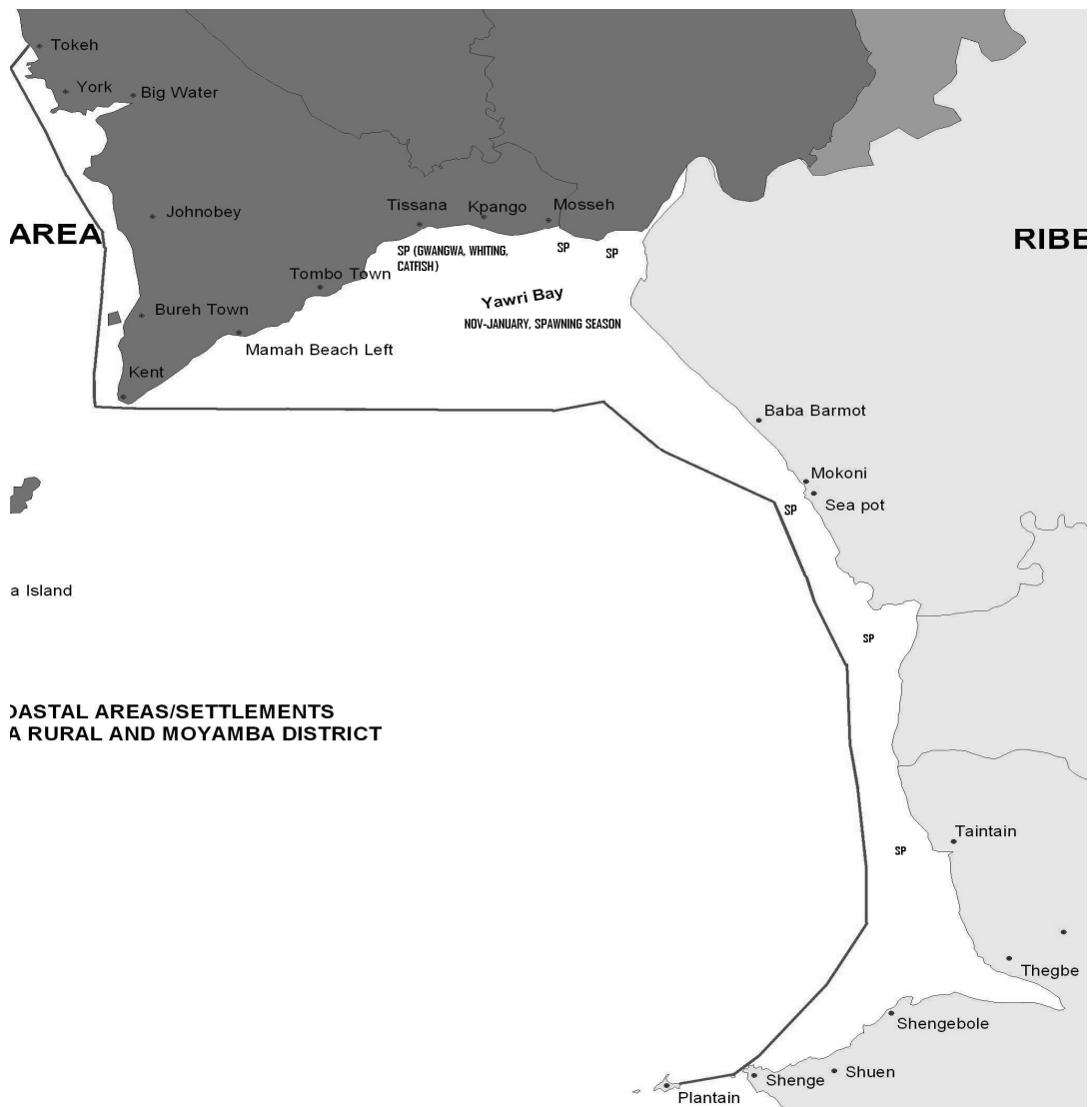


Fig. 8. Zones for MPAs in the Yawri Bay and Kagboro Creek: Spawning grounds for bonga and other commercially exploited fish stocks

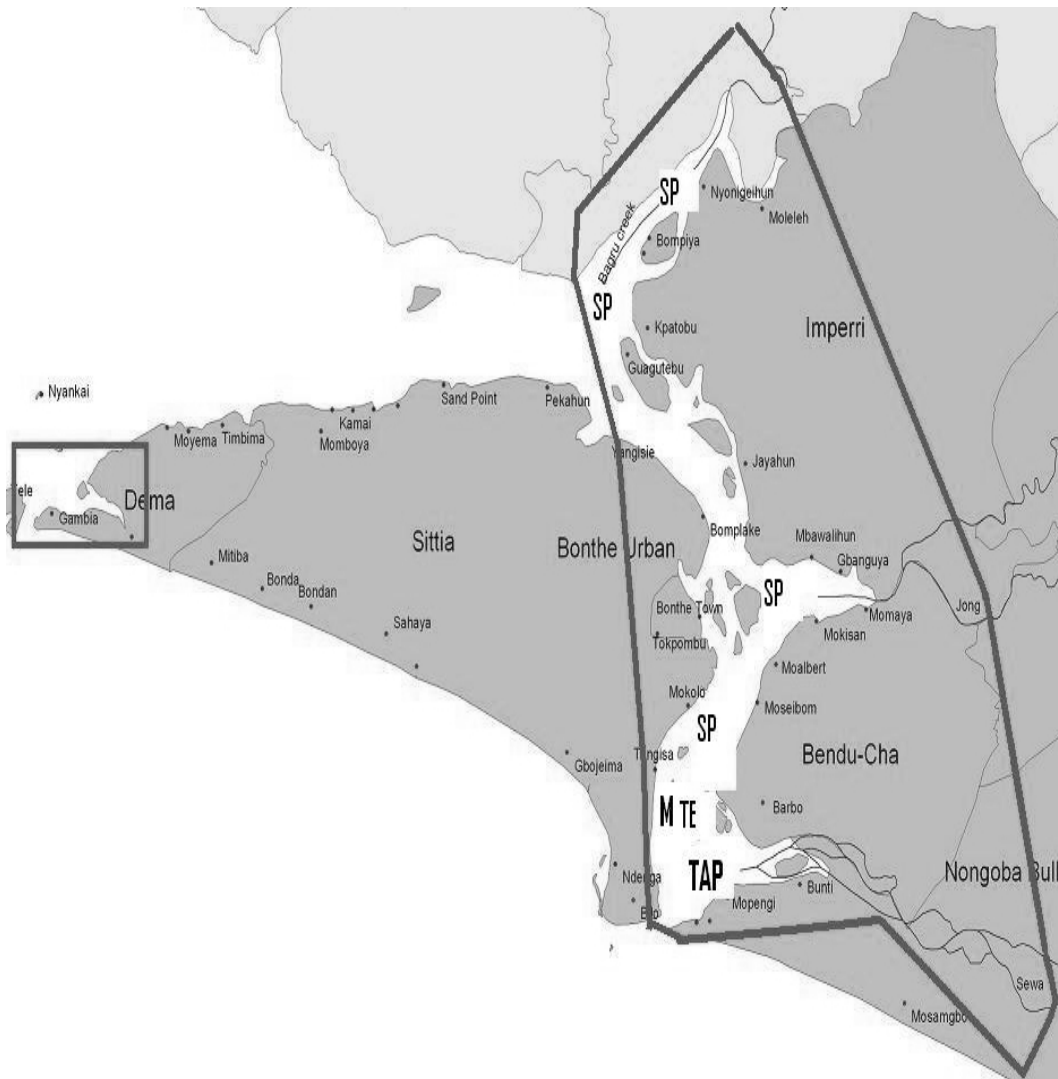


Fig. 9. MPA zones in the Sherbro River system, Southern Sierra Leone: SP = spawning ground for small pelagics (herring and bonga), TAP = occurrence of Tapong

Industrial fisheries

Cod end mesh sizes

- a. small pelagic purse seiners = 32 mm
- b. mid-water trawl = 60 mm
- c. demersal fish trawlers = 60 mm

Proposed management measures:

Banning

It has been proposed that paired trawling for both demersal and mid-water pelagic species should be banned

Co-management recommendations

The FAO/CECAF working group in 2006 agreed on the existence of four stocks in the Southern CECAF area:

| | |
|-----------------------|--|
| The Northern Stock = | Cape Verde, Guinea- Bissau, Guinea-Conakry, Sierra Leone and Liberia |
| The Western Stocks = | Ivory Coast, Ghana, Togo and Benin. |
| The Central Stocks = | Nigeria, Cameroon, Sao Tome and Principe and Equatorial Guinea |
| The Southern Stocks = | Gabon, Congo, DR Congo and Angola |

It was therefore recommended that countries targeting Bonga should collect biological data on the species to enable better analyses of the status of the stock, which we have started implementing under the ISFM Project . The following have been recommended:

- Future research should be carried out to harmonize the collection system of fishing effort at national and regional level for the artisanal fishery, especially for countries with overexploited resources.
- To investigate the possibility of carrying out acoustic assessment at depths below 15m with convenient methods. To capture the status of the bonga (*Ethmalosa* spp) resources. The Senegalese research vessel (ITAF Deme) is currently convenient for the herring stock assessment but not convenient for the Bonga (*ethmalosa*) which is more concentrated inshore below 15m depth. Currently there is no biomass assessment for *Ethmalosa* spp.
- Research into the population biology of pelagic fish species is required and extended surveys to determine the Stock level and the exploitation pattern.
- Research into the socio-economic, marketing and processing methods is also required for a comprehensive management plan.
- Consultation with neighboring States for the shared fish stocks between Sierra Leone and Guinea (e.g. the Bonga, Sardinella, anchovy and horse mackerel) is necessary when doing environmental impact assessment(pollution or erosion) that can be transmitted from one state to the other by oceanic currents. States should therefore cooperate at the regional or sub-regional level in research programmes and in the elaboration of mechanisms or protocols for the exchange of knowledge, experience and technical assistance in support of responsible development and management of shared fishery resources.

States should also cooperate in the exchange of information on shared stocks. Neighbouring States should share information relating to the fishery itself (biological characteristics of the resource, species production, economic information etc.) and the impact of coastal developments on fish stocks.

- Environmental impact assessments and Strategic Environmental assessment are needed for any coastal development project.

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