Federal Department of Fisheries
FEDERAL MINISTRY OF AGRICULTURE AND RURAL DEVELOPMENT

NIGERIAN INDUSTRIAL SHRIMP FISHERY

MANAGEMENT PLAN

FINAL VERSION

December 2012
Acknowledgement
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# Acronyms

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<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>BRD</td>
<td>By-catch Reduction Device</td>
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<tr>
<td>EAF</td>
<td>Ecosystem Approach to Fisheries Management (FAO)</td>
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<td>ECCAS</td>
<td>Economic Community of Central African States</td>
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<td>EEZ</td>
<td>Exclusive Economic Zone</td>
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<tr>
<td>ERA</td>
<td>(Ecological) Risk Assessment</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation of the United Nations</td>
</tr>
<tr>
<td>GCLME</td>
<td>Gulf of Guinea Large Marine Ecosystem</td>
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<tr>
<td>HACCP</td>
<td>Hazard Analysis and Critical Control Point</td>
</tr>
<tr>
<td>MCS</td>
<td>Monitoring, Control and Surveillance</td>
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<tr>
<td>MSY</td>
<td>Maximum Sustainable Yield</td>
</tr>
<tr>
<td>NESREA</td>
<td>National Environmental Standards and Regulations Enforcement Agency</td>
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<tr>
<td>NIMASA</td>
<td>Nigerian Maritime Administration and Safety Agency</td>
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<tr>
<td>NIOMR</td>
<td>Nigerian Institute for Oceanography and Marine Research</td>
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<tr>
<td>NOSDREA</td>
<td>National Oil Spill Detection and Response Agency</td>
</tr>
<tr>
<td>NTG</td>
<td>National Task Group</td>
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<tr>
<td>SPS</td>
<td>Sanitary and Phyto-Sanitary</td>
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<tr>
<td>TED</td>
<td>Turtle Excluder Device</td>
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<td>WTO</td>
<td>World Trade Organisation</td>
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1.0 Introduction

This plan represents the end of a design process and the beginning of an implementation process. The plan has been designed following the principles of the FAO’s Ecosystem Approach to Fisheries Management.

A National Task Group was established to lead the process which began with the production of a baseline report of the fishery. This report draws together knowledge of the fishery and begins the discussion about its management.

The question of the management of the fishery was discussed further during a workshop to identify and assess risks for the fishery, especially relating to ecological and human well-being. A risk assessment report was prepared on the basis of this workshop.

Finally, a bio-economic analysis of the fishery was undertaken to evaluate, using the best available information, the current performance of the fishery and the potential wealth that might be generated under alternative management and exploitation arrangements.

The plan presented below has been developed on the basis of these elements, which are themselves part of the plan and the planning process.

2.0 Purpose of the plan

The over-arching goal of the plan is to maximise the sustainable benefits realised from the exploitation of Nigerian shrimp resources by the industrial fishery, subject to ecosystem sustainability and social constraints, and to ensure that such sustainable benefits are equitably distributed.

To achieve this goal, three management objectives must be realised:

1. To ensure the sustainable generation, the growth and the equitable sharing of the wealth of the resource that is predicated on reliable resource data and effective monitoring, control and surveillance (MCS).
2. To minimise the ecological impact of the industrial shrimp fishery and to minimise the ecological impact of the activities of other sectors that may negatively impact the fishery.
3. To develop an appropriate implementation framework for this plan.

3.0 Scope of the plan

This plan concerns all shrimp resources exploited by industrial trawlers operating in the areas open to them (currently all of the Nigerian EEZ except for any non-trawling zones that may be declared).
4.0 Description of the fishery

4.1 Bio-ecology

The Niger Delta area (from Benin River mouth eastward to the Cross River estuary) is rich in nutrient from rivers discharging into the sea and is known for its rich shrimp resources. The main target species are the penaeid shrimps (*Penaeus notialis*, *Penaeus monodon*, *Melicertus kerathurus*, *Parapenaeopsis atlantica* and *Parapenaeus longirostris*).

Shrimp abundance in the area is highest within the inshore waters (0 – 50m depth). The shrimp fishing season is mainly between May and November.

In the 1970s and 1980s, the annual potential yield for shrimp was estimated to be between 3,500 – 4,020 tonnes. However, higher shrimp catches have been recorded since 1992, with 5,000 tonnes in 2007. Using a combination of production and export data, bio-economic modelling undertaken in the process of developing this plan suggests that the MSY may be over 7,500 tonnes.

Other important species being targeted are the royal spiny lobster (*Palinurius regius*) and the portunid crabs (*Portunus validus*, and *Callinectes spp.*).

Resources that are non-target, but retained for their economic value, include the fin fishes (bony and cartilaginous), cephalopods (squids and octopuses), and other invertebrates such as sea-cucumbers.

The penaeid shrimps have similar life cycles with both estuarine and marine water life stages. They spawn offshore between 10m and 80m depths and the hatched nauplius planktonic larvae are carried by current towards the shore. During this migration, they moult several times and arrive inshore as post-larvae. The post-larvae migrate into the brackish waters (lagoons and estuaries) and settle down as demersal species. They grow to juveniles and migrate back to sea where they become adult and the cycle repeats itself.

The Nigerian coastal zone has extensive estuaries, lagoon systems and an 853km coastline. The entire coastal area is very rich in penaeid shrimp resources and other crustaceans that are the main target of the industrial shrimp industry. The Niger delta region provides favourable habitat for the growth of the shrimps and also supports their life cycles.

The penaeid shrimps are found between 0m up to about 100m depth but different species occupy different depths, helping to avoid competition between them. *P. atlantica*, *P. notialis* and *P. monodon* occur more in waters shallower than 50m while the *P. longirostris* occurs at greater depths.

4.2 Environmental impacts and issues

The baseline report identifies some environmental impacts of fishing: gear non-selectivity, trawling impact on sea bed, and waste disposal from trawlers and other sources. The bottom
trawl fishery is a non-target method of catching shrimp and the quantity of by-catch species is usually high.

In the design of the net, a heavy chain and/or rollers are attached to the foot-rope of the net to catch shrimp and fish buried in the sediment but this action may destroy critical habitats for other organisms particularly, the benthic organisms (benthos) many of which are sessile and are sediment specific. Because these benthos are food for many demersal species, their destruction will affect other living organisms in the ecosystem.

There may also be re-suspension of sediment particles (silt and clay particles) increasing turbidity and reducing light for photosynthesis in shallow areas and possibly liberating other contaminants or pollutants that had been locked-up in the sediment.

The fishery may also be responsible for direct pollution due to poor sanitary and lack of waste management systems on the vessels. Various wastes are dumped directly into water untreated.

However, the bigger impact seems to be from onshore activities since more than 20% of Nigerians live along the coast and most of the biggest cities in Nigeria such as Lagos and Port Harcourt are located on/near the coast. Most of the wastes being generated in these cities are dumped directly into the sea, lagoons and estuaries. As of today, solid waste is a major problem in Nigeria waters and a major challenge to the shrimping/fishing industry. In a fish survey carried out by Nigerian Institute for Oceanography and Marine Research (NIOMR) in May 2009 off Lagos, in a single haul (around Badagry) that was sorted, a total of 66kg of solid waste was recovered and only about 20kg of fish were sorted.

Another issue of concern is the impact of oil and gas exploitation and exploration within the Niger Delta region which is a major shrimp resource base. There are frequent oil spills and negative effects of offshore installations which degrade the ecosystem with consequential harmful effects on shrimp resources.

4.3 Exploitation system

On the average, about 83% of the registered and operating fishing vessels in Nigeria between 1995 and 2007 were shrimping vessels. The main fishing method employed in this fishery is trawling and the main gear used is the bottom trawl net with an average length of about 12m and with minimum cod-end stretched mesh sizes of 44mm as approved by law. Almost all the vessels operating in Nigeria are rigged with twin-trawl nets on both sides of the vessel with otter doors to ensure better opening of the nets while trawling. All the nets are also fitted with a Turtle Excluder Devices (TED) and By-catch Reduction Devices (BRDs) for the escape of turtles and juveniles of non-target species. The shrimp trawl net cod-end mesh (44mm) is smaller than the fish trawl net cod-end mesh (76mm).

As at 1987, a total of 161 vessels were registered for fishing while 82 were registered for shrimping but in 2005, only 35 vessels were registered for fishing while a total of 203 vessels were registered for shrimping.
In 2010 the best estimate was that the fishery provided about 1,600 jobs for direct fishers and a further 760 for land-based workers. The direct fishers include the Captain and other crews on board vessels while the land-based workers are the administrative, financial and maintenance staff.

Most of the methods used for shrimping are technology-based such as the use of echo sounder or fish finder and the use of a ‘Try-net’ for sub sampling to estimate the species composition before the nets are shot.

Table 1 gives an indication of catches in value and weight from the fishery using export statistics and other information.

Table 1: Value of Catches in the Last Five Years

<table>
<thead>
<tr>
<th>YEAR</th>
<th>VALUE ('000 $)</th>
<th>EXPORT (TONNES)</th>
<th>IMPLIED PRICE/KG</th>
</tr>
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<tbody>
<tr>
<td>2006</td>
<td>46,804.100</td>
<td>7,736.222</td>
<td>6.05</td>
</tr>
<tr>
<td>2007</td>
<td>38,311.320</td>
<td>5,136.672</td>
<td>7.46</td>
</tr>
<tr>
<td>2008</td>
<td>15,413.034</td>
<td>1,856.992</td>
<td>8.30</td>
</tr>
<tr>
<td>2009</td>
<td>20,664.792</td>
<td>2,489.734</td>
<td>8.30</td>
</tr>
<tr>
<td>2010</td>
<td>38,552.247</td>
<td>4,644.849</td>
<td>8.30</td>
</tr>
</tbody>
</table>


Data from 2010-11 suggest that the fishery is heavily dependent on two shrimp species: *Penaeus monodon* which represents over 46% of the value and *Penaeus notialis* almost 37%. Less important species include *Parapenaeopsis atlantica* (12%), *Melicertus kerathurus* and *Parapenaeus longirostris* (both just over 2%).

4.4 Interaction between industrial and artisanal fisheries

The region of the continental shelf between the shoreline and roughly the 18m contour is almost exclusively fished by artisanal fishermen, but both the artisanal and industrial fishermen exploit the waters between the 18m and 40m contours.

Although by regulation the industrial fisheries are not supposed to interfere with the artisanal fisheries, the two sub-sectors target the same finfish and shellfish resources that straddle the 5 nautical mile non-trawling zone limits specified for the artisanal fisheries. This often occasions conflict between industrial fisheries and the artisanal fishers due to the destruction of the latter’s nets as the trawler operators encroach into the non-trawling zone.

The artisanal fisheries utilize the nearshore, estuaries and lagoons as their fishing area. These areas are known to be the breeding and nursery grounds for the target species in the industrial fishing and shrimping fisheries. The juveniles or the recruiting stages of the target species are continually harvested by the artisanal fishermen and this affects the recruitment into the fisheries. Of much importance is the “Nkoto” fishery that targets the small white shrimp (*Nematopalaemon hastatus*) as the primary target species. They use a net of about
10mm mesh size for catching the shrimp and in some areas (Osoroko in Lagos State), they practice a form of trawling (beam trawling) with outboard engines.

4.5 Trade

The industrial shrimp fishery in Nigeria is export oriented and packaging is done on board ready for the export market. The product form is mainly frozen head-on and packaged in two kilogram cartons. However a small percentage is peeled, de-veined and headless. Head-on constituted 99.1% of the total product exported in 2010.

Trade in Nigerian fish products has increased substantially over the past two decades and fish exports were valued at about US$ 60 million per annum. Fish exports to European and other overseas markets contribute significantly to the national economy. In a relatively short time, the fish processing and exporting industry has acquired access to tightly regulated markets by meeting international Hazard Analysis and Critical Control Point (HACCP) and Sanitary and Phyto-Sanitary (SPS) standards.

The Netherlands is currently the most important market (65%) followed by Belgium (26%), France (8%) and Spain (just over 1%).

5.0 Rationale

The most important rationale for this plan is that Nigeria has valuable shrimp resources but the exploitation of these resources is not currently making the social and economic contribution of which it is capable. Although there are a number of reasons for this state of affairs, the key issue concerns the access arrangements under which the fishery is currently being exploited. Licences are effectively unlimited at present and even if they were, international best practice indicates clearly that licences alone are incapable of generating resource wealth on a sustainable basis.

The Ecological Risk Assessment undertaken as part of the preparation of this plan identified a number of issues that needed to be addressed. Many of these are consequences of the current access arrangements.

Due to the paucity of data, the current stock status of the shrimp and other fish resources in Nigeria is not known with any certainty. However, the available evidence suggests that the stocks (shrimps and fish) are over-fished. Such evidence includes the increased number of vessels and number of days spent at sea by shrimpers for the given catch (i.e. the declining catch per unit of effort), the increasing amount of juveniles in landings and an observed decrease in the size of fish over the years (fish graded as small in the 1980s are now being graded as medium and even large sizes).

The attacks on vessels by sea robbers/militants have restricted the vessels to limited areas and as a result, these accessible areas are now overfished.
There is a need to improve data about the fishery however. There have been no recent direct estimates of the status of the stocks and evaluations have had to rely on indirect methods using landing data which may have some problems. Production data was validated using export data which are perhaps more reliable There is also a need to evaluate the impact of *P. monodon* in the Nigerian ecosystem in particular and Gulf of Guinea at large, especially as this species has now become one of the most valuable in the ecosystem.

The fishery is exploited by trawlers and as with shrimp fisheries the world over there is a need to deal with by-catch issues, including those related to endangered and protected species. The by-catch problem is by no means straightforward because juvenile fish are traded at sea (between the captains of shrimp vessels and artisanal middle-men). However, this situation does not appear to be sustainable because of the negative impact of fishing juveniles on the finfish sector. It is important therefore that the plan address the by-catch issue.

In addition, the fishery may have some direct impacts on the environment. For instance, as discussed in the previous section, the nature of the fishing gear used (heavily-weighted trawls) may cause some sea-bed damage. Ghost fishing through lost or abandoned gear poses a similar if slightly different problem.

But in this context, the fishery is probably more at risk from environmental impact generated by the activities of other sectors. Section 4.2 discusses some of the issues. Another important problem concerns the loss of mangroves and their replacement by the invasive exotic Nypa palm, which threatens the spawning and recruitment of most marine species including shrimps.

Another issue identified by the ERA is that the open-access nature of the fishery may be depressing incomes in the fishery. This is a complicated question because incomes in any sector will also be affected by incomes available elsewhere in the economy. Nonetheless it does seem that returns to the crew are currently very low resulting in disloyalty causing various forms of dubious practices at sea such as illegally selling some products and keeping the proceeds. Such activities contribute to resource depletion and to a loss of data of the quantity of resource harvested and disposed of at sea. The poor returns also result in a high turnover rate of labour (especially crew) which may affect sustainability adversely.

The high capital outlay required for investing in the shrimp fishery coupled with the difficulty in accessing funds results in a low percentage of Nigerian nationals’ ownership in the industry. About 90% of the shrimping companies are owned by foreigners and most of the essential jobs are taken by the foreigners to the detriment of nationals. One reason for this is that shrimp fishing requires highly skilled labour. The nationals are generally less skilled and less competitive, thereby ceding the more lucrative jobs in the industry to foreign nationals. Capacity building is essential for the sustenance of the industry.

Returns to the Government as representative of the resource owner are currently poor. The licence fee is low compared to the value of catches made in this industry. This issue needs to be addressed generally rather than simply as a licence fee problem, both to assist the sustainable exploitation of the fishery and more importantly to ensure an equitable
distribution of the benefits. Increasing the wealth by use-right under TAC requires reliable information of catch and data on the shrimp resources as well as effective MCS.

The export nature of the shrimp industry in Nigeria makes it essential that product quality continues to meet both national and international standard (WTO, HACCP, Ecolabeling etc.).

The Fishery Act has been reviewed but has yet to be enacted. The Ministry will ensure that nothing in the Act would prevent the implementation of this plan.

There is a need to improve compliance with current management measures, partly by improving Monitoring, Control and Surveillance (MCS) but also by developing arrangements that enhance voluntary compliance.

MCS is currently limited to observations at landing sites, due to a lack of sea and air patrol capacity. This needs to be addressed generally and not simply in the case of the shrimp fishery.

Information sharing between stakeholders (Department of Fisheries, Research Institute, Trawler operators) is inadequate. Reliable information is required through research on the biology and stock assessment of shrimp and others species within the ecosystem. There is a need to improve data collection, especially of key parameters such as catch by species by vessel, and to develop data-sharing protocols.

There is currently a shortage of manpower in the area of resource management.

6.0 Actions

6.1 Physical risks at sea

Exploitation of the fishery is hindered because some of the fishing grounds are inaccessible due to piracy, sea robbery and militancy. This is a critical issue. The main aim of the plan is to increase the economic returns from exploiting the fishery but, if effective action is not taken, success elsewhere in the plan is likely to be undermined by a worsening of the piracy problem.

The Ministry will coordinate with other Ministries and agencies in order to improve and increase surveillance at sea by the relevant security agencies. It is particularly important to empower the Navy through the provision of platforms to enable containment of the menace posed by militancy and piracy at sea.

In the West African Sub-region, ECOMOG which was set up to ensure safety in the ECOWAS states and the West African Standby Force with headquarters in Cotonou (Republic of Benin) are regional security instruments for addressing insecurity including maritime safety. It should be noted that the Economic Community of Central African States (ECCAS) is also addressing the issue of maritime security in Central Africa with the creation of a Regional Centre for Maritime Security in Central Africa (CRESMAC in French). This organisation is the
key structure in the implementation of the strategy to secure the vital marine interests of the ECCAS States and the Gulf of Guinea

6.2 Access to the fishery

Currently, access rights depend simply on vessel registration and licensing as stipulated in the Sea Fisheries Act Cap S. 4 of 2004. A licence is valid for one year from 1st January to 31st December and access is effectively open provided the operator has met all the conditions spelt out in the Act.

This approach will not enable sustainable wealth to be generated from the exploitation of Nigeria’s shrimp resources. Extra wealth will simply result in increased numbers of fishers until resource rents (net wealth) are reduced back to zero.

As a first step to address this problem, the number of licences will be limited to 150 shrimpers. The Ministry will develop guidelines explaining the procedure for licence allocation and transfer to ensure that those meeting the conditions set out in the Sea Fisheries Act mentioned above can continue to obtain a licence although this may have to be from another fisher.

However, even limitations in the number of licences will be insufficient to ensure a sustainable improvement in the economic performance of the fishery. The Ministry will therefore begin to explore the possibility of moving the fishery towards a catch-based management system.

The move towards catch-based use rights is important to address at least two important issues: (1) the need to develop a system that gives fishers a clear interest in the long-term health of the shrimp stock and (2) the need to give fishers an incentive to increase the sustainable benefits that can be generated by the exploitation of the shrimp resources. The latter depends on the former, although it also depends on the fiscal stance, a point addressed below.

It is expected that the fishery will be managed by such a catch-based use-rights system within 3 years.

Many of the actions set out in the remainder of this section of the plan, whilst intended to improve the current situation in the fishery, will also serve to develop the foundations of a catch-based system.

6.3 Catch assessment and monitoring

Before the system of TAC can be feasible there is need to have reliable data that will determine the level of TAC to be placed on the fishery. Regardless of the management system (whether effort or catch-based) it is essential to know accurately what is caught.

Under catch-based systems, it is also essential to know precisely who has caught what. It will be a requirement of the licence that vessels report catches every 24 hours.
Data must be transmitted electronically in a format that enables immediate archiving in a computer system (e.g. by using Excel or similar software).

Data should be reported on commercial categories by species. The Ministry will discuss with the industry and scientists the precise formats to be used. These formats may be updated from time to time.

The same data must be entered into the vessel log-book which must be submitted to fisheries inspectors at the end of each fishing trip. Landed catch must be measured accurately and reconciled with the reported catch.

The Ministry will maintain a catch registry on the basis of the information provided. False reporting is a serious offence that may result in the loss of use rights either for a specified period of time or permanently depending on the seriousness of the case.

In order to ensure the reporting of accurate data, vessels may be chosen at random to be unloaded completely to check actual and declared catches. Vessel owners may be present or represented on such occasions.

Accurate recording of catch data will be an integral part of any catch-based system but is also important under an effort-based system in order to assess catch possibilities.

As part of a move towards catch-based systems, a total allowable catch (TAC) will be set in addition to licence limitations. The Ministry will discuss with stakeholders and scientists as to how this TAC is to be set. One option is to set a precautionary TAC. If possible, this will be set using a limit reference point such as MSY; if not, it will be set conservatively with respect to the catch history of the fishery.

6.4 Fiscal arrangements

Trawler operators currently pay a licence fee in order to access the fishery. The amounts so raised are small compared to the potential net value of the fishery.

A fiscal arrangement will be implemented that shares the net wealth generated by the fishery in an equitable manner between the Government (as representative of the owner of the resource) and the private sector that exploits the resource.

The Ministry will conduct an enquiry into the most appropriate royalty arrangements to accompany the implementation of the catch-based use rights system. In doing so, it will consult widely with stakeholders.

One option would be to place a royalty on the turnover generated from the exploitation of the fishery; another would be to place a royalty on the catch right itself. The former is simple to operate but it may lead to serious under-reporting problems. Other options will be considered.
The enquiry will also take into consideration the broad fiscal environment under which the fishery operates. It will consider for instance whether high import duties on spare parts, which may discourage investment in the industrial trawling business, should not be reduced or abolished as part of a fiscal reform process.

In the immediate period, royalties will continue to be collected through licence fees. The appropriate fee will be determined from time to time by the Ministry.

6.5 Increasing catch value

International best practice suggests that under a catch-based use rights system (where the use rights are allocated at company or vessel level) the private sector will find ways to increase the value of the authorised catch. This can occur in many different ways and the main requirement that the Government must meet is to provide a supportive and enabling environment.

Areas where the Government will concentrate its efforts include:

- ensuring that an effective national safety and quality assurance system exists to protect consumers health and create confidence in the quality of Nigerian shrimp exports, and hence enhance their foreign exchange earnings,
- ensuring the industry’s compliance with rules and regulations to meet both national and international standards so that some companies actions do not undermine the performance of others.

Shrimp is already principally an export product so that export promotion does not seem to be a priority. If it were, this action is probably best undertaken by the private sector with some Government support in limited cases.

The Government will consult with the private sector to identify any constraints to the efficient and effective international marketing of shrimp products. Depending on the nature of the constraints, the Government may intervene to assist, for instance in the case of tariff or non-tariff barriers to Nigerian exports.

If any large scale programmes intended to increase product value are planned, it would be best to wait until the catch-based use rights system has been implemented. Otherwise increases in catch value can be expected to encourage unnecessary increases in fishing effort and capacity which will reverse the gains made due to produce value enhancements.

6.6 Ecosystem issues

There are two sets of issues to consider. First, fishing activities may negatively impact the ecosystem. Second, the activities of others may negatively affect the ecosystem and hence fishing.

In the first category, important risks concern the catching of endangered and protected species, and the catching of juvenile fish that are sold at sea as trash fish. Current legislation
concerning Turtle Excluder Devices (TEDs) and By-catch Reduction Devices (BRDs) already addresses these problems. This legislation will continue to be enforced as part of this management plan.

The effectiveness of the current measures will be evaluated from time to time and the measures may be adjusted to improve their impact. One option that may be adopted is to require vessels to carry observers. This option will be evaluated in the context of the revisions proposed for the catch-based use right system.

In addition to these gear modification measures, current legislation also includes non-trawling zones, one purpose of which is to protect coastal fish stocks. These measures also will continue under this plan and will be strictly enforced both through the VMS system and through improved surveillance at sea.

Fishing may also impact the ecosystem through the effects of lost or discarded fishing gear – “Ghost fishing”. The Ministry will undertake a communication programme to educate fishers on the impacts of ghost fishing. As part of this, fishers will be encouraged to report lost nets (both industrial and artisanal) for record purposes to FDF and NIMASA. The strict enforcement of the non-trawling zone should also assist in resolving this problem.

Finally, fishing may contribute to habitat destruction, particularly sea-bed alteration. The Ministry will encourage the development of eco-friendly shrimping gear and, where this is available, shrimpers will be required to use it.

Important though it is to address the ecosystem issues mentioned above, it is more often the case that fishers are victims of ecosystem changes that arise elsewhere.

One important problem concerns mangrove destruction and Nypa palm invasion. Mangrove ecosystems provide important spawning and recruitment environments for most marine species including shrimps. But these ecosystems are now under threat as a result of coastal zone development and the replacement of mangrove by the invasive exotic Nypa palm species. The Ministry responsible for Fisheries will collaborate with the Federal Ministry of Environment to ensure that the lessons from the GCLME demonstration project are learned and appropriate actions taken.

The activities of the oil and gas sectors may also impact fishing negatively first through competition for space and secondly through the effects of oil spillage and gas flaring. In order to address the latter issue, the Ministry responsible for Fisheries will collaborate with the Department of Petroleum Resources, NOSDREA and NESREA to ensure that proactive measures are put in place by oil and gas exploiters and explorers to reduce frequent incidences of spillage and high level of gas flaring in the Niger Delta.

The fisheries sector in general also suffers from the effects of land-based pollution, particularly from industrial effluents, agricultural pesticides and domestic waste. The Ministry responsible for Fisheries will collaborate with the Ministry of Environment and Waste Management Authorities in order to design effective management strategies to mitigate the effect of the pollutants on the marine environment.
It is reported that large quantities of solid wastes are harvested along with fishery products often by trawlers at sea. Measures will be put into place to give trawler operators the incentive not to dump such waste back into the sea.

Finally, fishing may be adversely affected by dredging in the Lower Niger. The Ministry responsible for Fisheries will collaborate with the Nigerian Ports Authority and the Ministry of Environment to mitigate this problem.

6.7 Technical measures

The fishery is already the subject of a number of technical management measures. As part of a precautionary approach, all of these measures will remain in place. However, the Ministry responsible for Fisheries will conduct a review of the effectiveness of the current set of measures as part of the review to determine the catch-based use right approach. Wherever possible as part of developing an enabling environment, regulations will be simplified or removed if they are ineffective or no longer required under the new approach.

These management measures include:

a. A non-trawling zone of 0 – 5nm from the coastline
b. A trawl net cod-end mesh size restriction of 44mm for shrimping
c. A vessel size restriction for inshore shrimping operation (23-25m overall length and 130 Gross Registered Tonnage)
d. The obligation to use Turtle Excluder Devices (TEDs) and other By-Catch Reduction Devices (BRDs).

On-shore inspections at landing sites indicate a very high compliance level with the latter three measures but compliance with the non-trawling zone remains poor. Efforts will be made to improve this situation through the implementation process, which involves:

i. Routine inspection of all fishing vessels that land in the country to ensure compliance with the provisions of the Sea Fisheries Act and related regulations
ii. Annual pre-licensing inspection of fishing vessels to ensure compliance with the relevant legal provisions before renewal of the fishing licence
iii. Regular workshops and meetings with all stakeholders in the sector to provide a platform for effective co-management of the fisheries resources.

One new measure that is being discussed by fishers concerns the possible introduction of a closed season. It is known that the main shrimping season is between May and November. At the NTG stakeholders meeting, it was proposed that a closed season between December and April may assist the recovery of stock and reduce pressure on the juveniles of the non-target but retained species. It might also reduce the impact of shrimp trawling on the habitat and consequently the ecosystem as a whole. However, experience in other countries shows that closed seasons can take on their own dynamics, especially in open access fisheries, so it will be essential to consider the use of such a measure in the context of the use right system.
6.8 Monitoring, control and surveillance (MCS)

It is clear that, to be effective, any fishery management plan must be backed up by adequate MCS resources. At the same time, it is not simple to discuss MCS requirements in the case of a single fishery because many of the key (and most expensive) inputs are indivisible and cover therefore most, if not all, fishery resources.

The Federal Department of Fisheries has an MCS unit with the mandate to ensure the enforcement of fisheries legislation. The unit is currently poorly equipped and as a result MCS activities are shore-based, involving the inspection of vessels, fishing gear, log books and the collection of fish landing data at landing sites. The inspectors who perform these duties are not adequately equipped with suitable tools such as net gauges to measure net mesh sizes, uniforms, weighing balances, safety gadgets (life jackets) etc, to enhance their performance. The restriction of MCS activities to landing sites only is as a result of lack of MCS patrol vessels.

However, this difficulty is supposed to be addressed by the security operatives such as commissioned military, police and customs officers who are legally empowered to engage in fisheries protection activities while on routine patrols at sea.

Unfortunately, protection of oil and gas installations and exploration activities are being given prime attention to the exclusion of fishing activities. Occasioned by these challenges, compliance with the fisheries regulations by trawler operators is therefore a voluntary matter which cannot be ascertained. The result of these challenges is poor governance output in this respect.

In order to protect its valuable fish resources, it is essential that the Nigerian government undertake some investment in basic MCS equipment.

A first requirement is to install a VMS system. It will be a legal obligation for all shrimpers to install and maintain in a functional state the necessary VMS equipment. In addition to providing position, the system should also be capable of transmitting catch data. The precise specification of the equipment will be determined by the Ministry responsible for Fisheries.

A second requirement is to develop some at-sea capacity in the form of patrol vessels jointly manned by fisheries inspectors and military / police personnel. As this role goes beyond the shrimp fishery, it will be necessary to consider Nigeria’s marine fisheries as a whole in order to determine the type and number of vessels. A sufficient operational fund must be implemented for these vessels.

A third requirement is to have some air patrol capacity (again with sufficient operational funding).

Finally, it may be appropriate to put fisheries observers on shrimping vessels.

6.9 Emergency measures
Under this plan, the Minister is authorised, in exceptional circumstances, to take emergency measures that may apply to all or part of the fishery. For instance, if excessive by-catch is being taken in a particular area the Minister may order a temporary suspension of fishing in that area. It is not expected that such measures will be taken frequently and they will not be used as a routine management measure. Such measures will be taken only to meet a clear temporary threat to the fishery or the resource.

6.10 Management budget

The fishery will require a management budget. Once the catch-based use right system is in place, this budget will be met by a levy on the turnover of shrimpers. The maximum levy will be 5% of turnover in year N to fund the management budget for year N+1.

In the transitional period, the Nigerian government will make this management budget available as an investment in the future of the Nigeria’s shrimp resources.

A committee will be set up to oversee management expenditure for the fishery. The precise membership of this committee will be published from time to time but will include as a minimum representatives of the Ministry responsible for Fisheries and the fishers.

7.0 Benefits and costs

Preliminary bioeconomic modelling of the exploitation of Nigeria’s shrimp resources suggests that the fishery is capable of generating net wealth in excess of US$ 30 million per annum.

It is difficult to be certain of the current performance of the fishery and further modelling with improved data is required especially concerning landings and economic parameters. However, international experience strongly suggests that fisheries managed by licences are incapable of generating sustainable rents because each time rents emerge they will encourage an intensification of fishing effort.

It is highly likely therefore that there is a very large gap between the potential and current economic performance of the fishery. The challenge is to design an exploitation and management framework (a set of institutional arrangements) that will gradually close this gap by encouraging the sustainable generation (and growth) of this wealth.

Preliminary as it is, the modelling shows clearly that the maximisation of such benefits requires that shrimp stocks be rebuilt to levels much higher than those corresponding to the MSY level. So the achievement of the economic goals will also deliver ecological goals (at least in terms of the resource itself) as a secondary outcome.

Much work is needed to improve the bioeconomic models. The data currently available have enabled the construction only of fairly rudimentary global production models taking the shrimp as a single resource. The improvement in data availability that will follow from the
implementation of section 5.3 will enable improvements in various directions. For instance, it will be possible to consider different shrimp species independently.

Great care is needed in the interpretation of the US$ 30 million estimate. It does not mean that there is this amount of wealth sitting out at sea somewhere waiting to be harvested. It means rather that with a change in the way the fishery operates, the resource can eventually produce net benefits of this kind of amount. As already stressed, the key is to design catch-based use rights that will enable the benefits to be generated on a sustainable basis.

The US$ 30 million is also only an indicator. Experience from other fisheries around the world suggests that the fishery could in fact do much better than this. The modelling which has been done so far considers only the production side, taking shrimp price as a given (a weighted average value across species and sizes). International best practice suggests that once they have secure use rights, fishers will find innovative ways to market their produce so that gains are made not only on the production side but also on the revenue side.

It is for this reason that section 5.4 stresses the need for a sharing of the benefits between Government and the private sector. The latter needs the former to define and enforce use rights and the former needs the latter to generate and increase the net benefits from shrimp resource exploitation.

In addition to these financial benefits, the plan will also consolidate existing benefits. The fishery will continue to provide sustainable jobs and incomes for those involved in the exploitation of the fishery; it will continue to contribute substantially to Nigeria’s export performance and the generation of hard currency and, although principally export-oriented, it will continue to contribute to some extent to Nigeria’s food security.

In terms of the cost of management measures, section 5.10 suggests a management budget of 5% of turnover. The bioeconomic modelling suggests that the fishery will generate sustainable revenues (turnover) of about US$50 million per annum once the catch-based use rights are in place and operating. This would give a management budget of about US$ 2.5 million per annum. This seems a reasonable amount to spend to ensure a return of US$ 30 million per annum.

8.0 Institutional aspects

A large number of agencies and other stakeholders have an interest in the industrial shrimp fishery. A partial listing would include:

i. Federal Department of Fisheries
ii. Nigerian Institute for Oceanography and Marine Research (NIOMR)
iii. Nigerian Navy
iv. Nigeria Police Force (Marine)
v. Nigerian Maritime Administrator and Safety Agency (NIMASA)
vi. Nigeria Customs Service
vii. Nigeria Immigration Service
viii. Department of Petroleum Resources
ix. Ministry of Environment / Waste Management Agencies/

Consultations between these stakeholders and the industry are not regular mainly because there is no legal framework to institutionalize such a platform. This situation engenders lack of information sharing and dialogue among the various stakeholders which is important for planning, development and management.

As part of the process to develop this management plan, an EAF National Task Group (NTG) was established. This NTG includes relevant stakeholders. It will now be institutionalized with legal backing as a shrimp fishery consultative forum. In addition to facilitating stakeholder meetings, this forum will disseminate information relevant to the fishery, including (but not limited to):

- Status and results of plan implementation
- Information on resource stock
- Education on various provisions of Fisheries Act and related Regulations
- Government intervention and policies to enhance progress in the industry.

As part of the process to establish this forum, a review will be undertaken of each agency’s regulatory roles in order to identify and avoid gaps and overlaps. This review will pay attention to the reform of the use right system and the subsequent responsibilities which emerge, especially any new requirements.

As part of the development of the forum, and in coordination with the management committee, a review will also be undertaken of data collection requirements and processes.
Appendix 1: Summary of management actions

<p>| MANAGEMENT OBJECTIVE 1 : Generation, growth and sharing of resource wealth predicated on reliable data and MCS |
|---|---|---|---|---|
| Operational objectives | Management measure | Performance indicators | Monitoring | Other |
| Increase maritime security | Coordination of relevant national agencies involved in maritime security | Reduced number of piracy and similar incidents | Ministry in Charge of Fisheries, Navy, about Air Force and NIMASA |  |
|  | Cooperation with ECOMOG/ECCAS regional force (CRESMAC) | Safe access to all fishing areas |  |  |
| Control of fishing capacity | Limited number of licences | Number of licences limited to about 150 vessels | Ministry in Charge of Fisheries | Short term strategy. Important to develop it further, otherwise incentive to make existing licensed vessels more effective |
|  |  | Licence registry maintained in real time on the Ministry’s web site |  |  |
| Reliable data collection | Research / Stock Assessment surveys, | Results available with updated stock estimates Estimation of MSY and standing biomasses | NIOMR and Ministry in Charge of Fisheries |  |
| Strengthening use rights | Implementation of a catch-based use rights system | Development of a discussion paper outlining options Detailed development of preferred option Implementation of preferred option | Ministry in Charge of Fisheries | Gradual development over 3 years Once preferred option chosen, need for detailed roadmap for its implementation |
| Catch control | Implement an effective catch Registry for landings | Ministry in Charge of | Need for detailed design of |  |</p>
<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Ministry in Charge of Fisheries / NIOMR</th>
<th>Ministry in Charge of Fisheries / Stakeholders</th>
<th>Government and other stakeholders</th>
<th>Ministry in Charge of Fisheries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitoring system</td>
<td>Development of system to determine Total Allowable Catch</td>
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<tr>
<td></td>
<td>Maintenance in real time</td>
<td>Fisheries</td>
<td></td>
<td>TAC determination important for all management systems. Development of system (choice of reference point – MSY or other, development of methodology, use of catch data and resource surveys, updating of bioeconomic models)</td>
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</tr>
<tr>
<td>Sharing of resource wealth</td>
<td>Monitoring of net wealth generated by the fishery</td>
<td>Ministry in Charge of Fisheries</td>
<td></td>
<td>Analysis of current fiscal situation required to provide baseline</td>
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</tr>
<tr>
<td></td>
<td>Development of a fiscal strategy for the fishery</td>
<td>Ministry in Charge of Fisheries / Stakeholders</td>
<td></td>
<td>Need to build understanding of the potential of the fishery</td>
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<td></td>
<td>Monitoring by an economics unit within the Ministry</td>
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<td></td>
<td>Agreement on equitable outcome</td>
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<td></td>
<td>Development and updating of bioeconomic models</td>
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<td></td>
<td>Discussion document produced</td>
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<td></td>
<td>Negotiation of agreed strategy with stakeholders</td>
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<tr>
<td>Growth of resource wealth</td>
<td>Creation of an environment that gives fishing enterprises an incentive to increase the value generated by the fishery</td>
<td>Ministry in Charge of Fisheries</td>
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<td></td>
<td>Use rights and fiscal strategy create appropriate incentives</td>
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<tr>
<td>Operational objectives</td>
<td>Management measure</td>
<td>Performance indicators</td>
<td>Monitoring</td>
<td>Other</td>
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<tr>
<td>Minimise fish by-catch</td>
<td>Requirement to use by-catch reduction device (BRD)</td>
<td>Current legal requirements enforced and improved</td>
<td>Ministry / Research</td>
<td>Evaluation of the current situation (baseline)</td>
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<td></td>
<td></td>
<td>By-catch rates falling</td>
<td></td>
<td>Definition of acceptable by-catch rates</td>
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<td></td>
<td>Spatial and/or temporal closure in case of high juvenile abundance</td>
<td>Geographical monitoring of catch</td>
<td>Ministry / Research / Fishing enterprises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>By-catch of endangered species eliminated</td>
<td>Requirement to use turtle excluder device (TED)</td>
<td>Current legal requirements enforced and improved</td>
<td>Ministry / Research</td>
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<td></td>
<td></td>
<td>Accidental catches reducing</td>
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<tr>
<td>Protect fish resources, their critical habitat and their exploitation from pollution</td>
<td>Documentation and creation of awareness on the impact of land-based pollution and</td>
<td>Reduction in the impact of pollution on the fishery</td>
<td>Ministry in Charge of Fisheries, Ministry of</td>
<td>Evaluation of the current situation (baseline)</td>
<td></td>
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<tr>
<td>due to other economic</td>
<td>that due to offshore</td>
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<td>Petroleum / Research and Enviroment</td>
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<tr>
<td>activities</td>
<td>petroleum exploitation</td>
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<tr>
<td>Include fisheries issues in the decision-making process</td>
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</tbody>
</table>

**MANAGEMENT OBJECTIVE 3 : Developing an appropriate implementation framework**

<table>
<thead>
<tr>
<th>Operational objectives</th>
<th>Management measure</th>
<th>Performance indicators</th>
<th>Monitoring</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective MCS Programmes</td>
<td>Legal obligation to use VMS</td>
<td>Compliance with management measures improves</td>
<td>Ministry / MCS unit, Navy, Airforce and NIMASA</td>
<td>It is difficult to address this issue only for the shrimp fishery. There is a need therefore to review MCS programmes in general</td>
</tr>
<tr>
<td></td>
<td>Develop appropriately-equipped at-sea capacity</td>
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<td></td>
<td>Develop some air patrol capacity</td>
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<td></td>
<td>Use observers where necessary</td>
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<tr>
<td>Effective institutional coordination</td>
<td>Establish a shrimp consultative forum</td>
<td>Forum functional – helping to coordinate roles and inputs from all agencies involved in the fishery and improving consultation among stakeholders</td>
<td>Ministry in Charge of Fisheries / Stakeholders</td>
<td></td>
</tr>
<tr>
<td>An appropriate management budget is available</td>
<td>Short term - funding available from Government</td>
<td>Funds available to ensure effective management</td>
<td>Ministry in Charge of Fisheries</td>
<td>In short term, Government makes funds available as an</td>
</tr>
</tbody>
</table>
Medium term - funding available through the implementation of the plan

Fishing enterprises

In medium term, funding comes from operators as exploitation performance improves

| Possible Emergencies identified | A programme of emergency measures is agreed | Application of the precautionary principle – potential emergencies are identified and actions to be taken are agreed in advance | Ministry in Charge of Fisheries, NIMASA, Research and other relevant stakeholders |