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Overview and research plan for the introduction of conservation technologies in oceanic shrimp trawling in Nigeria

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Abstract

In Nigeria, over 250 licensed industrial shrimp trawlers catch marine shrimps including *Penaeus notialis, Parapenaeopsis atlantica, Penaeus monodon* and *P. kerathurus* which are exported to earn foreign currency worth US $50 million annually. Demersal shrimp trawling generates a lot of undersize and juvenile fish bycatch and inadvertently capture the endangered sea turtles as incidental catch to shrimps. The reduction of incidental catch of sea turtles and juvenile fish from the catch in shrimp trawling is regarded as a priority issue in the global efforts to develop more responsible fisheries. The implementation of sustainable technologies in shrimp trawling started with the introduction of Turtle Excluder Devices (TEDs). This is in accordance with the Turtle Conservation Regulation of Fisheries Act of Nigeria (decree) No 71 of September, 1996 (a supplement of the sea fisheries Act (decree) No 71 of 1992. Nigeria was certified in 1998 among other 43 nations, to export all categories and species of shrimps to United States of America based on satisfactory compliance by the operators in the fishing industry. Recently, it was observed that the preserved sea turtles have grown bigger and their current effort is to modify the existing TED and provide a larger existing opening for the turtles to escape. The investigation and introduction of juvenile and thrash fish excluder devices (JTEDs) and other By-catch reduction devices (BRDs) has started. This should guarantee a substantial reduction in the amount of juveniles of commercial fish species (which constitute over 40 % of by catch) in order to guarantee increases in the production (harvest) of food –fish. The socioeconomic implications of reduction of the by-catch in trawl catches and consequently the by-catch trades that are conducted by small scale fishers in the remote villages will also be investigated. The development and introduction of a combination of turtle and juvenile and trash fish excluder devices should be a viable option in the foreseeable future. The lessons learned from the TED experience will be brought to bear and applied in the current JTED project in Nigeria. The introduction of the new technologies through participatory approach will involve all the stakeholders in the industry. The industrial fishermen are expected to play a key role in the design, construction and experimental fishing trials using commercial vessels as well as the trial selection of most suitable/appropriate JTED. Regulatory measures that will facilitate the adoption of the technologies should be up-dated or put in place through bottom-up approach, involving all the stakeholders. Management strategies for monitoring, control and surveillance should be strengthened. Interaction, collaboration and cooperation among member states in the sub-region, especially between Cameroon and Nigeria should be promoted and sustained.

Key Words: Marine shrimps, Responsible fisheries, By-catch, Nigeria.

INTRODUCTION

FAO and UNEP are implementing a project funded by the Global Environmental Facility (GEF) in 12 shrimp producing and exporting countries of the world with Nigeria and Cameroon from Africa. Nigeria lies between latitudes $4°16'$-$13°52'$ N and longitude, $2°49'$ - $14°37'$ E. It has a coastline of 853km which borders the Atlantic Ocean in the Gulf of Guinea. It has a maritime surface area of 46000km^2 between 0 and 200m water depth. The continental shelf is relatively narrow and the width ranges between 14.8km in the west of Lagos and 27.8km in the east of Calabar. In 1978 Nigeria declared a 200 nautical miles Exclusive Economic Zone (EEZ) which covers an area of 210,900km^2 over which it has sovereign rights for the purpose of exploiting, conserving and managing its fisheries resources.

The fisheries within the territorial waters and the EEZ can be broadly classified into coastal artisanal, coastal inshore and offshore resources (Amadi, 1991) all of which have tremendous potentials for economic prosperity for Nigeria if well harvested. Conservation of the resources should also guarantee increases in food-fish production, in order to meet substantially or partially the shortfall of about 1.0 million metric tons, required meeting the demand of the large population that was estimated to be over 120 million in 2002.

Artisanal fishermen use stows or filter net to catch shrimps in the brackish water lagoons, creeks and estuaries. The same net is towed in the coastal waters 1–2 nautical miles for the crayfish *Nematopalaemon hastatus.* The fishing unit is made up of planked canoe (LOA 7.5m –9.5m) powered by 25 or 40Hp outboard engine. The conical filter net, otherwise called 'beam trawl' with a codend mesh of 10.0mm, is towed and lot of crayfish and juvenile fish by catch are captured at a ratio of about 8 parts of a crayfish to 1 part of juvenile thrash fish/fish by catch. The fish by catch comprised of 25 species belonging to 20 families (Ambrose *et al.,* 2005). Nigerian Institute for Oceanography and Marine Research, Lagos, Nigeria has conducted some investigations on the effect of codend fitted with by-catch reduction devices e.g. fisheye on the performance of beam trawl. One of the drawbacks of the fish eye BRD is its inability to exclude jelly fish (a non commercial species which blocks the opening resulting in poor quality crayfish. (Ambrose, 2005)

The Nigerian Trawlers' Owners Association (NITOA), an umbrella organization of about 36 trawler operators operates about 293 Nigerians flagged registered fishing trawlers/vessels which currently exploit

demersal fish and shrimps resources. The trawlers ranged between 13.0 – 25.0m LOA. Lower catch rates, longer trawling periods of about 45 per trip (instead of 25 – 30 days in the '90s) and reduction in the size of the fish are obvious indicators of over-fishing of the resources. Significant losses of fish biodiversity and habitat degradation have been attributed to uncontrolled shrimp trawling. Therefore, the reduction of the impact of shrimp trawling on the fish resources is paramount. Responsible fishing demands that the refined shrimp trawl net(with TED/JTED/BRD) must be highly selective for the target shrimp species and also ensure that non target fish, mammals and other endangered species are allowed to escape and released unharmed.

THE DEVELOPMENT OF TURTLE EXCLUDER DEVICE (TED) FOR USE IN SHRIMP TRAWL NETS IN NIGERIA

Turtle Excluder Devices (TED) is a conservation strategy to exclude the endangered sea turtles from being captured while the shrimps enter the codend. In 1996, TED became a pre-condition and a regulatory requirement for all nations which export shrimps to the United States. This is accordance with the Turtle Conservation Regulations of Fisheries Act of Nigeria (decree) No 71 of September, 1996 (a supplement of the Sea Fisheries Act (decree) No. 71 of 1992.The Nigerian Institute for Oceanography and Marine Research in collaboration with the Federal Department of Fisheries developed the locally made TED with super shooter or bent rod weed less grid for adoption by the Industrial fishermen. The hard TED grid with minimum size of 81.0cm by 81.0cm, was installed in codend extension made of polythene (PE) synthetic netting material with R1500 tex twine thickness and 45 or 50mm mesh size (Solarin *et al.,* 2003).The angle of inclination of the grid is best at $45°$. Many of trawl nets are fitted with TED with bottom escape opening. Only one fishing company has adopted the top opening. However, fairly large fish species of economic importance, including the croakers and shiny nose are excluded from the catch and allowed to escape and a few captains reported reduction in the shrimps catch. It is important to note that large specimens of endangered species like sharks are also excluded.

Recently, it was observed that the preserved sea turtles have grown bigger. Therefore, it is necessary to provide a larger opening for the modified TED in order to allow the turtles to escape. In this regard TED modification involving the introduction of large escape opening with single or double-flip covers are in progress. Four workshops have been conducted to sensitize all the stakeholders (including the net constructors, industrial fishermen from the fishing companies under the umbrella

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of Nigerian Trawlers' Owners Association (NITOA) as well as Managers and Fishery Administrators, on the design, construction, configuration and installation of TED.

There is a cultural practice among some local fishermen in the maritime states, which guarantees conservation of the marine turtles. The capture of marine turtle is forbidden by tradition. A fisherman who contravenes the law is punished and is compelled to perform elaborate and expensive funeral rites normally serve as enough deterrent and prevent or dissuade the fishers from the indiscriminate capture of marine turtles. The Nigerian Institute for oceanography and Marine Research, Lagos is soliciting for external funding in order to investigate the life cycle of the sea turtles and identify the nesting grounds and beaches in Nigeria.

SUMMARY OF ACTIVITIES FOR INTRODUCTION OF JTED/BRD IN SHRIMP TRAWL NETS IN NIGERIA AND CAMEROON

In summarizing, work plan for the introduction of appropriate JTED/BRD will involve the following: (a) Quantification and identification of by-catches which should involve obtaining fishery related information on species composition and quantity, (b) Comparative experimental trials of JTED/BRD options and traditional nets on board commercial fishing vessels culminating in the selection of most suitable option, (c) Promotion/adoption of the JTED and establishment of regulatory measures with adequate monitoring, control and surveillance strategies.

The target shrimps *Penaeus notialis* (white shrimp), *Parapenaeopsis atlantica* (brown), *Penaeus monodon,* and *P. kerathurus* (tiger) constituted less than 10% of the catch.The landed fish by-catch are always multi species dominated by the Sciaenid family with five major species. The fish are graded as extra-large/large, small and the smaller specimens categorized as miscellaneous species (Misc.) 1, 2, 3 or 4 in descending order size. The thrash fish usually less than 10 cm (TL) which may constitute over 40% of the total weight of the by-catch are sold at sea to small scale artisanal canoe fishermen. Reconnaissance survey and sampling of the catches will be implemented for collection of data.

JUVENILE AND THRASH EXCLUDER DEVICE (JTED) AND BY-CATCH REDUCTION DEVICE (BRD) OPTIONS

Based on the interaction with the international project consultant, the project seeks to investigate the following JTEDs/BRDs in order to reduce drastically the fish by-catch in shrimp trawl nets:

a). Composite square mesh panel fixed to the codend
b). Codend made completely of square mesh netting/webbing
c). Nordmore grid.

This is a mechanical device which may not combine effectively well with the existing TED (made of supper shooter or bent rod or weed less grid) which is a regulatory requirement. (d) Fish eye. The device is based on fish behavior and maybe a suitable option that can complement TED.

EXPERIMENTAL TRIALS

Each shrimp trawl net will be fitted with a TED placed in a codend extension (140-160M by 100M) in order to conform to existing regulations. As indicated earlier TED/BRD combination is applicable/feasible for (a), (b) and (d) options listed above. Each test net will be towed at 2.5 - 3.0 knots (1.2 – 1.5 ms $^{-1}$) simultaneously in parallel with the control or traditional net. Variables such as day and night, water depth, locations or spatial variation as well as seasonal variation can also be investigated.

The random fishing operation will involve two twin trawls of four nets whereby the main rope from the outrigger boom holds three bridles, two of which are attached to two outer doors while the one in the middle is connected to the sledge door. Two day-time hauls and two night hauls will be undertaken (within 24 hours duration) with the nets randomly placed either on the port side or the starboard side after a 3 hours trawling period. Each BRD/conventional or traditional net will be used for minimum of 20 days experimental fishing. Therefore, experimental fishing trials for 4 BRDs will last for 80 days.

DATA COLLECTION AND ANALYSIS

The catch in the codend of the control (conventional/traditional) net and the BRD test net will be emptied into partition tray and sorted into shrimps and by catches respectively. The catch will be sorted further, according to the species composition using suitable identification key (Schneider, 1990). The following data will be collected from each tow, based on the methods of Briggs (1992) and Broadhurst *et al.,* (1996):

a). Total weight of shrimps (kg) and by species
b). Total weight of by-catch (kg) and by species
c). Carapace length of shrimps
d). Length frequency measurements (Total length, height/depth, width, girth, as well as the weight of fish specimens)

The analysis will include 2 – tailed student t-test to compare

the mean by-catch from the control and traditional net. A one way Analysis of variance (ANOVA) can also be used to determine any significant difference in the catch between the control and the BRD nets. It is desirable for the industrial fishermen in Cameroon to adopt the TED prior to JTED/BRD in order to confirm to the global requirements outlined in the code of conduct for responsible fisheries.

SOCIO-ECONOMICS

The thrash fish may constitute over 40 % of the by-catch is often sold overboard at sea to small scale canoe fishermen. The thrash fish is landed mainly in remote coastal villages where it is smoke dried with traditional oven and sold in informed markets. Many fishermen and fishwives are involved in thrash fish trades. Details of the activities and socioeconomic implication of reducing the by-catch trade needs to be investigated. The survey of the thrash fish trade will include training of survey assistants for data collection in remote fishing settlements. The cost implications of introducing the JTED to the fishing industry and a reduction in revenue from thrash fish trade to the industrial fishermen will also be investigated. However, the overriding principle is conservation of the resources and sustainability of the fish bio-diversity.

REGULATION AND MANAGEMENT MEASURES

Nigeria's efforts to ensure responsible inshore fishing practices and proper management of the living marine fish and shellfish resources date back to 1971 when the first comprehensive marine fisheries legislation came into force under the Sea Fisheries Decree No 30 of 1971. In order to further promote the sustainability of inshore fisheries and the fisheries of the Exclusive Economic Zone of Nigeria, the old decree was replaced in 1992 and replaced by the Sea Fisheries Decree No 71 of 1992.

The main Decree contains the general provisions of the conditions for the issue of "Motor Fishing Vessel Licenses", duties and powers of Authorized Persons and penalties for offenses committed under it. The supplements of the Decree namely "The Sea Fisheries (Fishing) Regulations" and the "Sea Fisheries (Licensing) Regulation" contain specific provisions which guide and control investment in industrial marine fishing business and mode of operating such a venture in Nigeria.

The current sea fisheries licensing and fishing regulations which impact on shrimp trawling, by-catch and discard are:

a). Obligatory pre-purchase assurance in writing by the licensing authority that any procured vessels entering into Nigerian shrimping business would be licensed after due process. This is a measure to control, before investment, fishing effort and for preventing over-capitalization.

b). Vessels survey and tonnage measurement in Nigeria by the Federal Ministry of Transport's Government Inspector of Shrimping (GIS) to ensure that only suitable and permissible vessels enter into the Nigerian shrimping or fishing fleet.

c). Restriction on the size of a shrimp trawler to 23.2m LOA and 130 GT to prevent over-sized vessels from entering into the trawl shrimp fishery.

d). Delimitation of a 5 km non-trawling zone, which places restrictions on trawling in a sea water area covering about 7898.78 km^2 of the Nigerian continental shelf essentially to protect the nursery ground from indiscriminate fishing. It is also to protect the artisanal fishermen who operate within the zone, as well as to reduce conflict between them and trawler operators.

e). Codend mesh size specification, 44mm (1¾") stretched, for any shrimp trawl net to promote sustainability of inshore trawl fisheries through rational exploitation.

f). Prohibition of the use of the same vessel licensed to trawl for fish from trawling for shrimps in order to limit the efforts to trawl for shrimp.

g). Prohibition of dumping (i.e. discard) of edible and marketable sea products and transshipment at sea of by-catch. The immediate purpose is to encourage vessels, by bringing all catches back to the home port, to increase supply of fish in the domestic market; indirectly this should also discourage non-compliance with mesh size regulation which leads to catching small-sized for juvenile fish. By the side, when this provision is complied with by the industry, it will allow for easier study of the by-catch problem.

h). Regulation concerning a minimum size of fish for sale to discourage the catching of undersized fish and ensure the use of legal mesh size in the codend

i). Prohibition of single and pairs trawling by motorized vessels less than 20 GT and in water shallower than 18m to protect the juvenile fish and biodiversity in fishing grounds which also happen to be nursery grounds in some areas.

j). The installation of Turtle Excluder Device (TED) on shrimp trawl nets is a requirement from 19 September, 1996.

The issue of closed areas and/or season as well as limiting the fishing efforts are undergoing due consideration. Coastal lagoons serve as reserve areas for shrimps to grow and should be limited or restricted to towing of stow/filter net (which is highly selective for the shrimps/crayfish). This is essential, especially during the period when the sub-adult shrimps undertake a return journey back to the seas (as the lagoon becomes less saline after the rains in order to facilitate the recruitment at sea. Constraints to better participation of stakeholders

in the management of resources, mainly relate to the fear of profit, loss through a perceived reduction in catches when trawl nets fitted with JTEDs for better selectivity are used.

CONCLUSION

Juvenile and thrash fish excluder technologies/devices should complement the turtle excluder device which still remains mandatory for installation in shrimp trawl nets. The final selection of JTED should avoid as much as possible complex designs. The cost implication of constructing the device should be considered as well as using local materials without compromising the efficiency of the device. The technology should aim at reducing drastically of fish by-catch, maintaining the quantity and improving the quality of the shrimps, reducing the time and labor required for sorting and packaging the shrimps due to cleaner products among other advantages in order to be very attractive for adoption by the trawler fishermen. Collaboration and promotion of technical exchange and cooperation among the regional countries are also desirable towards successful implementation of the project.

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REFERENCES

Amadi, A. A. (1991): The coastal and marine environment of Nigeria – Aspects of ecology and management. NIOMR Tech. pap. No. 76, 34 p

Ambrose E. E (2005): Effects of fish eye codend on by-catch reduction in near shore, been trawl shrimp fisheries in Nigeria. Journal of Aquatic Science 20 (2): 97-105.

Ambrose, E. E., Solarin, B. B., Isebor, C. E. and Williams, A. B. (2005): Assessment of fish by-catch species from coastal artisanal shrimp beam trawl fisheries in Nigeria. Fisheries Research 71: 125 – 132.

Briggs R. P (1992): An assessment of nets with a square mesh panel as a whiting conservation tool in the Irish sea Nephrops fishery.Fisheries Research, 13: 133 – 152.

Broadhurst M. K., Kennelly, S. J. O' Doherty, G. (1996) : Effects of square mesh panels in codend and of haul back delay on by-catch reduction in the oceanic prawn–trawl fishery of New South Wales, Australia, Fishery. Bulletin, 94: 412 – 422.

Schneider, W. (1990). FAO species identification sheets for fishery purposes. Field guide to the commercial marine resources of Gulf of Guinea. FAO Rome. 268 pp.

Solarin, B. B., R. E. K, Udolisa, N. O. Omotoyo, S. Opurum, E. E. Ambrose and F. Aniebona (2005): Design characteristics and the specifications for the construction of turtle excluder device in shrimp trawl nets in Nigeria .African Journal of Applied Zoology and Environmental Biology vol. 7: 32 -37.