FISHERIES AND AQUACULTURE DEVELOPMENT IN NIGERIA: AN APPRAISAL

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ABSTRACT
Nigeria has a coastline of 853km and over 14 million hectares of inland waters and thus owns significant fisheries. The contribution of fisheries to the Nigerian economy is significant in terms of supply of high quality dietary protein, income generation, creation of employment and enhanced inflow of foreign exchange earnings through shrimp export. However, due over-exploitation of the natural resources, by-catch and discard problem, inadequate infrastructure and social amenities development, inadequate supply of fish feed, fish seeds and slow adoption of new technology and management strategies etc. The domestic fish production (0.55 million tons) has fallen short of the demand (1.5million metric tons). Aquaculture development is the solution to the unpredictable production through capture or artisanal/industrial fisheries.

INTRODUCTION
Nigeria is a vast country of about 140 million people covering about 923,768 sq. km of landmass. Nigeria is endowed with a coastline of 853km and over 14 million hectares of inland waters. The coastline stretches from the Western border with Republic of Benin to the Eastern border with Cameroon Republic. In 1978, Nigeria established an Exclusive Economic Zone (EEZ) which is an area beyond and adjacent to the territorial sea extending 200 nautical miles from the baseline. The surface area of the continental shelf is 46,300km^2 while the EEZ covers an area of 210, 900km^2 (World Resources, 1990), within which Nigeria exercises sovereign rights for the purpose of exploring, exploiting, conserving, and managing the natural resources. Nigeria is therefore blessed with an abundance of marine, brackish and inland water resources. Fish and fishing contribute immensely to the national economy by providing high animal food protein source, employment and poverty alleviation. The Nigerian fishing industry is practiced in two environments: capture and culture fisheries.

History of Fishing and fish farming in Nigeria
The history of fisheries development in Nigeria is a comparatively recent one, though reports have it that a fishing company operated from the coastal waters of Lagos long before 1915. Deliberate efforts at developing the country's resources can be said to date back to the second world war when, because of the naval blockage of the high seas, the colonial administration decided to develop the country's local resources including fisheries. A fisheries establishment was inaugurated in 1941 as a Fisheries Development Branch of the Department of Agriculture in the colonial office with headquarters at Apese village in Onikan, Lagos State. A senior Agricultural officer was appointed to conduct a survey of the industry. A preliminary survey of the canoe fisheries of Apese village and Kuramo waters around Victoria Island, Lagos was conducted. Small motor fishing crafts were acquired for exploratory fishing in the estuaries, lagoons and creeks. Between 1948 and 1956, major efforts were made at extending the artisanal fisheries programme to the coastal areas of Nigeria. Trawling surveys were undertaken in the vicinity of Lagos and Cameroons. An active extension service was established to demonstrate the benefits of improved fishing techniques and gear to the coastal canoe fishermen.

The bulk of the domestic fish production in Nigeria presently comes from the capture fisheries dominated by artisanal fishery sub-sector which produces over 80%. Musa et al (2005) reported that the sub-sector contribution of aquaculture to the domestic production is an average of 6% whereas the annual yield potential is put at 2.5 million metric tons. It is therefore imperative to step up fish production through aquaculture in order to achieve fish self-sufficiency for the country. Onuoha and Deekae (2006) see aquaculture as principally a way of supplementing unpredictable production through capture or commercial fisheries.

The first attempt at fish farming was in 1951 at a small experimental station in Onikan, Lagos, where different tilapias were cultured, though the results were not impressive. Modern pond culture started with a pilot fish farm (20ha) in Panyam, Plateau State for rearing the common/mirror carp, *Cyprinus carpio* following the disappointing results with Tilapia culture. Ever since, sufficient interest has been generated that made regional governments establish fish farms, such as Buguma in Rivers state, Abagana in Anambra state, Agodi Garden farm in Ibadan etc. Although, the major

species cultured include fin-fish (tilapias, catfish, and carp), catfishes of the family, Clariidae are the mostly farmed fish. Since the culture of *Clarias gariepinus* through hypophysation was initiated in Western Nigeria in 1973 (Elliot 1975), the procedure has been widely practiced throughout Nigeria thus leading to increase of farm-raised catfishes from the 80's to date. The favoured catfish species include: *C. gariepinus, Heterobranchus bidorsalis, Clarias x Heterobranchus* (hybrid *Heteroclarias*) and *Chrysichthys nigrodigitatus.* The Clariid fishes have been favoured in aquaculture because of its hardiness, ability to accept a wide variety of natural food organisms and cheap supplementary feed. It has efficient food conversion ability (FAO, 2000). It is very well appreciated in Nigeria (where it is often referred to as lung fish).

Shrimp Fisheries

The coastal shelf of the Niger Delta basin up to Qua Iboe and Cross River, rich in organic debris input due to its characteristic frequent rainfall, supports rich shrimp resources. Shrimps are also abundant at the mouths of Badagry, Lagos, Lekki lagoon systems and mouths of rivers on the Delta (Dublin-Green and Tobor, 1992). A total of 173 licensed vessels are trawling for shrimp in Nigeria and are owned by different companies, which are joint ventures. Annual shrimp production in Nigeria is estimated at 12,000 tones of which 8,000 tones are exported. Thousands of local fisher folks operating from several fishing villages and settlements dotting the banks of creeks and rivers engage in full-time, year-round shrimp fishing. The kinds of gear and harvesting techniques employed by these local shrimp fishers are quite diverse and expectedly, the bulk of shrimp, mostly juvenile migrants; caught by the artisanal sector is consumed internally, though some dried shrimp emanating from the artisanal sector are also exported to other African countries. The estuarine shrimp, *Nematopaleamon hastatus,* erroneously called "cray fish" in the local parlances, is a preferred condiment in most Nigeria dishes. Commercial shrimp farming is a new venture in Nigeria; lately pursued by mostly oil giants and their foreign collaborators. In an attempt to boost Nigeria's shrimp production and export, Shell Petroleum Development Company (SPDC) and the United States Agency for International Development (USAID) proposed in 2004 to embark on industrial shrimp aquaculture in the Niger Delta.

Fish Demand and Supply

Over the years, the demand for fish has always exceeded the supply. Going by the 2005 estimates, the annual national fish demand of 1.5 million metric tons so far outstrips the domestic supply of 0.55 million tons (Dada, 2003). The statistics for fish supply from 1985-2002, as reported by the Federal Department of Fisheries (FDF) revealed that the average domestic annual fish supply, including those from the distant waters has never met the demands. The deficit has always been met through importation. In 1990, fish imports accounted for 27.2% of the total fish supplied. By 2002, this has risen to 57.1%. It has been projected that the deficit would continue to increase. The seriousness of the shortfall in demand and supply for a commodity that used to be the cheapest source of animal protein available to the people is obvious and this calls for concerted effort to narrow the gap to forestall widespread malnutrition. With an extensive coastline of 853 km and over 14 million hectares inland waters, the country has the resource capacity to meet its own fish demands as well as export. The present contribution of the capture fisheries sector to the domestic fish production, based on the report of the Presidential committee on Fisheries and Aquaculture Development, 2005, can be substantially increased from the present level of 27,000 MT to a well over 200,000 MT, if the Nigerian EEZ fisheries potential is well exploited for the Tuna and deep sea demersal and pelagic resources (Raji, 2007). Similarly, the hitherto unexploited lantern fishery would also be explored to provide fishmeal for the feed industry. Musa et al (2005) reported that the sub-sector contribution of aquaculture to the domestic production is an average of 6% whereas the annual yield potential is put at 2.5 million metric tons. In order to meet demand, Nigeria is importing 700,000 metric tonnes of frozen fish annually (Fish Site, 2008a). This figure mirrors the current slump in production that the country is facing. In 2007, Nigeria spent N505bn on frozen fish imports though it has over 800 km of coastline.

Contribution of Fisheries to National Economy

The contribution of fisheries to the Nigerian economy is significant when viewed from the perspective of supply of high quality dietary protein and micronutrients, income generation, creation of employment and enhanced inflow of foreign exchange earnings through shrimp export. At the artisanal level, over 500,000 fishing families are involved in fish production while more than 100,000 "fish mammies" are involved in fish processing and marketing. Revenue of over N2 billion is realized

annually from issuance of industrial fishing licenses. Presently, shrimp export generates foreign exchange worth over $50 million annually with annual shrimp exports ranging from 1,500-2000 MT. Nigeria is the largest African aquaculture producer, at 15,489 tons a year followed by Egypt (5645 tons) and five other African countries (Zambia, Madagascar, Togo, Kenya and Sudan) each producing more than 1000 tons (Fish Site, 2008b). With annual domestic fish supply of about 400,000 tons, the fisheries sector accounts for about 2 per cent of national GDP of the country. Fish also contributes up to 40% of the animal protein intake and substantial proportion of employment, especially in rural areas. The sector is a principal source of livelihood for over 3million people in Nigeria. The sector's contribution, though minimal, is also evident on the export market.

Development Constraints

Like any other economic or human endeavour, there are a number of constraints that work against the enhanced fish production and the development of fisheries in the country. These include:

- *Inadequate Infrastructure and Social Amenities*

Inadequate infrastructure and social amenities in rural fishing communities, low prioritization of the sector by State and Local governments leading to unrealistic poor funding, poor and most often non-existent access roads and other means of communication between key production areas and marketing centres.

- *Poor record-keeping*

Poor record-keeping and lack of reliable exploratory statistical data makes projection of fish production and stock management cumbersome. Although various efforts have been made in the past four decades by the Nigerian Institute of Oceanography and Marine Research (NIOMR) and others to survey the marine resources and estimate the potential yields of inshore marine fish and shrimp resources, the data so far generated are inadequate for effective management. Paucity of data on fish stocks inevitably warrant the over dependency on precautionary approach as the only management option in Nigeria.

Unfortunately, shrimp trawlers and other trawl vessels operating in the country are foreign, owned by big fishing nations permitted by fisheries access agreements, through paying a lump sum in cash, with no properly defined obligations to respect the state of the fish stocks. Most often than not, trawlers operate beyond permissible limits (within non-trawling zone) and disregard other polices such as recommended mesh sizes of net.

The lack of transparency in catch data reporting, trans-shipment at sea and negligence on the part of the regulatory bodies with regard to data collection have made it near impossible to know precisely how much fish is taken from the natural stocks annually.

Conflicts

In addition to the above characteristics, shrimps, naturally, migrate from coastal/oceanic waters to estuaries and vice-versa. For these reasons, some trawl captains, desirous to make good catches, oftentimes trawl in the 5 nautical miles non-trawling zone. This unscrupulous fishing activity results in avoidable conflicts between local fisher folks and their industrial counterparts.

Bycatch and discard problem

In trawl fisheries, by-catch may be defined as anything the fisherman does not intend to catch and may include the turtles, fish, crabs, sharks, weed and seabed debris (Eayrs, 2005). Sometimes this is called incidental or accidental catch. Discards are that part of the by-catch that are released or returned to the sea either dead or alive. FAO has recently estimated that nearly 7 million tons of fish by-catch is discarded globally by commercial fishermen every year. This is equivalent to about 8% of the global catch from marine capture fisheries. For shrimp trawling, the Sea Fisheries Decree No. 71 of 1992 recommends that the ratio of fish to shrimps should be maintained at 75:25. In practice this is never maintained and more fish, relative to shrimp is caught.

Over exploitation

Lack of substantial data as earlier stated implies poor management and the trend of shrimp and fish catches is on the decline due to over harvesting among other factors. According to Millennium Ecosystem Assessment (2006), capture fisheries worldwide is undergoing stock depletion. The pink shrimp (*Peneaus notialis*) has been the dominant target and supportive species in Nigeria and prior to the end of the 20th century, *P. notialis* fishery was quite lucrative, resulting in bumper harvest by trawlers. The collapse in *P. notialis* fishery resulted in withdrawal of some trawlers from Nigeria around year 2000. Then, industrial shrimping was no longer profitable as before. Then there was a

sudden emergence of *P. monodon*, an alien species which revived and prevented industrial shrimp operations from total collapse in Nigeria. Today, *P. monodon* with its comparative largeness, in terms of size and biomass, is adjudged a blessing, but, the negative implications, if there may be, of this "salvaging" exotic species as to the well being of indigenous shrimps, general biodiversity and ecosystem equilibrium are yet to be ascertained. There is need for set up a regional, collaborative, observatory effort on the use of some threatened stocks, like the shark, in the West African region. The shark, compared with other fish species, has a very long reproductive cycle and a low fertility rate. Overfishing has seriously reduced their numbers in the region (CTA, 2008). There is need to improve the management of such stocks and maintain a balance in the local marine ecosystems.

- *Slow Adoption of New Technology and Management Strategies*

Ineffective and obsolete fisheries legislation, which fails to take modern management practices into consideration, are still in use by various government arms of Nigeria. (Raji, 2007) reported that Kebbi and Niger States are the only two States in the country that have amended their fisheries edicts to accommodate community-based fisheries management.

Nigeria can achieve the desired breakthrough in fish production both for domestic consumption and export if fish farmers can embrace modern techniques in fish cultivation. The catfish business has presently gotten to a revolutionary stage with over 55 innovations that have taken place. For instance, knowledge has moved from the technology that preached that catfish would grow to 200 g in 9 months if stocked at 2 fish/m^2. Today, catfish is stocked, even at 300 fish/m^2 under high intensive culture can be grown to 1.5kg on the average in 6 months. That is why so many people are now showing interest in catfish.

- *Inadequate availability of fish Seeds and Feed*

As it has been generally concluded that aquaculture development is the solution to fish-food crisis in the country, inadequate supply of quality seed for the culturable fish species has since remain a major problem. The need for readily available cheap, quality fish feeds is also a hindrance to the advancement of fish farming in Nigeria. Many research works are on-going on the use of locally available plant feedstuffs to replace or substitute fishmeal in fish feeds. The results such research are awaiting adoption and translation into economic feed production at commercial quantities.

Aquaculture in Nigeria

Artisanal fishermen and fishing communities in Nigeria had for generations practised traditional methods of fish culture in tidal pools and floodplains (Dada 1975, Sagua 1976). These were extensive polyculture systems, which do not fall strictly under the modern definition of fish culture, that is, "production under controlled conditions", and presently do not play any significant role in the national economy. Modern fish culture or fish farming in Nigeria is of recent practice and is a more reliable source of increasing fish protein production for its teaming population. The first attempt at fish farming was in 1951 at a small experimental station in Onikan (Lagos State) and various ***Tilapia*** species were used (Longhurst 1961). Modern pond culture started with a pilot fish farm (20 ha) in Panyam (Plateau State) for rearing the common/mirror carp, ***Cyprinus carpio*** (Olaniyan 1961, Ajayi 1971), following the disappointing results with tilapias. Although the first years of Panyam fish farm's existence were hardly satisfactory, the trials nevertheless generated sufficient interest that regional governments established more fish farms.

Small-scale farms comprise a large proportion of aquaculture ventures ranging from homestead concrete ponds (25-40 m^2) operated by individual farmer or family to small earthen ponds (0.02-0.2 ha) operated as part-time or off-season occupation by communities, institutions, associations or cooperative societies (Anyanwu *et al.* 1989). The available water surface suitable for aquaculture was estimated as 483,406 ha (Ita *et al.* 1985). Both indigenous and introduced species are cultivated in ponds, reservoirs and cages. Tilapias, clariid catfishes and the common/mirror carp are the most widely cultured fish in Nigeria (Satia 1990; Vanden Bossche & Bernacsek 1990) and are suited to low-technology farming systems in many other developing countries. This is because of their fast growth rate, efficient use of natural aquatic foods, propensity to consume a variety of supplementary feeds, omnivorous food habits, resistance to disease and handling, ease of reproduction in captivity, and tolerance to wide ranges of environmental conditions (Fagbenro 1987a).

Nigeria's aquaculture industry produced over 30,000 tonnes of various freshwater and brackishwater fish species in 2000 and is based mainly on herbivorous/omnivorous tilapias and omnivorous/ carnivorous catfishes, cultivated under intensive (commercial) and semi-intensive (artisanal) production systems. Both systems involve input of supplementary and complete feeds, which account for up to 40% and 60% of production costs, respectively (Fagbenro,1987; Satia,1990).

Two sources of fish feeds are identified namely, farm-made aquafeeds and commercial pelleted feeds. There are a few commercial sources of pelleted fish feeds as only specialized animal feedmillers engage in fish feed production on demand; as such, the majority of fish feeds produced (69.75%) are farm-made. Even then, two main types of feeds are produced by both sectors namely herbivorous fish (tilapia) feeds, which contain 30-35% crude protein, and carnivorous fish (catfish) feeds, which contain 45-50% crude protein. In 2000, the Nigerian aquaculture industry consumed an estimated 35,570 tonnes of feed representing a negligible proportion (< 1%) of the national feed production. The gross ingredient composition used in fish feeds follows the least cost formulation.

CONCLUSION

The Nigerian fishery is a growing one with great potentials waiting to be tapped for sustainable development. The fisheries act(s) need review to accommodate current management realities. The Government should endeavour to sponsor exploratory research to generate necessary data requisite for viable fisheries management. Catch data collection on both artisanal and industrial sectors should be intensified. Moreso, ensuring strict compliance of fisheries laws and regulations is imperative as well as policy support for fish farming which is the stronghold of future fishery development in Nigeria.

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