

A REVIEW OF BONGA FISHERIES OF THE CROSS RIVER STATE NIGERIA

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ABSTRACT

The Nigerian pelagic fishery contributes about two-thirds of the total marine fishery resources of the country. The main components of this fishery are the Clupeid (*Ethmalosa*, and *Sardinella* spp) and the Scombroid (jacks, barracuda, and tuna) fisheries. In 1979 to 1983, fish production from the national inshore and brackish water zones was 1,702,685 tonnes. Bonga (*Ethmalosa fimbriata*) which dominates the pelagic fishery in the Cross River State of Nigeria, contributed about 158,612 tonnes (i.e. 9.3%) of this national marine fish catch.

Although bonga is caught along the entire Nigerian coast, a significant fishery exists mostly in the wider estuary of the Cross River State, which borders on the Cameroon Republic. In the Cross River State, and within the period, Bonga contributed 24% to the marine fish landings. The highest volume of Bonga in the State tends to be localised in Ibeno/Eket.

Bonga is supported by a single species (*Ethmalosa fimbriata*). It is a phytoplankton feeder, occurring in estuaries, lagoons, and shallow seas at the rather high temperatures of 25°C where dense diatom blooms appear. The peak season is in the dry season (November to March) within the estuaries of the Niger Delta to the Cameroon Republic. The species forms an important fishery all the year-round in the open sea off these estuaries, whenever the canoes venture to sea, but these open sea fisheries are affected by weather conditions.

The best, and most suitable gear for Bonga are the gill nets, cast nets, boat seines, and shore seines. Dried and smoked Bonga are a common market commodity in the southern parts of the country generally, but particularly in the Cross River State where it is a readily available and acceptable food item.

INTRODUCTION

The Bonga fishery consists exclusively of one species, namely *Ethmalosa fimbriata* (Bowdich), *Ethmalosa dorsalis* (Cuvier and Valenciennes); and in Nigeria the fishery is more or less localised along the coast, and numerous estuaries of the Niger Delta Region. It is extensively fished in the wider estuary of the Cross River, which borders with the Cameroon Republic. In the western States of Nigeria, there are important fisheries for Bonga during the dry season (December to March) within the estuaries of the principal rivers of the delta (Benue, Escravos, Forcados, Ramos, Dodo and Pennington). The species also forms the main fishery all year round in the open sea off this section of the delta coastline, but these open sea fisheries are very much affected by weather conditions (Oslen and Lafevre, 1969). Presently in the Cross River State, Bonga forms very important fishery along the estuarine fishing villages notably Ibeno/Eket, Oron, Effiat/Mbo, Ikot Abasi, and Ifiayong/Uyo. The fishing season normally extends from November to May with a peak period of three months from January to March.

With the role of both the national, and State Governments in subsidizing fishery development in the Cross River State particularly in the mechanization of fishing crafts, the fishing activity of the Cross River State fishermen along the coast has considerably increased in recent years. As a result, the area of exploitation of the fishery has increased tremendously and the landings of Bonga in the Cross River State have gone up from 8% of the annual fish landings from the national inshore and brackish water in 1979 to 11% in 1980, and almost stabilized at 9% in 1982 and 1983. More than 9% of the total Bonga fish landings of Nigeria came from the Cross River State.

Within the State, Bonga contributed 24% of the marine fish landings. It is true to say that the success or failure of this fishery determines to a large extent the well-being of some fishing communities in the Cross River. There has always been great demand for dried and smoked Bonga fish from the Cross River State by neighbouring Nigerian States.

DISTRIBUTION

In distribution, Bonga is seen along the West African coastline extending from Villa Cisneros, Rio de Oro to Lobito, Angola (Bainbridge, 1963). This range of distribution (24°N to 12°S) corresponds roughly to the extreme northerly, and southerly limits of the 25°C isotherms throughout the year as shown by various surface temperature charts (Longhurst, 1962); suggesting that temperature is possibly the basic limiting factor to the longitudinal distribution range of the species (Bainbridge, 1963). According to Zei (1969), *Ethmalosa* has two main areas of concentration, i.e.

- From the River Senegal to Sierra-Leone;
- Along the Coasts of Nigeria, Cameroun, and east-wards to the mouth of the Congo.

These areas (including the more isolated Abidjan Region) are characterized by extensive estuarine regions enriched by river effluents. Although a significant fishery for Bonga exists in the Niger Delta, and the wider estuary of the Cross River, which borders with the Cameroun Republic, a small fishery occurs in the lagoon system open to the sea at Lagos (Bainbridge, 1963)

CATCH TRENDS

The national fish landings from the inshore and brackish water during the period 1979 to 1983 ranged from 356,888 to 370,040 tonnes with a total of 1,702,685 tonnes. The Cross River State Bonga contributed to 158,612 tonnes or 9.30% of this national marine fish landings.

In the Cross River State, the marine fish landings for the five year period ranged from 110,603 tonnes to 157,376 tonnes with a total of 659,892 tonnes. The catch for Bonga fish ranged from 27,367 to 34,871 tonnes and with a total of 158,612 tonnes thus, contributing 24% to the Marine fish landings there.

Bonga is generally classified among the most easily available and acceptable table fish in the Southern States of Nigeria; and it constitutes one of the important commercial fishes in the Cross River State. The quantity of Bonga fish landed within the five year period was valued at ₦213 million.

At the national level, Bonga from the Cross River State contributed 8% in 1979; 11% in 1980; 10% in 1981; and 9% in 1982 and 1983 to the marine fish production in the country. In the Cross River State, 25% of the marine fish landed in 1979 was Bonga which was estimated at ₦26.8 million and in 1981; Bonga also contributed 26% to the marine fish production in that State, and was valued at ₦38.7 million (Table 3). At this point, it seems true to say, that the Cross River State is the main producer of Bonga fish to the rest of the country.

Ibeto/Eket in the Cross River State is the centre of greatest concentration of Bonga fishery activities. Oron fishermen staying along Utan Brama, Mbe Ngoro, and Abana Ntuen near the Cameroun/Nigerian border also specialise, and land bonga the whole year-round. The Bonga fishermen in Nwaniba/Uyo migrate and join the Oron fishermen to fish along the Cameroun/Nigerian border. Oyorokoto near Ikot Abasi is a large fishing settlement for bonga fishermen. The Ibeto/Eket and Ikot Abasi bonga fishermen bring in their catches mostly from the estuaries of the Niger Delta, while the Oron, Nwaniba&Uyo bonga fishermen bring in their catches from the wide estuaries of the Cameroun/Nigerian border where Bonga fishing is intensively carried out throughout the year.

Large scale shoals of *Ethmalosa* is common along these areas, and the fishing by the fishermen is normally restricted to these estuarine coastal belt of about 10 to 16km from the shoreline, due on the one hand to the limitations of their dugout canoes, other types of fishing crafts and on the other during the tides of good harvest when bonga is seen nearer to the estuarine shore. The shoals are usually caught at a depth of about 15 metres.

SIZE COMPOSITION OF THE CATCH

The minimum size at maturity, and the various length distribution usually represented in the catches landed by the fishermen in Nigeria have been recorded by Fagade and Olaniyani (1972) to exhibit three modes of 40, 120, and 270mm. Solzen (1958) working on the size composition of this species in the Sierra Leone river estuary, had observed a modal length distribution pattern of 120, 150, and 280mm, and again 330 and 360mm. The mean length of the

species had been measured to be 23.62–34.61cm for the males and 23.90–24.84cm for the females in the Niger Delta according to Oslen and Leføvere (1969) as quoted by Fagade and Olaniyan (1972). In March to May, specimens with total length of 70mm are most frequent in the catch while larger ones ranging from 70mm – 170mm are obtained throughout the entire year. But in the peak season for Bonga fishing in November to May, larger sizes ranging from 170–310mm are caught (Fagade and Olaniyan, 1972). In the Cross River State, especially in Ibeno/Eket, the common size ranges usually landed by the fishermen fall between 150 to 310mm during the peak season.

SPAWNING GROUNDS AND SEASONS

The bonga (*Ethmalosa fimbriata*) spawns in the sea at the beginning of the dry season. The planktonic eggs hatch and in the high temperatures of the tropics metamorphose quickly, and immature stages move up the estuary into the brackish water creeks where they grow to 11–17mm (TL) before they migrate back to the sea (Bainbridge, 1961; Salzen, 1958; Longhurst, 1961) as quote by Moses (1980). After collecting the eggs of *Ethmalosa fimbriata* from the Lagos Lagoon between January and May with higher figures in February and March, Fagade and Olaniyan (1972) inferred that the species spawned between January and May with peak spawning in February and March. Watt (1957) studied the seasonal variations in the chemical composition of bonga, and found that the average fat content increased from less than 10% of the dry weight in January to more than 20% during June and July after which it declined to below 10% by September. Salzen (1958) has shown that fluctuations of the condition factor follow a similar pattern. According to Bainbridge (1961), there appeared to be no appreciable spawning of the species within the estuary, and concluded that the aggregation of *Ethmalosa* within the estuary during the dry season is a feeding aggregation associated with the high standing crop of diatoms. Bainbridge (1963) further observed that since neither the eggs or larvae of *Ethmalosa* are present in the plankton of the estuary, spawning therefore, takes place at sea.

Table 1 – National Fish landings/Cross River State Bonga fish catch data in tonnes 1979–1983

<i>Year</i>	<i>National Inshore and Brackish water fish Landings (A)</i>	<i>Cross River State Bonga Fish Landings (B)</i>	<i>(B) as a Percentage of (A)</i>
1979	356,888	27,367	8.0
1980	274,158	29,895	11.0
1981	323,916	32,481	10.0
1982	377,683	33,998	9.0
1983	370,040	34,871	9.0
Total	1,702,685	158,612	9.3

Source: (A) – *Fisheries Statistics of Nigeria, 1983.*
(B) – *Marine Fish Production by Species in the Cross River State 1978–1984.*

(B)

Table 2 – Marine Fish/Bonga fish Landings in the Cross River State 1978–1983

<i>Year</i>	<i>Marine Fish (A)</i>	<i>Bonga Fish (B)</i>	<i>as a % of (A)</i>	<i>Value in Naira (₦)</i>
1979	110,603	27,367	25.0	26,819,600.00
1980	122,544	29,895	24.4	34,482,500.00
1981	123,221	32,481	26.4	38,721,550.00
1982	146,148	33,998	23.3	47,996,000.00
1983	157,376	34,871	22.2	65,177,870.00
Total	659,892	158,612	24.0	213,197,580.00

Source: As in Table 1.

Table 3 – Percentage Contribution of Cross River State Bonga Fish to the National/Cross River State Marine fish landings

Year	National	Cross River State
1979	8.0	25.0
1980	11.0	24.4
1981	10.0	26.4
1982	9.0	23.3
1983	9.4	22.2
Total	9.3	24.0

Source: Compiled from Tables 1 and 2.

FECUNDITY

Fagade and Olaniyan (1972) had estimated the number of eggs in the mature ovary of *Ethmalosa* by gravimetric method and found that the number of eggs in the ovary ranges between 2.38×10^4 for a 175 mm fish to 1.87×10^5 for a 305mm specimen. Bonga with total length above 25.5cm according to them, exhibited wide variation in their fecundity, while the less variable fecundity of 17.5 to 25.5cm size class, being first spawners showed little variation in total number of eggs in the ovary.

FOOD AND FEEDING HABIT

Quite intensive studies have been made on the food, and feeding habits of Bonga (*Ethmalosa fimbriata*) by Bainbridge (1963) and other authors. It has been established that Bonga is a planktonic feeder feeding to a much greater extent on phytoplankton viz., Dinoflagellata *Dinophysis* spp), diatoms including the main *Pleurosigma* spp, *Nitzhia* spp, *Paralia sulcata*, *Cymatodiscus* and *Cymatotheca* spp, *Coscinodiscus radiata*, *C. lineatus* etc., and to a lesser extent on zooplankton including lamellibranch larvae, copepod, nauplii and a few other zooplankton as recorded by (Bainbridge *loc. cit.*). Bonga occurs in highest concentration in estuaries and lagoon, as well as in the shallow sea at the rather high temperatures of over 25°C, where any when dense phytoplankton diatomblooms appear. These are most frequent during the dry season, engendering the main estuarine canoe fishery (Oslen and Lafeverre, 1969).

The ability of *Ethmalosa* to feed on phytoplankton is associated with the extremely fine filtering mechanism of the gill rakers. Thiemann (1934), as quoted by Bainbridge (1963) made brief exploratory surveys of the estuaries of some West African Rivers – the Bonny River in Nigeria, the Bimbia and Cameroun Rivers both in the Cameroun Republic. The survey further emphasized the huge number of phytoplankton with large species of *Coscinodaceae* predominant as food for Bonga. According to Wilson (1979), *Ethmalosa* inhabits estuarine lagoons and the inshore waters feeding on zoo-and phytoplankton. The fish is highly adapted to its mode of feeding.

From January to July, there is a high standing crop of phytoplankton in the estuaries which coincides with the main fishing season for *Ethmalosa*. From August to October, with sparse phytoplankton within the estuaries few Bonga are caught, and their stomachs contain very little food material. It seems possible, therefore, that the association of *Ethmalosa* fisheries with estuaries, and lagoons open to the sea may be related to the availability of food (Bainbridge, 1963).

AGE AND GROWTH

The size distribution of Bonga fish caught with gill-nets varies little within the season and total size range is rather small. No success was achieved in aging the fish. Scales show some sort of growth zones, but they are too numerous to represent annuli (FAO, 1969). There is a size variation in age one ranging from 14cm to 15cm (FL) and in age two from 21cm to 24cm (FL). Spawning fish arrive in the lagoon, and estuarine spawning grounds as from Novem-

ber onwards. The first group of spawners include first year and second year old fish 14cm to 15cm (FL), and 21cm to 14cm (FL) respectively. Most late spawners of February to May are first year old Bongas. The period of November to May represents maturation in the advanced stage and spawning (Wilson, 1979).

The adult Bonga fish according to Bainbridge (1963), has a length range of 26cm to 30cm (FL). Landings of Bonga fish reach a maximum about the middle of the dry season, and fall off to negligible quantities at the height of the wet season. About 28cm represents the modal length of adult bonga fish taken by cast nets, and which did not change during the year.

As the scales and operculum of bonga do not reveal any growth ring, then the determination of the age of bonga by the use of these two conventional materials could not be feasible. Fagade and Olaniyan (1972) applied length distribution method in determining the age of this fish. Bonga having total length below 170mm belong to the one year old class and the ones ranging in length from 170 to 310mm belong to the two year old class. If spawning is restricted to a definite age groups, this then means that Bonga exhibits a growth of 170mm in the first year, and a growth of 140mm in the second year. The male Bonga attains sexual maturity at a total length of 120mm, while the females have mature gonads at a total length of 170mm. It could be inferred that the normal life span of Bonga is 2½ years, as they attain sexual maturity and almost full adult size at the age of one year, within which time they can only spawn once in their life time.

SHOALING BEHAVIOUR

Bonga are always found in huge shoals in the estuaries, and inshore waters. There are different kinds of shoals each having its own characteristics features. Bainbridge (1963) observed the shoal of bonga in the estuary remaining for about 40 minutes moving slowly and apparently rising and falling in depth. Among the shoals, pattering, leaping, rippling and flipping types are recognised based on the physical movement of the fish. The shoaling behaviour of Bonga as narrated by the Bonga fishermen in Ibeno/Eket, tends to tally with what has already been described by Balan (1962) and Nair (1972) for *Sardinella longiceps*, an Indian oil sardine. It has been reported that the surface shoals of bonga are observed to be luminiscent during the nights of the dark phase of the moon. They are easily caught when the luminiscence is moderate while bright luminiscence is unfavourable for bonga fishing since the light enables the fish to see and avoid the nets. The shoals of bonga occasionally descend to the deeper level of the estuaries, or even the sea, but their occurrence in depths could be known for the nature of bubbles, which ascend to the surface or from the characteristic odour. The local fishermen always search for this sign while trying to locate a bottom shoal, and according to them these bubbles are released by Bonga from the bottom, while feeding within the region. At times, a very strong fishy odour emanates from the fishing grounds indicating the presence of bonga concentration at the bottom, and within which time, the fishermen usually make very heavy catches from such shoals. This fishy odour is probably caused by the discharge of mucous form large concentration of Bonga.

The occurrence of Bonga shoals near the shore at the beginning of the fishing season is clearly linked with the salinity of the water. When brakish water of low salinity prevailed, no bonga shoals were caught, but as soon as the estuarine water was replaced by clear, salt seawater good catches were obtained (FAO, 1969).

MIGRATION

Regarding the migrational pattern of Bonga, not much is understood. Longhurst (1960) had conducted some tagging experiments which strongly indicates that there is a considerable exchange of individuals of shoals between the inshore/estuary/offshore, and vice-versa, which appear to suggest more of a local migration. Bonga exhibits a complex behaviour in relation to hydrographic conditions because the breeding does not occur in the estuarine area, and the adults exercise a frequent inshore-offshore movement (Longhurst, 1961, Bainbridge, 1961; 1963).

FISHING SEASON

Bonga fishery in the Cross River State usually commences in November and terminates in May, with the January to March portion representing the peak period of the fishery. After May, no appreciable quantity of bonga may be caught in the estuaries, and none at all in August to October.

Longhurst and Bainbridge (1963) observed that it is only in the dry season and that of certain parts of the open coast and in particular the open sea off the Niger Delta, the fish are caught all-year-round whenever the canoes venture to sea.

FISHING CRAFT AND GEAR

The fishing for Bonga is carried out mainly with the traditional fishing craft, and gear. The traditional dug-out canoes employed for Bonga fishery along the coast of Nigeria are of two main sizes. The bigger size ranges from about 9 metres to 12 metres long, 0.9m wide and about 0.8m deep with a two-tonne capacity. In both types, the fishermen use big paddles for propulsion as well as for control of the canoes when in operation. Some of these dug-out canoes have been fitted with outboard motors ranging from 18–40 Horse Power (HP). Most of these outboard motors are supplied at highly subsidized prices by both the State and the Federal Governments to the fishermen in order to increase fish production for public consumption.

The best and most suitable gear for Bonga are the gill-nets, cast nets, set nets and drift nets. Currently, some Bonga fishermen in the State are also employing boat seines, and shore seine nets in catching Bonga especially in Ibeno/Eket. These seine nets are basically a wall-net of enormous length. Plastic floats, stone sinkers, and wooden floats are attached to the head and foot ropes respectively to keep the nets in position. One end of the net is tightly secured to the shore, while the canoe either mechanised, or non-mechanised takes the other arm into the sea in a semi-circle, forming a large loop and assisted by a large group of fishermen to draw the net back to the shore. Large shoals of Bonga mixed with other fishes are trapped.

Gill nets, sets, and drift nets are all wall-like nets of various sizes and meshes. The traditional ones, until recently with the introduction of the imported synthetic types, were made of cotton twines provided with lead sinkers, and floats to keep them vertical. The operation of the nets consist in spreading the nets in the fishing ground with one of the ends either secured to the dug-out canoe or just allowed to drift with heavy plastic floats without the canoe. The nets drift in the direction of the current, and tide. Shoals of Bonga while moving about are gilled or entangled in the nets. After some few hours, the fishermen haul up the nets, and collect the fish.

Cast nets are conicaly shaped nets with large mouth tapering to a tiny end which is tied. At the mouths, are strong ropes with lead sinkers. Pouches are formed along the whole length of the mouths. The tiny ends of the nets are provided with hard ropes which fishermen use in hauling the nets after throwing them (Saphe, Nigeria, Consortium, 1980). The method of operating cast net consists in throwing the net fully spread over a shoal of Bonga which are trapped as the circumstance of the net closes as result of the lead weights attached to the net. Cast netting is mostly operated along the creeks and in the estuaries.

PROCESSING OF THE CATCH

In the Cross River State, and in Nigeria as a whole, dried and smoked Bonga is the most widely accepted food item in the market. The artisanal Bonga fishermen are still using the traditional method of smoking their catches, even though in some places, for instance in Esuk Enwang (Effiat/Mbo Local Government Area) and Queenstown near Ikot Abasi Local Government Area, the State Government had built model smoking kilns at these production centres for the smoking of Bonga. The fishermen have not found the need to make use of these smoking kilns. These smoking kilns, are at present therefore, existing as monuments in these fishing settlements. Presently, it has not been possible to evaluate the acceptance of Bonga in the fresh and frozen form by the upland consumers due mostly on the one hand to the non-availability of roads linking up the production centres and the upland markets. What really happens under the situation is that since bonga has not undergone any or massive icing or freezing in the fresh condition, no one is yet familiar with what problems could be associated with the handling of bonga in the frozen conditions in Nigeria.

It may be suggested in this paper that block ice could be conveyed to the landing centres for preservation of bonga in the fresh condition for the upland market. In the Cross River State of Nigeria and during the peak season for Bonga, huge quantities are landed and because of lack of facility for icing and freezing, spoilage sets in, and the fishermen are left with no alternative than to empty their canoe loads of the catches back to sea. Such spillage forms about 30% daily wastage on the fishermen's Bonga landings during the season.

Ethmalosa fimbriata being a clupeoid fish as *Sardinella longiceps* - and Indian oil sardine of high economic importance, though not of the same species as bonga, has been studied in detail in terms of handling it in the fresh and frozen condition. In India, under a similar condition when *Sardinella longiceps* are caught in such unmanageable quantities during the peak season, the fish is rather utilized as manure for lack of facility for preservation by freezing or some other economic way of processing. In trying to reduce this economic waste on this commercial Indian sardine, a research had to be conducted by the Central Institute of Fisheries Technology, Cochin, India, and was discovered that one of the major difficulty encountered in preserving *Sardinella longiceps* in ice, or even in the frozen state was the phenomenon of belly bursting. The belly walls of this sardine normally broke up exposing the visceral portion thus reducing the consumer acceptability of the fish. A successful method of icing and freezing that sardine had since been worked out and implemented - thus, reducing the economic wastage (Anon, C.I.F.T.).

Currently, ice is being manufactured in Uta Ewa - Ikot Abasi, and the modern fishing terminal with facilities for ice production in Ebughu-Oron had been completed, and commissioned. Ice is no more a scarce commodity in this State. It is my opinion, that before ice, not to mention freezing, could be introduced to the Bonga fishermen for preservation of the fish at the landing centres, a detailed investigation should be carried out to indicate what problems could be encountered with the fish in ice, and the economic aspects of such a venture on the part of the fishermen, the government and the consumer.

DISCUSSION

Data in respect of Bonga Fishery based on annual fish landings from the national inshore and brackish water with particular reference to the Cross River of Nigeria have been presented. It is clear that Bonga from the Cross River State forms 9% of the National Marine Fish landings; and within the State as a major pelagic fish of high economic importance, Bonga forms 24% of the marine fish landings.

The effort of both the State and Federal Government canoe mechanization and fishing inputs subsidy schemes have made tremendous impact in enhancing Bonga production in the State. Government efforts should not be relaxed in this direction.

The problem seriously posed in this fishery is that of preservation of the catch in the fresh condition. It becomes a matter of mere common sense that in order to get Bonga to the upland market, and to preserve the catch, efforts have to be made to increase the shelf life. The only practical answer on the part of the fishermen is to smoke the catch, in the absence of any other method. The fishermen are already used to their traditional method of smoking bonga, but smoking kilns could facilitate larger quantities of bonga to be smoked at a stretch. It calls for more smoking kilns to be built at the landing centres, and intensive extension work to demonstrate the usefulness of the smoking-kilns to the fishermen. Good communication road system - where feasible, should be constructed to link the fishing bases with the hinterland.

About the most ideal thing to do, would be to provide ice, freezers cold room facilities, freezing and chilling at such populous Bonga fishermen centres as Utan Brama with more than 6,000 fishermen, and in Ibeno with about same number of fishermen, but the provision of such infrastructure should be handled with care until it could be ascertained that the fishermen would only buy the idea in terms of profit and loss of the venture.

Since Bonga is a fish of great economic importance in the Cross River State, the Nigerian Institute for Oceanography and Marine Research should incorporate a proper research into the Bonga fishery of this State in terms of preservation of the catch; spawning survey for bonga; identity of stock/stocks of bongas; and environmental studies that affect bonga fishery in whatever way in the Cross River State of Nigeria.

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