A REVIEW OF THE COMMERCIALLY EXPLOITED MARINE FISHERY RESOURCES OF NIGERIA.

by

Nsentip Ukpong Nsentip, Esq.
Ministry of Natural Resources
Fisheries Division
Calabar.

ABSTRACT

The annual estimated total marine fish catch in Nigeria for the period 1971 to 1979 is 0.3299 million metric tons. In the Six Nigerian maritime states, annual average catches for the past four years of 1976 to 1979, the Rivers ranked first with (46.60%); followed by the Cross River State with (24.64%); Bendel (15.94%); Lagos (8.49%); Ondo (4.27%) and Ogun (0.064%).

The differential distribution pattern of the predominant fish groups for the maritime states, the component species, their life habits in relation to hydrographic factors leading to seasonal fluctuations in the fisheries have been highlighted. Attention has also been focussed on the types of fishing crafts and gear in common use along the coastal states and the fish species obtained from them.

The landings by the exploratory and commercial fishing trawlers including the distant water vessels (imports) form about 4.24% of the total marine fish landing. Some notes have been made on the types of gear used by these vessels and the productive areas of operation along the entire Nigerian coast, including some information on the species abundance in each region, and their depth wise distribution obtained by the landings from these trawlers.

The occurrence and distribution of marine plankton in relation to the hydrographic and oceanographic factors along the Nigerian coast have also been discussed to enable perfect understanding of fish abundance and fluctuation in Nigeria.

INTRODUCTION

The area considered in this paper falls entirely within the tropical zone of the Eastern Central Atlantic Ocean, around the Coast of West Africa, and lies between longitude (25°N - 10°E); and latitude (5°S -15°W). Out of a total fish landings of 10.6 million metric tons for the period 1973 to 1979 (FAO, 1980) from fifteen countries including Senegal to the Congo, within this region, Nigeria contributed 32.7%. The fisheries of this zone are supported by a large assemblage of pelagic, bathypelagic and demersal species which are caught by various types of fishing gear. The fishing industry in Nigeria is passing through an initial phase of changing over from the traditional to the modern methods of exploitation. The use of indigenous dug out canoes, sail crafts, and less effective gear is fast giving way to fishing with the help of mechanised canoes and the larger powered crafts employing the more effective types of fishing gear, and other ancillary equipments such as echo sounders, radars etc. Just after the Nigerian civil war, most state governments placed emphasis on revenue from fisheries but over the ensuing years the policy of the various state governments with regards to fisheries changed over to offering financial aid in the form of subsidies to promote expansion of the fishing industry, and other independent allied industries. The Federal and the maritime state governments of Nigeria have realised the need to incur expenditure on exploratory fishing, training of fisheries and technical personnels, as well as on fisheries research. Coupled with the functions, and work of the Nigerian Institute of Oceanography and Marine Research (NIOMR) and the Fisheries Division of the various State Ministries of Agriculture and Natural Resources

much information on the potenital fishery resources of both the inshore, and offshore fishing grounds have been gathered, including some of the life histories and Biological behaviour of the commercially important fish and prawn resources of this country. The number of artisanal mechanised fishing canoes increased from 4,204 in 1971 to 12,510 in 1979; the inshore trawlers increased from 39 in 1971 to 92 in 1979, with a corresponding increase in the marine fish landings from 258,463 metric tons in 1971 to 484,734 metric tons in 1979 (Fisheries Statistics of Nigeria, 1980). These increases have at least marginally narrowed the gap between fish demand and supply. Compared with the earlier years, up to 1970, there exists now some satisfactory manner of handling the fish landings due to the increasing infrastructural facilities such as, smoking kilns, cold storages, ice and marketing of the fish.

The Nigerian fisheries has played a very significant role in the national economy of this country. Calculating at the modest price of one naira per kilogram of fish landed, the marine fish catch for 1979 could be valued at well over ₦485 million. Presently there are more than four hundred and fifty thousand fishermen who are actively engaged in fishing. There are still many more people, though not actively engaged in the actual fishing who are participating in the fish trade, fish curing, and establishing of ancillary fishery enterprises. These people therefore, depend on fisheries business for their livelihood. Fish is a popular food item for more than 80% of Nigeria's population. Some private businessmen have invested money in trawling for fish and shrimps in this country. This itself has equally created job opportunities for people of all categories including school leavers and graduates. We still have far richer unexploited fishery resources around the coast of Nigeria. Our efforts should, therefore, be concentrated on very intensive applied fisheries research, more exploration of the ocean depths to aid place this country in the world fisheries map.

Fish Landings in NIgeria

Nigeria's total fish catch is currently 0.80 million metric tons. Within the past nine years of 1971 to 1979, the total annual fish landings has ranged from 0.47 million metric tons to 0.80 million metric tons, with an average of 0.12 million metric tons. The world fish production in 1979 was 71.3 million metric tons, and Nigeria contributed a total fish catch of 0.54 million metric tons for that year. The total fish production for (1973-79) of all the fifteen countries (Table 1) considered in this paper on the West Coast of Africa was 10,582,315 metric tons, of which NIgeria contributed 3,459,219 metric tons of the catch forming 32.69%, and coming first as a fish producing country within the zone. Nigeria is followed by Senegal with (22.79%); Ghana (16.04%); Zaire (8.01%); Benin (1.74%); Congo (1.16%); Gambia (1.06%); etc (Table 1).

State - Wise Marine Fish Landings

The marine fish landings of Nigeria for four years of (1976-1979) was 1,351,867 metric tons with an average of 1552.07 metric tons, which contributed to about 67.42% of the overall fish landings of the country. In the Six Maritime States of NIgeria the annual average catches for the four years are: Rivers ranked first with (46.60%); followed by the Cross River State with (24.34%); Bendel (15.94%); Lagos (8.49%) Ondo (4.27%) Ogun (0.064%) (Table 2).

Table 1 Fish Landings (1973 - 1979) in Metric tons West Coast of Africa.

	1973	1974	1975	1976	1977	1978	1979	Total	Percentage
Nigeria	465100	473220	466238	496647	504014	518435	535435	3459219	32.688
Senegal	315800	356872	362552	362012	347987	358747	308160	2412130	22.793
Ghana	223700	219513	254515	237697	268143	264029	229904	1697501	16.040
Zaire	156900	128810	113380	117858	107000	108706	115182	847836	8.011
Ivory Coast	65500	75251	68470	76995	83407	79011	92050	540684	5.109
Cameroun	67600	65736	66280	70326	70168	68996	69421	478527	4.521
Sierra Leone	66700	67739	68597	53792	52652	50080	57592	417152	3.941
Benin	29100	27802	25933	25504	24928	25452	25452	184171	1.740
Congo	16200	16717	16103	18869	16364	17297	20630	122180	1.154
Gambia	10200	10795	10795	10795	23001	28724	17446	111756	1.056
Guinea	9500	12100	13370	9920	9120	10000	18453	82463	0.779
Togo	10900	11150	14420	11380	8440	15639	8098	80027	0.756
Liberia	9300	10064	10064	10132	10190	10812	13484	74046	0.699
Gabon	4900	4900	6056	6056	6056	13350	13603	54921	0.518
Guinea Biassau	1700	1700	1649	3442	3758	3729	3724	19702	0.186
							TOTAL	10582315	100.000

Source: FAO, 1980 Year Book of Fishery Statistics Vol. 48.

Table 2 Marine fish Production (Coastal) States of Nigeria.

	1976	1977	1978	1979	Total
Rivers	153,050	154,789	157,068	165,003	629,910
Cross River	80,029	80,936	82,118	90,025	333,108
Bendel	52,359	52,952	53,723	56,448	215,482
Lagos	27,891	28,206	28,623	30,069	114,789
Ondo	14,021	14,181	14,389	15,116	57,707
Ogun	211	216	217	227	871
Total	327,561	331,280	336,138	356,888	1,351,867

Source: FDF, 1980: Fisheries Statistic of Nigeria.

Fishing Villages, Fishermen population fishing craft and gear

Table 3, shows an analysis of the number of fishing villages, fishermen population, and fishing crafts, as well as the catch from the six maritime states of Nigeria for (1978-1979); based partially on the "Final Report on Situation study of fish Demand and Supply in Nigeria", Nigeria, F.D.F. (1980). From it, more than 300,000 metric tons of fish are landed annually by 382,000 local fishermen, operating 79,000 canoes, of which about 17.2% have been fitted with out board motors ranging from 18-40 HP. By 1979, there were 92 inshore trawlers operating on the continental shelf of Nigeria. Forty four of these trawlers engaged in fishing while the remaining 48 engaged in shrimping. The active fishermen population is highest in the Cross River State with (131,000); followed by Bendel (97,000); Rivers (87,200); Lagos (49,100): Ondo (15,000) and Ogun (2,550). Bendel State has the highest number of motorized fishing craft (7,020); followed by Cross River (3,000); Lagos (800); Rivers (410); and Ogun (360); which all add up to only 11,590 motorized canoes. The bulk of the artisanal fish landings came from non-motorized canoes (67,464).

The traditional fishing crafts in Nigeria are generally the wooden dug-out canoes, and plank-canoes of various sizes varying from 9 metres to 13.7 metres length overall. The sizes are designed to suit the particular local environment. The traditional fishing gears are many and varied. They include the cast net, gill net, fish fences with several narrow entrances, basket traps, wire netting traps, lift nets, round and V-shaped stick traps, bamboo screens, hooks and lines, fixed stake nets, and baited basket traps. These gears are designed to suit the type of fish caught. For instance long lines, and hand lines are used for hooking sharks, and sheer fishes etc; the various seine nets are employed for shoaling fishes like bonga, drift-nets, and bottom set gill nets are effectively employed for gilling the fishes at wide ranges in different columns of water. The inshore, and other commercial trawlers use mostly the otter-trawl nets for fish and shrimps.

Exploited Marine Fishery Resources of Nigeria

The pelagic, and demersal fisheries are exploited in Nigeria. Nearly two thirds of the marine fish landings in Nigeria come from the pelagic fisheries; while the remainder comes from demersal fisheries.

Table 3 Structure of artisanal marine fisheries of the Six Maritime States of Nigeria (1978 -1979)

Maritime States	No. of Fishing Villages	Number of Fishermen	Total	Non-Motorized	Motorized	Motorized As % of Total	Artisanal Marine Fish Output in Metric tons
Rivers	200	87200	24604	24194	410	1.7	127920
Cross River	247	131000	23000	20000	3000	13.0	113500
Bendel	650	97000	21130	14110	7020	33.2	28000
Lagos	500	49100	9820	9020	800	8.1	28030
Ondo	180	15000	450	-	-	-	-
Ogun	151	2550	550	140	360	72.0	2840
Total	1829	381850	79504	67464	11590	11590	300290

Source: Saphe (Nigeria) Consortium (1980); Fish Demand and Supply in Nigeria.

Pelagic Fishery Resources

Nigeria has an abundant, and varied pelagic fishery resources. This fishery is composed mainly of:

i. The Clupeoid fishery - of which Ethmalosa, and Sardinella spp are the most abundant.

ii. The scombroid fishery - composing of mainly the jacks, barracuda and tunas.

The Clueoid Fishery

The bonga, Ethmalosa fimbriata (Bowdich); E. dorsalis (Curvia and Valenciennes) is of extremely great economic importance in Nigeria, and in some other parts of the Gulf of Guinea. Although bonga are to be found along the eastern coast of the tropical Atlantic, they have two main areas of concentration: i.e.

- from the River Senegal to Sierra Leone
- along the coasts of Nigeria, Cameroon and eastwards to Congo mouth.

These areas (including the more isolated Abidjan region) are characterized by extensive estuarine regions enriched by river affluents (Zei, 1969).

Bonga is a phytoplankton feeder and 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, and when dense diatom blooms appear. These are most frequent during the dry season, engendering the main estuarine canoe fishery. However bonga are also caught all the year round in the open sea, but these open sea fisheries are very much affected by the weather conditions (Oslen and Lefevere, 1969). Bonga also exhibits a complex behaviour in relation to hydrographic conditions because the breeding does not occur in the estuarine areas, and the adults exercise a frequent inshore - offshore movement (Longhurst, 1961; Bainbridge, 1961, 1963). Bonga forms very important fishery along the estuarine fishing villages notably Ibeno/Eket; Ifiayong; Oron all in the Cross River State; and in Boniboye in Bendel State.

Bonga fishery is supported by a single species - Ethmalosa fimbriata. The landings of bonga within 1971-1979 was 57,308 metric tons forming 2.71% of the artisanal marine fish landings for the period (Table 4).

Table 4 Total catches of Bonga (1971-1979) in metric tons form Artisanal Marine fish landing.

	Total Artisanal fish Landings	Total Bonga Fish Landings	% Bonga in Artisanal Marine Fish
1971	199639	6163	3.09%
1972	218728	6713	3.07%
1973	228411	6913	3.03%
1974	226004	7121	3.15%
1975	229854	7195	3.13%
1976	245336	5594	2.28%
1977	247858	5734	2.31%
1978	255426	5844	2.29%
1979	264495	6031	2.28%
TOTAL	2115762	57308	2.70%

Source: Fisheries Statistics of Nigeria, 1980

The Sardine Fishery

In Nigeria, on the Gulf of Guinea, and in the countries east or west of it, sardines are available. In the Gulf of Guinea, the term "sardines" is used for "Clupeids" (Postel, 1960). The composite species of sardine presently exploited in Nigeria are: Sardinella cameronensis; Sardinella aurita, S. eba, S. ocellata; Ilisha vorax: Ilisha africana; Harengula rouzi; Pellonula vorax; Harengula pellonula (Sivalingam, 1970). The species of the genus Sardinella in the Gulf of Guinea is often fished, recorded, and treated in the statistics as a special group, making it difficult to trace the exact abundance, distribution, and behaviour of the various species, namely, for instance Sardinella aurita and Sardinella eba. On the other hand Sardinella is generally confused with Sardinella ocellata (Zei, 1969).

The taxonomic status of Sardinella cameronensis as a separate species, along the Nigerian and the Cameroon coasts is questionable. Some authors are of the opinion that Sardinella cameronensis might merely be a separate race or even a synonym of Sardinella eba (Zei, loc. cite).

In Nigeria, sardines play a subordinate role, and from the total catch of fish from distant water fishing vessels for 1971-1979 which was 1,098,618 metric tons, sardine contributed 22,042 metric tons forming 2.0% of the total catch (Table 5).

Table 5 Total Catches of Sardine (1971-79) in metric tons from Distant Water Vessels.

Year	Overall Landings Distant Water Vessel	Overall Landing of Sardine	% of Sardine in Distant Water Vessel
1971	54416	7	0.01
1972	65063	-	-
1973	71410	1225	1.72
1974	74905	3247	4.33
1975	114186	1148	10.06
1976	133977	2895	2.16
1977	164449	2878	1.75
1978	202208	249	0.12
1979	218000	53	0.02
TOTAL	1096614	22042	2.00

Source: Fisheries Statistics of Nigeria, (1980)

Mackerel Fishery

In Nigeria, the mackerel fishery is represented by a single species known as Scomberomerus tritor. Mackerel is available in the high seas, and is caught by the distant water trawlers, and not within the tolerable continental shelf of Nigeria to be exploited by the artisanal marine fishermen.

Mackerel contributed a total landing of 223,572 metric tons out of the 1098614 metric tons of fish landed by distant water vessels; and forming 20.35% of the catch within 1971-1979 (Table 6).

Table 6 Total catches of Mackerel - (1971-79) in metric tons by Distant Water Vessels.

Year	Total Landings Distant Water Vessels	Overall Catch of Mackerel	% of Mackerel in Distant water Vessels
1971	54416	7454	13.70
1972	65063	6129	9.42
1973	71410	7155	10.02
1974	74905	6783	9.06
1975	114186	30522	26.73
1976	133977	31200	23.29
1977	164449	27074	16.46
1978	202208	51612	25.52
1979	218000	55643	25.52
TOTAL	1098614	223572	20.35

Source: Fisheries Statistics of Nigeria, 1980

Ribbon Fishes/or Cutlass Fish/or Silver Fish/or the Hair Tails

In Nigeria, Trichiurus lepturus; and some other species of the family Trichiuridae are common, but they do not form any major fishery of economic importance. Longhurst (1969) has reported the occurrence of Trichiurus lepturus on the entire Gulf of Guinea; and also along the Congo Coast (Francis Poinsard, 1969).

Within the period (1971-79), Ribbon fishes made up a total of 3867 metric tons of fish, and contributed 0.35% of the toal landings of distant water vessels (Table 7).

Table 7 Total landings of Distant Water Vessels/Cutlass Fish (1971-79) in Metric tons.

Year	Total Landings of Distant Water Vessels	Overall Landings of Cutlass Fish	% of Cutlass Fish in the Landings of Distant Water Vessels
1971	54416	-	0.00
1972	65063	-	0.00
1973	71410	374	0.52
1974	74905	671	0.89
1975	114186	1003	0.88
1976	133977	1694	1.26
1977	164449	60	0.40
1978	202208	-	0.00
1979	218000	65	0.30
TOTAL	1098614	3867	0.35

Source: Fisheries Statistics of Nigeria, 1980.

The Seer Fishes

The Seer fishes of the family Scombridae are represented by a few species under two genera, Scomberomorus Lacepede, and Acanthocybium Gill. They are generally high-priced quality fishes. Some of the fishes grow to a length of over a meter. These fishes are highly carnivorous, and depend largely on smaller fishes. The fishing season lasts from October to March (Rao, 1973).

Among the most dominant species of this group of fishes in Nigeria, is the Spanish mackerel, Scomberomorus maculatus. In Nigeria S. maculatus is landed all the year round, with a peak season in September (Sivalingam, 1970), and it is a much priced fish in the Nigerian market. Within the period 1971-1979, 41,002 metric tons of Spanish mackerel was landed in Nigeria, and this contributed to about 3.73% of the total marine fish catch of distant water fishing vessels (Table 8).

Table 8 Total Landings of Distant Water Fishing Vessels/and Spanish Mackerels in Metric tons (1971-1979).

Year	Total Landings of Distant Water Fishing Vessels	Total Landings of Spanish Mackerel	% of Spanish Mackerel in Distant Water Fishing Vessels
1971	54416	2915	5.36
1972	65063	2545	3.91
1973	71410	1787	2.50
1974	74905	4507	6.02
1975	114186	5757	5.04
1976	133977	2003	1.50
1977	164449	8673	5.27
1978	202208	8673	3.93
1979	218000	4153	1.91
TOTAL	1098614	41002	3.73

Source: Fisheries Statistics of Nigeria, 1980.

Carangids and Allied Fishes

The trevallies, the horse mackerels, the queen fishes, etc. of the family Carangidae, the dolphin fishes of Coryphaenidae, and the king fishes of Rachycentridae, are a mixed assemblage of pelagic warm water fishes, (Rao, 1973) which form a fairly high proportion of the catches along the coast of Nigeria. Of the above fishes the horse mackerels are the most abundant. They seem to breed almost throughout the year. (V. Rao, Loc. Cit.). The important species in Nigeria are Caranx senegallus; Caranx hippos, Caranx africanus; Megalaspis sp, and Chorinemus sp. Some Carangids grow to 60cm. In general it may be stated that these fishes occur all the year round. Out of the total marine fish catch of 1098614 metric tons landed by distant water fishing vessels for 1971-1979; horse mackerels contributed a total of 604966 metric tons forming 55.07% of the landings (Table 9).

Table 9 Total Landings of Distant Water Fishing Vessels/ Horse Mackerels.

Year	Total Catch of Distant Water Fishing Vessels	Total Landings of Horse Mackerels	% of Horse Mackerels in Distant Fish. Vessels
1971	54416	30881	56.75
1972	65063	30258	46.51
1973	71410	41757	58.47
1974	74905	41921	55.97
1975	114186	53741	47.06
1976	133977	80700	60.23
1977	164449	89145	54.21
1978	202208	113836	56.30
1979	218000	122727	56.30
TOTAL	1098614	604966	55.07

Source: Fisheries Statistics of Nigeria, 1980.

Barracudas and Grey Mullets

Barracudas (family Sphyraenidae); the grey mullets (family Magulidae), and the hardyheads (family Atherinidae) comprise a supergroup (order Mugiliformes) the members of which inhabit mostly the inshore waters, often entering the estuaries, and back waters (Rao, 1973).

Several species of barracuda under the genus sphyraena are represented in the Nigerian waters. Barracudas are active predatory fishes. They are caught by artisanal fishermen along the coastal and brackish waters of Nigeria. And out of the total landings of 2189046 metric tons for 1971-1979; barracuda contributed a total landings of 134523 tons, forming 6.15% of the artisanal fish landings (Table 10).

Table 10 Total Inshore and Brackish Water Fish Landings/and Barracuda in Metric tons for (1971-1979)

Year	Total Inshore and Brackish Water Fish landings	Total Landings for Barracuda	% of Barracuda in the catch
1971	204047	13557	6.64
1972	222942	14766	6.62
1973	233921	15206	6.50
1974	233870	15590	6.67
1975	226208	15752	6.96
1976	255824	14360	5.61
1977	264850	14722	5.56
1978	272581	15088	5.53
1979	275803	15482	5.61
TOTAL	2189046	134523	6.15

Source: Fisheries Statistics of Nigeria, 1980.

The grey mullets are represented in Nigeria by the genera Mugil. A few of the mullet species are restricted to the river systems. The common marine species fall under the genera Mugil, Liza and Valamugil. Mugil cephalus Linn, and others are active non-predatory fishes feeding on detritus, and the smaller components of the phytoplankton and zooplankton. Mullets are suitable for fish farming. The fry are common in salt water lagoons, streams, and creeks, which can be collected and stocked in both marine and brackish water fish farms some species of mullets can thrive well in freshwater environments too. Mullets can grow to a maximum size range of 25.45cm (Rao, 1973). The mullets form 5.35% of the artisanal marine fish landings of 1971-1979.

Table 11 Total Inshore and Brackish Water Fish Landings/ Mullets in Metric Tons for (1971-179).

Year	Total Catch of Inshore and Brackish Water Fish Landings	Total Landings of Mullets	% of Mullets in the Catch
1971	204047	11799	5.78
1972	222943	12852	5.76
1973	233921	12235	5.23
1974	233870	13634	5.83
1975	226208	13776	6.09
1976	255824	12732	4.98
1977	263850	13077	4.96
1978	272581	13335	4.69
1979	275803	13726	4.98
TOTAL	2189046	117166	5.35

Source: Fisheries Statistics of Nigeria, 1980.

Demersal Fishery Resources

Demersal stocks of fish in Nigerian waters fall into two major faunistic groups: (a) - the Sciaenid group: Occurring from the surface down to about 60 meters depth which represents the lower most limit of the thermocline. This group composes silvery, and greyish coloured fish of the families: Sciaenidae (croakers); Polynemidae (Threadfins); Pomasyidae (Grunters); Ariidae (Catfishes) and Cynoglossidae (Soles). (b) Sporid fauna occurring above, and below the thermocline, and consisting of red, and brown fish of families sparidae (Breams); Lutjanidae (snappers); Mullidae; Triglidae (Garnards) and Priacanthidae. (Longhurst 1961, and 1964), as quoted by (Tobor, 1973).

Sciaenids

A good part of the trawler landings from the offshore regions is made up of the members of the family Sciaenidae, and are popularly known in Nigeria as the Croakers, and they form the most valuable fish group in the multi-species trawl fishery of the country. Among the croakers (Pseudotolithus) which are mostly common in the trawl landings in Nigeria are Pseudotolithus typhus; P. senegalus from the offshore trawlers.

In the estuary Pseudotolithus brachygnathus is the dominant species while P. elongatus is the typical sciaenid on the continental shelf at mixed layer depths (Longhurst, 1969).

Tobor (1973) has given the bathmetric distribution of Croakers. Long croakers (Pseudotolithus typhus) occur between 6 and 30 metres, with their highest value at 6-10 metres. Short croakers (P. typhus) occur from 36-55m.

The total annual trawl landings of croaker for the period 1971-1979 was 17,308 metric tons forming 44.90% of the landings (Table 12).

Table 12 Total annual Trawl Landings/Croakers in Metric Tons (1971-1979).

Year	Total Annual Trawl Landings	Total Landing of Croakers	% of Croakers in the Trawl
1971	1090	313	28.71
1972	1404	499	35.54
1973	2012	839	41.69
1974	3267	1315	40.25
1975	4231	1823	43.09
1976	5464	2349	42.99
1977	7727	3919	50.72
1978	7475	3719	49.75
1979	5892	2532	42.97
TOTAL	38562	17308	44.88

Source: Fisheries Statistics of Nigeria, 1980.

Catfish

Catfishes are easily landed by trawlers and by the indigenous dug out canoes all along the coast of Nigeria. The most common species include Tachysurus sinensis; Tachysurus gambiensis; Arius latisculatus; A. parkii; A. heudeloti; A. granulatus; A. mercatoris. Catfishes are caught in great abundance between 6 and 30mm, and recent observations indicate that A. heudeloti occurs in depths greater than 70m (Tobor, 1973). Catfishes inhabit the coastal waters, estuaries, and shores, and occasionally entering the backwaters. They are very destructive to other fishes, and are caught by all types of gears in Nigerian waters. Catfishes are consumed in fresh, or smoked condition.

Within the period 1971-79 catfishes contributed a total of 1126 metric tons of trawl landings forming 2.92% of the catch (Table 13).

Table 13 Total annual Trawl Landings/Catfishes in Metric Tons (1971-1979).

Year	Total annual Trawl Landings	Total Landings of Catfishes	% of Catfishes in the Trawl Landings
1971	1090	63	5.78
1972	1404	50	3.56
1973	2012	85	4.22
1974	3267	136	4.22
1975	4231	147	3.47
1976	5464	144	2.63
1977	7727	159	2.06
1978	7475	180	2.41
1979	5892	162	2.75
TOTAL	38562	1126	2.92

Source: Fisheries Statistics of Nigeria, 1980.

Polynemids: (The threadfins)

Tobor (1973) has given the bathymetric distribution of this group of fishes in Nigeria. The commercially important species in Nigeria are Pentanemus quinquarius; Polydactylus auadrifilis; Galeoides decadatylus. These fish are caught in large number between 6 and 40m. Other species in the group are Polynemus virginicus, Polynemus macronemus (Fowler, H. 1934). These fishes are mostly valued as food, and are caught on the sandy shores of the tropical countries, and some also migrate into the rivers.

Table 14 gives the landings of these fish in the trawl fisheries of 1971-1979; and they form 2.37% of the landings.

Table 14 Total Annual trawl Landings/Threadfins in Metric tons (1971-1979).

Year	Total Annual Trawl Landings	Total Landings of Threadfins	% of Threadfins in the Trawl Catches
1971	1090	13	1.19
1972	1404	10	0.71
1973	2012	30	1.49
1974	3267	82	2.51
1975	4231	71	1.68
1976	5464	123	2.25
1977	7727	234	3.02
1978	7475	218	2.92
1979	5892	132	2.24
TOTAL	38562	913	2.37

Source: Fisheries Statistics of Nigeria, 1980.

Soles

The most important flat fishes in Nigeria which yield heavy catches all along the coasts of the country include: Cynoglosus browni; Cynoglosus senegalensis; C. monodi; C. goreensia; C. canariensis; C. cadenati. Others include Solea sp; Psettodes sp; Poecilopsetta sp; Pseudorhombus sp. Like the croakers, soles are landed all the year round in Nigeria.

Soles are caught in shallow, medium, and deep waters of 6-10; 36-40, and 56-60 metre depths respectively. There are deep water species distributed down to 71-75m (Tobor, 1973).

Table 15 Total annual trawl landings/Soles in Metric Tons (1971-1979).

Year	Total Annual Trawls Landings	Total Landings of Soles	% of Sole in the Trawl Landings
1971	1090	49	4.49
1972	1404	46	3.28
1973	2012	93	4.62
1974	3267	120	3.67
1975	4231	117	2.76
1976	5464	135	2.47
1977	7727	227	2.93
1978	7475	189	2.53
1979	5892	145	2.46
TOTAL	38562	1121	2.90

Source: Fisheries Statistics of Nigeria, 1980.

Table 18 Annual Catch Prawns in metric tons (1971-1979)

Year	Total annual Landings Inshore	Total annual Prawn Landings	% of Prawn Landings in the annual catch landings Inshore
1972	204047	1942	0.95
1972	222942	2116	0.95
1973	233921	2179	0.93
1974	233870	2244	0.96
1975	226208	2268	1.00
1976	255824	1763	0.69
1977	263850	2117	0.80
1978	272581	1926	0.70
1979	275803	1901	0.69
TOTAL	2189046	18456	0.84

Source: Fisheries Statistics of Nigeria, 1980.

The Big Eye

The big eye, Brachydeuterus auritus (Val. 1831) of the family Pomadasyidae is probably one of the most abundant fishes along certain parts of the West African coast (Raitt and Sagua, 1969). Big eye is distributed along the entire coast of West Africa from Guinea to Gabon, reaching and having very high concentration around Sierra Leone up to Nigeria where it constitutes almost 8% of the total weight of fish caught and being particularly abundant at 30 and 50 fathom depths (Salzen, 1957; Chrzan, 1961).

Brachydeuterus auritus is distributed from Senegal to the Congo occurring at most of the trawling positions from 15 to 20 down to 100m. At several stations it made up more than 60% of the total weight of the catch (William, 1969). Describing the Nigerian trawl fishery, Longhurst (1964) states that big eye "sometimes is taken in such quantities, especially when the trawler is fishing rather deeper than normal, as temporarily to flood the Lagos market with this rather inferior category of fish". "An enormous potential source of protein would appear to be B. auritus, which was the only important single species of fish in the region, yet nowhere is it considered important, and it is at times difficult to dispose of in many areas except as trash fish" (William, 1965). Big eye is eurybathic species capable of crossing the fish community boundaries in that it can swim at most depths above, and below the thermocline down to about 100m (Longhurst, 1965) B. auritus is carnivorous. The family Pamadasyidae contains about 15 genera in West African waters (Fowler, 1936). The entire length range of Brachydeuterus auritus is only from 10-20cm. In the overall trawl landings of 38562 metric tons (1971-1979), big eye contributed 4.47% of the landings (Table 16).

Table 16 Total annual trawl landings/Big eye in metric tons (1971-1979).

Year	Total annual Trawl Landings	Total landings of Big eye	% of Big eye in the Trawl landings
1971	1090	94	8.62
1972	1404	84	5.98
1973	2012	136	6.76
1974	3267	225	6.89
1975	4231	243	5.74
1976	5464	224	4.10
1977	7727	238	3.08
1978	7475	239	3.24
1979	5892	241	4.09
TOTAL	38562	1724	4.47

Source: Fisheries Statistics of Nigeria, 1980.

Elasmobranches

A large bizzare of elasmobranches (sharks, rays, and skates) exist in the Nigerian waters as well as the coast of West Africa (Fowler, 1936). Among them are the Carcharhinus sp; Scoliodon sp; Rhynchobatus sp; Dasyatis sp; and Aetobatus sp.

Elasmobranches formed 12.88% of the toal 2189046 metric tons of the inshore, and brackish water fish landings for (1971-1979).

Table 17 Annual catch of Elasmobranches in metric tons for (1971-1979).

Year	Sharks	Rays	Skates	Total Inshore Fish Landings
1971	4767	4529	61	204047
1972	5193	4933	67	222942
1973	5347	5080	69	233921
1974	5584	5635	-	233870
1975	5742	6778	-	226208
1976	15739	3652	-	255824
1977	16404	3908	-	272581
1978	16404	3908	-	272581
1979	16968	3937	-	275803
TOTAL	239504	42207	197	2189046
Grand Total		281908		2189046

Source: Fisheries Statistics of Nigeria, 1980.

Prawns

The commercial prawns of Nigeria according to Bayagbona, Sagua and Afinowi (1970) include Penaeus duorarum (Burkenrood); Parapenaeopsis atlantica (Balss), Penaeuskerathurus (Forskal) (Annual report: Federal Department of Fisheries, 1971). Others include Penaeus setiferus, and Plesionila sp.

"Approximately 75% of the prawns landed now in the Nigerian waters fall under the U.S. shrimp market grouping of 16/20; 21/25; 26/30 (tails per lb.). This size, frozen, fetches top price in the U.S., and other international prawn markets where it is exported, while the local demand is rather limited" (Thomas, 1969).

A significant feature of the distribution of the prawn catches off the Nigerian coast (in about 3,000 square miles of trawlable grounds) is their clear relationship with the presence of muddy bottom deposits. Whenever, the bottom changes to hard sand, or gravel, little, or no prawns are caught (Raitt and Niven, 1969).

In Lagos, good commercial prawn landings occur in depths between 28 - 40m, off the Niger delta, from 16m depths onwards. In the shallower grounds (9-25m) off Lagos, large prawns (P. duorarum) occur in lesser quantities, along with smaller prawns (cocktail type), Parapenaeus atlantica (Thomas, 1969). Prawns contributed to 0.84% of the total inshore and brackish water marine fish landings of 1971 - 1979 (Table 18).

Marine Biology, and Oceanography in Relation to Fisheries

Topography

In the tropical region South of Dakar, and in the Gulf of Guinea more mud is found, and the shelf becomes rather smooth. The coastline is more indented, and lagoons are found all along the coast from Ivory Coast to Nigeria (Gulland, 1971).

Generally, the continental shelf off the West African Coast is very narrow. Salzen (1957) reports an average width of 19.31 km to 22.53 km from the coastline in Ghana to the 100 meter contour, which forms the edge of the shelf. The shelf widens westwards to 40.2 km off Sierra Leone, and 112.65km to 128.74km off Guinea. It narrows down again to 40.23km to 72.41 off Senegal, becoming progressively narrower northwards (Longhurst, 1963). East of Ghana, the continental shelf becomes slightly wider off the Niger Delta, but narrows down again South of Gabon.

Two submarine canyons have been described close to the coast of West Africa. There are the Avon Deeps in the Bight of Benin, just east of Lagos, and the "Trou Sans fond" close to Abidjan, Ivory Coast (Longhurst, 1965a). With the exception of these two canyons, the shelf shows a gradual slope, especially off the wide Guinea shelf, where the shallow Bissagos Bank extend up to 32.18 km out to sea.

The continental slope is steep, with a drop of from 100 meters to 1,000 meters in 16 km, except off the Bissagos Banks, where the slope is not as steep and this drop extends for 96.55 km.

Very few coral communities have been described for the area, but corals do appear at normal fishing depths off the coast of Cameroon and Gabon (Anon, 1965a). In other places where corals have occurred, they appear only at depths of 80 to 140 meters. Dead corals are buried under deltaic mud in the Niger delta area (Allen and Wells, 1962).

Hydrography

Sverdrup, et al (1942), and many other authors (e.g. Schott, 1942; Longhurst, 1962) have described the surface water movements of the tropical Atlantic, and including the Gulf of Guinea. Off northwest Africa,the cool Canary current flows Southward, and then bends Westward, and merges with the North Equatorial Current. Similarly in the South, the Benguela Current flows north off Southwest Africa, and then Westward into the South Equatorial Current. Between these major systems the Equatorial Counter-current, and its continuation, the Guinea Current, flows Eastward into the Gulf of Guinea. More recently, the Equatorial undercurrent flowing strongly eastward below the Westward flowing Equatorial Currents have been shown to be important (e.g. Nenmann 1960, Voigt, 1961; Rinkel, 1969, Panomarenko et al. 1967 as quoted by Gulland (loc. cit.).

Maximum monthly temperatures of more than 27°C occur in the area between Dakar and North Angola. Seasonal changes in temperature of more than8°C are equally common in this region, and also in areas of strong upwelling (Gulland, loc. cit.). According to Berrit (1959) as quoted by Longhurst (1962), the coastal region of the West coast of Africa is characterized by the seasonal movement of an oceanic temperature front. The movement of the surface temperature can be followed by observing the relative position of the 25°C isotherm. In March, on the West Coast of Africa, the 25°C isotherm lies at Southern limit off the coast of Guinea, and Sierra Leone. This coincides with the Canary current reaching its Southern limit, the waning of the Equatorial counter current and upwelling coastal winds. The 25°C isotherm begins its northward movement in May and reaches its northerly limit in August at 20-25°N. During this northernly movement, the Equatorial counter current moves in behind, and the coast is under the influence of this warm, low nutrient water. Biological enrichment

takes place along this movement front, and in the areas of coastal upwelling.

Typically high salinity sections across the West coast of Africa around the Equatorial region including the Gulf of Guinea are cited below: In the core, the salinity exceeds 36.5% (Neuman, 1969). Williams (1969) found salinities in excess of 36.2% near the equator at depths around 50 or 60 meters extending as far as 1°E or 2°E into the Gulf of Guinea. However, the salinity maximum in the core of the Atlantic Equatorial undercurrent near its source at 39°W are close to the South from the equator (Rinkel et al, 1966). It is remarkable that salinities of more than 36.2% in the core of the undercurrent could be observed even in the inner part of the Gulf of Guinea (Neuman, 1969).

Surface salinity is generally high in the sub-tropical region (-- 36%) but lower and seasonally fluctuating along the tropical coasts. There are two major areas of seasonally reduced salinity - in the Bights of Benin and Bonny, and off the coasts of Sierra Leone, and Guinea. Part of this reduced salinity is due to the influence of large rivers, and part directly to heavy rainfall (Gulland, loc. cit.).

The hydrographic features of major importance to the basic productivity of the region, and hence to the fisheries, is the extensive areas of upwelling. Off the northwest coast of Africa, there is upwelling (in some parts of the Canary current) throughout the year, though the location, and extent varies seasonally, so that the effect is of a series of rather seasonal and local upwelling. These extend from South of Dakar (in the northern winter), to beyond the northern limit of the region in the summer. There are also seasonal upwelling areas in the Gulf of Guinea (Berrit, 1961, 1962, as cited by Gulland, 1971).

The mid-water fish fauna of the Gulf of Guinea is exceptionally rich in number of individuals, and to a lesser extent, in species. Roughly the vertical distribution parallels that known for other regions of warm seas except that in the Gulf of Guinea, due to upwelling in the area, the zones are in general displaced upwards, and temperature boundaries are more important than absolute depth (Voss, 1966).

Due to the strong upwelling in the Gulf of Guinea species of cephalopods are more common here than elsewhere. Bathyteuthis, according to Clyde Roper, as quoted by Voss (1966), is more prevalent in the Gulf of Guinea than else where in the world outside the Southern ocean in Antarctica. The other very numerous cephalopod in the Gulf of Guinea due to upwelling is Ommastrephes pteropus, and their numbers according to Voss (loc. cit.), should be of special significance in the distribution, and abundance of tunas in the eastern tropical Atlantic ocean.

Biological Production

The main areas of biological production as reviewed by Gulland (loc. cit.) are the coastal upwelling areas, and the oceanic area along the Equator. The production in each area varies seasonally in accordance with the seasonal variation in upwelling, but at the peak, production is very high, up to 5.2g^{C}/m^2/day off Dakar, and 2.7g/m^2/day off Takoradi. Outside the peak productive season, the production is low (0.2-0.4g^{C}/m^2/day in the above areas). The thickness of the euphotic zone is about 30-40m on parts of the shelf between Sierra Leone, and Ghana, but -- 100m in open ocean stations in the Central Gulf of Guinea, and Cpe Verde Islands.

Highest production of phytoplankton is confined to the estuarine zone around Sierra Leone and to the northern, and southern extremes of the Gulf of Guinea. Bainbridge (1960a) showed that phytoplankton production of the central Gulf of Guinea was highest in the river estuaries. He obtained an average figure of 19,057 Harvey Units/M^3 for the dry season (January to July), and 353 Harvey Units/M^3 for the rainy season (July to December) in the Sierra Leone estuary. In the open sea, figures showed the same dry rainy season relationship, although very much reduced 687 and 71 Harvey Units/M^3 respectively.

The reduction in standing crop of phytoplankton during the rainy season was attributed to high dilution of estuarine waters, and the flushing effect of the river floods.

The high areas of zooplankton coincide with the areas of high phytoplankton production and zooplankton production would be expected to fluctuate with that of phytoplankton. This was shown by Bainbridge (1969a) to be the case off the Sierra Leone estuary. The greater part of the zooplankton of the Takoradi (Ghana) upwelling zone, was made up of the copepod Calanoides carinatus (Bainbridge, 1960b).

Longhurst (1958, 1959) has shown that there is a general decrease in benthose biomass abundance with increasing depth. Off senegal figures range from 74g/M^2 for the 0-20m), but the decrease of abundance with increasing depth is less pronounced. There is also a relation to the kind of bottom sediment, a moderate amount of silt giving the highest indices of benthos abundance. In the upwelling areas off Ghana, Buchanan (1958) found up to 540g/M^2 in sandy silt (Gulland, loc. cit.).

General Nature of the Fisheries

Within the zone under consideration i.e. from Dakar to the Congo, the available evidence suggests that the demersal fish in the zone as a whole do not make long-range migrations along the coastline, but mainly move towards or away from the shore-line. For practical purposes, therefore, each exploited area of the shelf can be considered as a separate stock. These areas are separated from one another by intervening shelf areas where little fishing takes place because the adjacent country has not developed its fishery, and the shelf is not rich or wide enough to attract vessels from more distant areas. The areas according to Gulland (loc. cit.) were distinguished in the 1968 working group report as follows:

Major demersal fishing areas

Bissagos, Guinea, Sierra Leone, Ivory Coast, Ghana and Nigeria.

Areas with little fishing

(Separating the major fishing areas)

Liberia, Togo, and Dahomey; Cameroun to Cape Lopez. Though larger vessels from the adjoining areas are tending to move into lightly fishes sectors.

Of the major demersal fishing grounds, the best are in areas of upwelling, and of these the Bissagos ground has the largest biomass, because the continental shelf is particularly wide (200km). Furthermore, and on a smaller scale river mouths usually provide rich trawling grounds where large sized fish (Sciaenidae, Polynemidae, Ariide, Skates) are caught. The best example of this is the mouth of the Congo River.

The richest prawn grounds (Penaeus duorarum) are in the vicinity of larger river mouths or lagoon entrances to the sea, e.g. Southern Senegal, Nigeria. Spanish trawlers have recently developed deep - water fishing for shrimp off Mauritania, Senegal, Congo and northern Angola.

The pelagic inshore fisheries are based mainly on bonga (Ethmalosa fimbriata) and Sardinella. The presence of Sardinella spp. seems to be correlated with the presence of upwelling. Sardinella spp. are known to be abundant off Senegal and northen Angola, and to occur in varying quantities off Ivory Coast, Ghana, Gabon and the Congo (Gulland, loc. cit.).

DISCUSSION

The foregoing review of the commercially exploited marine fishery resources of Nigeria has given an indication of the true picture of the paucity of fish available along our inshore/coastal, or lightly put, our continental shelf.

From this very narrow continental shelf, (Salzen, 1957), more than 300,000 metric tons of fish are landed annually by 382,000 peasant fishermen operating 79,000 dug-out canoes, of which about 17.2% have been fitted with out board motors ranging from 18-40 H.P.

The accessible stock of Pelagic groups which are being currently exploited efficiently by these artisanal marine fishermen as revealed by Table 19 are barracuda, mullets, and bonga. The other pelagic fishes; mackerel, carangids, seer fishes, sardine and ribbon fishes are caught within our territorial waters by some foreign distant fishing vessels, and brought to our coast as import for sale. The paucity of fish within our continental shelf is due mostly to the non-occurrence of upwelling along our coast. The pelagic fishes (mackerel, carangids, seer fishes, sardine, ribbon fishes) brought in by distant water fishing vessels are cuaght out there in regions of strong upwelling in the central Gulf of Guinea (Voss, 1969).

Table 19 Dominant pelagic fishery resources

Period 1971-1979	% Total contribution from artisanal marine fish landings	% total contribution from distant fishing vessels marine fish landings
Barracuda	6.15	-
Mullets	5.35	-
Bonga	2.70	-
Carangids	-	55.07
Mackerel	-	20.07
Seer fishes	-	3.73
Sardine	-	2.00
Ribbon fishes	-	0.35

Source: Compiled from text (See tables 4 to 11).

By the close of 1979, 92 inshore trawlers were actively operating within our continental shelf. Out of this number, forty four of them were engaged in fishing, while the remaining 48 were shrimping. Table 20, gives an idea of our demersal fish catches.

Table 20 Dominant demersal (trawl) fishery resources.

Period 1971 - 1979	% Total contribution in marine trawl fish landings
Sciaenids	44.88
Elasmobraches	12.88
Bigeye	4.47
Catfishes	2.92
Soles	2.90
Threadfins	2.37
Prawns	0.84

Source: Compiled from text (See tables 12 to 18).

In order to intensify the fishery production in Nigeria, more exploratory surveys are called for to chart and map out the fishing grounds of the commercial fisheries, including the assessment of stocks, and research into the various aspects of the biology of these fisheries. Aside, Nigeria, has got to build up a strong fleet of distant water fishing trawlers for the exploitation of our off shore fishery resources, rather than concentrating all our effort within the inshore region. These activities will increase the yield, and help to solve the fish/food problem to a very great extent in this country.

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