OBAFEMI AWOLOWO UNIVERSITY, ILE-IFE, NIGERIA.

Inaugural Lecture Series 165

SELF SUFFICIENCY IN FISH PRODUCTION IN NIGERIA

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An Inaugural Lecture Delivered at Oduduwa Hall
Obafemi Awolowo University
on Tuesday 13th January, 2004.

Inaugural Lecture Series 165

ISSN 0189 - 7848

Printed by
Obafemi Awolowo University Press Limited
Ile-Ife, Nigeria

INTRODUCTION

Nigeria lies between latitude 4^0 16 ^{1} and 13^0 52^1 N of Equator and Longitude 2^0 49^1 and 14^0 37^1E of the Greenwich Meridian covering a total land mass of 923,773 km^2. It has a population of about 130 million. Nigeria is richly blessed with an extensive network of rivers/ tributaries, natural and man-made lakes, coastal waters and offshore waters, which are abundant in fin-fish and shell-fish resources. As a coastal state, it has a coastline of 853 km which is shared by eight coastal states.

In 1978, Nigeria declared 200 nautical miles Exclusive Economic Zone (EEZ) covering an area of 210,900 km^2 over which it has sovereign rights for the purpose of exploiting, conserving and managing its fisheries resources.

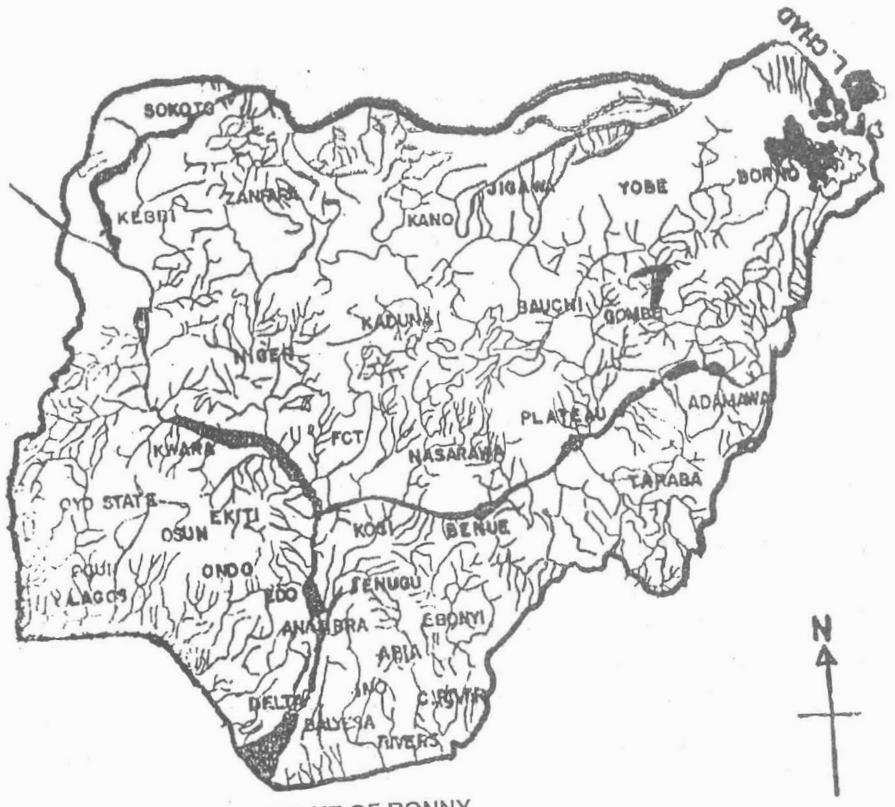
Inland Water Bodies

Nigeria possesses vast inland water resources as shown in **Fig. 1.** The topography is traversed by three major drainage systems. They are the drainage basins formed by:

(a) River Niger and Benue with their tributaries flowing in southward direction from their confluence in Lokoja
(b) River Yobe and its tributaries which empty their waters into freshwater Lake Chad; and
(c) the south coastal river systems including River Ogun, Osun, Benin, Escravos, Forcados, Nun, Sumbreiro, Bonny, Cross River, Imo and Akwa Ibom.

The rivers in these drainage systems as shown in fig 1 have been formed into the National River Basin Development Authorities by the Federal Military Government in 1976 for the multi purpose water resources development.

A major feature of these large rivers is the very extensive lateral flooding in the high water season, due either to local rains or to floods arising from higher areas in the catchment. The lateral flooding leads to temporary lacustrine conditions over vast areas annually. The seasonal flood plain support a viable fishery. The seasonal flood plains



DIGITAL MAP OF NIGERIA SHOWING RIVERS AND OTHER WATER BODIES

also provide temporary lakes, ponds and swamps which are generally large enough to support large and economic fisheries. These swamps and pools along rivers are usually invaded by fishermen and stripped of almost all the fin-fish fauna during the dry season.

Table 1 shows the approximate area of inland water surface as estimated by Ita (1993).

Table 1: Area of Inland Water Surface

Inland Water Resource	Area (ha)
Freshwater Bodies (Basin & Floodplains)	3,221,500
Major Rivers	10,812,400
Major Lakes and Reservoirs	853,600
Deltas and Estuaries	858,000
Minor Reservoirs	98,900
Miscellaneous Wetlands	4,108,100
Fish ponds	5, 500
TOTAL	**19,958,000**

Source: E.O. Ita (1993)

Lakes

Lake Chad is the major natural lake in Nigeria and its water is shared by Nigeria, Cameroon and Chad. During the pre-drought period, 5,500 km^2 (25%) of the lake water lie within Nigeria. Other natural lakes include Oguta lake in Imo State.

Reservoirs

There are several large and small reservoirs built all over the country. The major reservoir is the Kainji reservoir with a maximum area of 1280 km^2. Other large reservoirs in the country include Jebba reservoir built on Niger river below Kainji. Tiga reservoir on Kano river, Bagauda reservoir on Chelawa river, Asejire reservoir on Osun river, and Shiroro reservoir on Kaduna river.

Coastal Lagoons

The Badagry creek, the Lagos lagoon and Lekki lagoon form an extensive lagoon system with an area of 700 km^2, parallel to the western coast of Nigeria. The Niger Delta covering an area of 36,260 km^2 consists of a network of tributaries though which penetrate saline waters to a considerable extent. A total area of over 15,000 km^2 swamp land occur in the Delta which are suitable for aquaculture.

The Niger Delta with floodplain and swamps of about 15,000 km^2 could produce about 60,000 metric tons of fish (Welcomme, 1979) while the coastal lagoons covering an area of 760 km^2 could produce 6,450 metric tons of fish annually (Kapetsky, 1981).

Coastal Waters and Exclusive Economic Zone (EEZ)

The Nigerian continental shelf according to Bonzon and Horemans (1988) is 37,934 km^2, while the EEZ is 210,900 km^2. The first 2 nautical miles of the coastal waters are non-trawling zones.

Characteristics of Nigeria's Fisheries

Nigeria's fisheries can be divided into two main branches:

(a) Inland capture and culture fishery, and
(b) Marine capture and culture fisheries

Inland Fisheries

The fisheries of these inland waters can be divided into three major groups:

(i) the riverine fisheries including swamps and floodplains.
(ii) the fisheries of natural and man-made lakes; and
(iii) Fish farming in established fish ponds, flood ponds, cattle ponds, stagnant ponds of seasonal rivers, burrow pits and mining padducks.

The fishing activities are dominated by artisanal fishermen who operate on part or full time basis and employ principally canoes, traps, and other active and passive fishing gear and methods e.g. castnets, gillnets, longlines etc.

The catch of the inland capture fishery is dominated by *Lates spp, Gymnarchus spp, Clarias spp, Citharinus spp, Tilapia spp, Chrysichthys spp and Synodontis spp.* Welcomme (1978) reported that the fisheries of the rivers and their floodplains have been estimated to yield 40% of the 1.1 million metric tones of freshwater fish produced on the African continent.

Marine Fisheries

Both artisanal and industrial operators participate in the exploitation of the renewable fin-fish and shell-fish which occur in the estuaries, saline creeks, coastal waters and offshore. The activities of the artisanal fishermen are still based mostly on traditional craft, old gear and motorized and non-motorized canoes. The first 5 nautical miles of the territorial waters are reserved for exploitation by artisanal fifishermen. The commonly caught fish species include Croakers (*Pseudotolithus spp*) Bonga (*Ethmalosa spp*) Herrings (*Sadinella sp),* Catfish (*Chrysichthys spp and Arius spp*),,Sole (*Gynoglossus spp),* Threadfins (Galeoides spp), Shiny Nose (Polydactylus *spp*) and Grunters *(Pomadasys spp)* The artisanal fishing represents about 85% of local fish production in Nigeria.

Industrial Fisheries

The industrial fisheries sub-sector depends largely on the use of trawling vessels for fishing and shrimping in the territorial and offshore waters.

The tuna fishing is yet to be exploited and it is estimated that Nigeria has potentials for 10,000 metric tons. Private sector operators are yet to venture into the tuna fishery.

The shrimp fishery is a major foreign exchange earner. It is estimated that 15,000 metric tons are harvested annually.

Aquaculture

Fish farming contributes substantially to the animal protein component of human diets. Fish farms produce more fish per hectare than natural waters. The fish farms are stocked with the most

advantageous number of the most suitable species of fin -fish. Highest possible yields are obtained with the addition of suitable fertilizers and supplementary feeds to the farms.

About 1.75 million hectares of suitable sites have been identified in the country for fish farming. Currently, many subsistent level fish ponds exist but the yield is low. Homestead ponds with sizes ranging from 30 – 50 cm^2 were built of concrete blocks and they have fairly good yields. Commercial fish farms are being developed and these involve extensive and semi intensive production systems.

Intensive re-circulating fish production systems have recently been built at high cost and they are yielding high profits.

Fish Demand

The population of Nigerian according to the 1991 census was 88.5 million. Based on a growth rate of 3% per annum and a per capita fish consumption of 12kg, the projected population of Nigeria as at 2004 is 130 million. The estimated fish demand as shown in Table 2 is 1.56 million tons.

Table 2: Projected Population and Fish Demand (1996 – 2015)

Year	Population (Million)	Fish Demand (Million tons)
1996	102.6	1.23
1997	105.7	1.27
1998	108.8	1.31
1999	112.1	1.35
2000	115.5	1.39
2001	118.9	1.43
2002	122.5	1.47
2003	126.2	1.51
2004	130.0	1.56
2005	133.9	1.61
2006	137.9	1.65
2007	142.0	1.70
2008	146.3	1.76
2009	150.6	1.81
2010	155.2	1.86
2011	159.8	1.92
2012	164.6	1.98
2013	169.6	2.04
2014	174.7	2.10
2015	179.9	2.16

Source: Tobor (1990)

Domestic Fish Production

The domestic fish production in Nigeria can be determined by the sum total of the fish catches from rivers and lakes, artisanal and industrial fishing and aquaculture. The 1985 – 1994 fish production figures are presented by the Federal Department of Fisheries as shown in Table 3.

TABLE 3: NIGERIA FISH SUPPLY BY SECTORS 1985 – 1994 (UNIT METRIC TONS)

SECTORS	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
GRAND TOTAL	304,299	372,301	498,150	463,540	676,739	434.579	596,630	721,492	619,211	515,135
1.ARTISANAL: SUB-TOTAL	201,383	267,136	248,987	297,624	303,500	283,534	291,286	283,943	201,176	234,601
(i) Coastal & Brackish Water	140,873	160,169	145,755	185,181	171,332	170,459	168,211	184,407	106,276	124,117
(ii) Inland: Rivers & Lakes	60,510	106,967	103,232	112,443	132,168	113,075	123,075	99,536	94,900	110,484
2. AQUACULTURE (fish farm)	15,000	14,881	15,221	15,764	25,607	7,297	15,840	19,770	18,703	18,104
3.INDUSTRIAL (COMMERCIAL) TRAWLERS: SUB-TOTAL	26,142	25,042	24,900	36.549	33,645	25,529	36,226	39,365	35,644	30,488
(i) Fish (Inshore)	23,766	22,419	21,383	32.740	28,411	21,120	28,768	25,592	22,464	21,886
(ii) Shrimp (Inshore)	2,376	2,623	3.517	2,868	5,234	3,666	6,200	9,373	8,956	7,884
(iii) EEZ	-	-	-	941	-	743	1,258	4,400	4,224	718
4. DISTANT WATER: SUB - TOTAL	61,704	65,242	209,042	113,603	313,987	118,219	253,278	378,414	363,688	231,942
CATEGORY A: FISH	-	-	-	-	-	-	-	16,080	6,231	2,574
SHRIMPS (PRAWN)	-	-	-	-	-	-	-	9,493	71	124
CATEGORY B: FISH	-	-	-	-	-	-	-	127,251	1,164	-
SHRIMPS (PRAWN)	-	-	-	-	-	-	-	-	5	-
CATEGORY C: FISH	61,704	65,242	209,042	113,603	313,987	118,219	253,273	225,590	356,217	229,244

NOTE: CATEGORY A: Nigerian Flagged, Registered Vessels Fishing in Foreign Waters

CATEGORY B: Foreign Flagged Registered Vessels chartered by Nigerians Fishing in Foreign Waters.

All Landings in Nigerian Ports

CATEGORY C: Direct Importation.

Source: *Federal Department of Fisheries (1994)*

Annual Fish Yield Potentials In Nigeria

Fish yield potentials in the inland and marine waters of Nigeria approximate to 517.360 metric tones as shown in Table 4.

Table 4: Estimates of Fish Yield Potentials in the Inland and Marine Waters of Nigeria.

Water Body	Annual Yield Potentials (Metric tons)
Rivers and Flood Plains	226,550
Lake Chad	24,500
Kainji Lake	8,500
Other natural lakes and reservoirs	35,000
Coastal and brackish waters	190,000
Inshore waters (5 – 50 m)	16,000
Offshore waters	
(a) demersal resources	6,730
(b) pelagic resources	9,460
TOTAL	**517,360**

Source: Tobor (1990)

Fish Demand and Supply Situation

The current demand for fish in Nigeria as shown in Table 2 is 1.56 million tons while the fish production can be approximated to be 0.3 million tons. Thus, there is a large deficit of about 1.26 million tons. This gap is filled through fish importation.

It is however questionable whether the available statistics reliably measure the current production levels. It is possible that a

considerable part of the subsistence and small-scale commercial catches is consumed locally without being recorded officially. It is also possible that a substantial part of the fish caught in the hinterland are lost due to storage and inefficient processing facilities. The data collection mechanism *in the country needs to be overhauled* so as to ensure that all fish catches are recorded. The production data are probably higher than the figures presented in Table 2.

Despite the fish importation, Nigeria earns foreign exchange from fish exports especially from the exportation of shrimp and ornamental fishes. Concerted efforts are therefore required to increase the fish production to a stage where the country can be self-sufficient.

Research Contribution

Since 1973, my studies and research have largely been in the area of fish population dynamics. Arawomo (1973) reported that the fish genera *Citharinus* and *Distichodus* constituted high proportions of the total fish populations in Lake Kainji. This confirmed the observations of Turner (1970) and Bazigos (1972) that *Citharinus spp* were the most abundant fish in Lake Kainji shortly after its impoundment. The dominance of the *Citharinidae* in the lake was as a result of luxuriant algal growth in the lake on which the fish species fed (Arawomo, 1973, 76, 82). Imevbore and Okpo, 1975; Arawomo, 1976). *Citharinus* and *Distichodus* were observed to grow faster in the lake than in the river, suggesting that the fish groups were well adapted to the lacustrine life (Arawomo, 1973).

During this period of study, Arawomo (1973) reported that only few specimens of *Citharinus* and *Distichodus* caught carrying ripe eggs in the lake. However, the availability of numerous juvenile specimens of the fishes at the mouth of inlets and bays suggested that the fish species breed in the rivers or river-like environments. Thus they migrated in and out of the lake,

The fecundities of *Citharinus latus* ranged from 161,840 to 305,250 eggs, while that of C. *Distichodoides* ranged from 519,850 to 684,500 and *Distichodus rostratus* carried between 293,450 and

699,900 eggs (Imevbore, 1970; Arawomo 1973). Though the fecundities of these fishes are high, their inability spawn in the lake had led to the decline in their population (Ita, 1978). The breeding of the *Citharinidae* in Lake Kainji needs to be further studied. In order to prevent the indiscriminate exploitation of *Citharinus* in the lake and to guarantee the successful breeding as well as halt the decline in the population, Arawomo (1973) suggested the banning of gillnets with mesh sizes below 63.5 mm and the control of fishing during the breeding season at the month of the inlets. These proposed laws are yet to be enforced and hence the continued population decline of *Citharinus* in the lake.

Similar studies carried out in Loch Leven, Scotland revealed that juvenile trout fed on *chironomids, crustacea* and *nematodes* which were abundant in the offshore mud zone of the loch (Arawomo, 1980, 1984). The migration of the juvenile trout into the loch was associated with increased water discharge caused by the floods (Arawomo, 1981). Further growth was reported by Arawomo (1982) in the lake than in the river for juvenile trout because of the high productivity of the lake.

The management of commercial fish species in waterbodies require a knowledge of its reproduction. The is a major link in the life cycle of the fish. Arawomo and Adekeye (1990) reported that *Heterotis niliticus* have a prolonged breeding cycle. The onset of the rain was found to stimulate the initiation of the development of sexual products in both sexes. *Heterotis niloticus* was reported by Arawomo and Adekeye (1990) to have a fecundity of between 2750 and 7060 in the work carried out on Niger river at Patigi. There was an increase in fish catches per unit effort with boat motorization on the transport sector of the riverine fisheries (Adekeye & Arawomo, 1988). This increase in fish production led to the provision of greater employment opportunities and an increase in the per capita income of the fishermen.

River fisheries of Africa are of considerable importance because of the large quantities of fish which are obtained from them. While

sampling the rivers and streams of the Federal Capital Territory, Arawomo (1980, 1987) caught 35 fish species, among which are the following species of economic importance:

Clarias garieperius
Citharinus citharus
Labeo senegalensis
Sarotherodon galilaens
Tilapia zillii
Synodontis resupinatus

Further work on the river of the Federal Capital Territory include pre-impoundment surveys of the fishes of the proposed Jali and Lower Usman reservoirs (Arawomo 1983 a, 1983 b). Arawomo (1987) also reported the presence of 25 fish species in River Gurara which is currently diverted and developed into a reservoir to provide domestic water consumption for Abuja. There is need to carry out a pre-impoundment survey of the proposed reservoir.

Arawomo (1983 d) carried out a survey of the fishes of the freshwater of the Niger Delta. A total of 42 fish species were caught out of which twenty of them could grow to commercial sizes. Arawomo (1983 d) also reported that the freshwater swamps at Yenagoa in Bayelsa State were inhabited by *Clarias gariepinus* and *Parachenna obscera*, which can tolerate low oxygen content waterbodies.

Arawomo (1983 d) also identified organic wastes and sewage, out board motor effluents, fertilizers and pesticides, dredging effluents, industrial effluents and oil spill as sources of pollution that affect freshwater fishes in the Niger Delta basin.

The conservation of the fin-fish fauna of Nigeria and the strategies for conservation were enumerated by Arawomo (1992). These include the banning of obnoxious fishing methods, the regulation of mesh sizes and the protection of fish nursery grounds in waterbodies.

Idowu, *et.al* (1999) also highlighted the effects of tariffs and increased credit facilities on Fishery activities of fishermen in Lagos

State. It was recommended that adequate and sustained assistance should be given to artisanal fishermen to obtain credit as well as a downward review of tariffs on fishery inputs for increased production.

Simulium Control Programme

Arawomo (1980) participated in a study of the effect of control of *Simulium* with DDT on the rivers and streams in the Federal Capital Territory. The level of DDT absorbed in the body tissues of the fishes were determined. The values obtained were however less than the recommended safe concentration level. The DDT was later replaced by ABATE as larvicide for the control of *Simulium* (Arawomo 1983). ABATE was found not to constitute any danger because it did not accumulate in the fish tissues. However, over-dosing with ABATE can be lethal to fish.

Fisheries in Osun State

Arawomo (1996) reported that Osun State has the following large man-made lakes:

(a) Asejire built on Osun River (area 2369.11 ha)
(b) Osogbo/Ede built on River Erinle(area: 1372.7 ha)
(c) Iwo built on R. Ayiba (area: 62.16 ha)
(d) Eko-Ende built on R. Otin (area: 297.45 ha)
(e) Ijebu-Ijesa built on R. Osun and (area: 50.18 ha)
(f) Owalla built on R.Erinle. (area: 3000 ha).

As a participant in the Nationally Co-ordinated Research Programme of the National Agricultural Research Project (NARP), an inventory of the fishes of Owalla reservoir was carried out. The following are the fish species captured in Owalla reservoir as reported by Olayemi (2000):

Gnathonemus senegalensis
Alestes longipinnis
Chrysichtys auratus
Ctenopoma kingsleyae

Hemichromis fasciatus
Tilapia mariae
Tilapia zillii
Sarotherodon galilaeus
Barbus callipterus

Awoyemi (1999), studied the effect of using fertilizer on the growth rates of Oreochromis niloticus and Clarias gariepinus in homestead fish ponds. Fast growth of these fishes were obtained on the application of super phosphate and poultry manure in Osun State.

A survey carried out on the aquaculture potentials revealed that there were five Government owned fish farms with a total size of 39.17 ha and 162 private fish ponds totaling 297.71 ha.

Opa Reservoir Fisheries

Opa reservoir with a size of 0.95 km^2 was formed in 1979 when a dam was built on the Opa river. Since the commissioning of the reservoir, various studies have been going on to monitor the development of such aspects as pollution, planktonic, plant and animal life in the reservoir.

The establishment of a fishery on the reservoir is a secondary benefit. The benefits enjoyed from the Opa reservoir fishery include the provision of more food through a commercial fishery, provision of some form of recreation for staff members through sport fishing and most importantly, the reservoir stands as a natural laboratory for various fishery and hydrobiology research. The fish fauna of Opa reservoir include the following:

Mormyrus rume
Gnathonemus senegalenis
Clarias gariepinus
Heterobranchus bidorsalis
Hepsetus odoe
Schilbe mystus
Synodontis resupinatus

Sarotherodon galilaeus
Oreochromis niloticus
Tilapia zillii
Hemichromis bimaculatus
Hemichromis fasciatus
Macrobrachium spp (prawn)

Arawomo (1983 a) reported that *Oreochromis niloticus* in Opa reservoir was reported to be faster in growth in the new environment. Komolafe & Arawomo (1996) reported on the reproduction of *Oreochromis niloticus* where they exhibited mouth-brooding habits.

Arawomo & Fawole (1997) studied the food and feeding of *Sarotherodon galilaeus* while Fawole & Arawomo (1997) determined the age and growth of *Sarotherodon galilaeus* where six-year groups were identified.

Fawole & Arawomo (1998) also reported on the biparental mouth-brooding habit . Komolafe & Arawomo (1999) studied the distribution pattern of *Oreochromis niloticus* where they were caught within the inshore area. Abayomi (1994) reported that *Clarias gariepinus* in Opa reservoir was an omnivore and had a fecundity of about 650,025 eggs.

Initially, fish was sold to members of staff on regular basis before the influx of poachers who have resorted to the stealing of the University fish, boats and fishing materials. The sampling programme had been disrupted and this has adversely affected the research work of both staff and students.

The problems of the poachers have to be addressed before further work can be continued. Poachers are thieves and they have to be treated accordingly.

Strategies for Attaining Self-sufficiency in fish Production

In order to attain self-sufficiency in fish production, greater attention is needed for increased production throughout the country so as to improve the proportion of animal protein intake in Nigerian diet. The following are suggested to enhance the acceleration of

fisheries development in the inland and marine capture sectors as well as in aquaculture:

(a) Conservation of the river and lake fin-fish fauna through the following means:
   (i) Gear control either by restriction or banning
   (ii) Mesh regulation through the control of mesh size in the mesh selective gear;
   (iii) Site control by creating some areas to serve as reserves; and
   (iv) Season control by regulating periods of fishing in order to prevent fishing during spawning seasons or when the fish are congregated in much reduced water area during dry season or when pre-spawning fish are vulnerable to certain fishing methods.

(b) Enforcement of factors limiting the abundance of fish in rivers and lakes such as: Limiting fishing intensity capable of reducing fish abundance below the level which cannot permit their continuous and profitable exploitation.

(c) Banning obnoxious and illegal fishing practices such as:
   (i) use of poisonous chemicals.
   (ii) use of ichthyotoxic plants in waterbodies so as to maximize catch.
   (iii) use of dynamites, hand grenades and bombs which can lead to mass mortality of fishes.
   (iv) use of castnets and beach seines with small meshes so as to prevent the catching of juvenile fish, and
   (v) use of electric fishing devices except under licence.

d) Prevention of poaching by foreign vessels or poaching by unauthorized fishermen in rivers and lakes.

(e) The transformation of flood plains and swamps into fish culture units.

(f) Enhancement of aquaculture programme through the provision of fingerlings of fast growing fish species such as *Clarias spp*, *Heterobranchus spp*, *Heterotis spp* and *Tilapia spp*.

(g) Assistance in the establishment of fish feeds to meet the demands of aquaculture.

(h) Reduction of post harvest wastage.

(i) Establishment of fish sanctuaries in selected locations all over the country.

(j) Reduction of tariffs on fishing inputs.

(k) Granting of fishing rights to fisheries officers in reservoirs owned by water Corporations, and

(l) Provision of a conducive environment for private sector initiative by the Government.

There are various research personnel on fisheries that are scattered all over the nation. Various results have been produced which can enhance fish production. The collation of these research findings by a national body and the utlization of these research results will help to bridge the gap between supply and demand.

As suggested by Arawomo (1973), the successful breeding of the Citharinidae in Lake Kainji can help to restore the population of the fish. The utilization of the 1.75 million hectares that have been designated as suitable sites for aquaculture and the encouragement of many families to own homestead fish ponds can increase fish supply.

Proper management of the fisheries of the numerous reservoirs built across the country and the development of the vast floodplains for fish culture can help to increase fish yield.

Can Nigeria Attain Self-sufficiency in Fish Production ?

Mr. Vice Chancellor Sir, this question can be better answered by those responsible for decision making in this country. Personally

as a researcher, I strongly believe that we can be self-sufficient in fish production.

Many rivers, streams, natural and man-made lakes and ponds, serve Nigeria. Even the smallest stream can be a source of fresh protein to a community especially in the rural areas. These bodies of water constitute valuable natural resources with a lot of benefit yet to be fully exploited. There is however scanty scientific information on some of these waters. The only solution is to fund research adequately so that our research results can lead to massive fish production that will yield excess fish that can be exported.

Thank you.

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