

**CULTURABLE FISH SEEDS IN NIGERIAN WATERS:  
A RESEARCH SURVEY (1978-1985)**

By

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**ABSTRACT**

The desired species identified in this survey include mullets, catfishes, fast growing fish predators, species for control of weeds and grass in ponds, cichlids and shrimps. Five coastal State: Lagos, Ondo, Bendel, Rivers, and Cross River State were covered in the studies. Investigations were also carried into the major rivers and their tributaries. A combination of the estimation methods of Le Cren (1962) and Pitcher and Mac Donald (1973) was employed in the analysis of data. From the detailed data collected from (1978-1985), the survey indicated that about 100 million fish seeds can be collected annually from Nigerian waters using appropriate gears - seine nets, cast nets, and fish traps. Of this number, 60% is available along the coastal belt of the country while 40% is in the major rivers, their tributaries and swamps. At the present level of fish culture development in Nigeria, this is more than enough, even after allowing for 50% mortality due to handling and transportation stress.

**INTRODUCTION**

A key priority area that is often neglected in fish farming in developing countries is the under exploitation of the abundant culturable fish seeds in their natural environment. Rather, emphasis seems concentrated on the establishment of indoor hatcheries that have never functioned

This is a misplaced priority because of the capital intensive nature of hatcheries and highly skilled personnel to make them functional. In order, therefore, to accelerate fish culture development in Nigeria, and some countries of Africa, a detailed research work is needed to map out nursery beds of the most desired species, their breeding habits, and breeding seasons with a view to collection of their seeds at the peak period for stocking of fish farms. The success on the establishment of both pond and indoor hatcheries also depends on the knowledge gained from the study of each individual breeding characteristics.

This research survey (1978–1985) presents a fairly detailed information on quantity of culturable fish seeds available in Nigerian coastal and inland waters, periods of peak abundance, factors effecting their natural abundance and suitable gears for collection of the seeds from the wild with minimum stress.

## METHODOLOGY

During the period January 1978 – October 1985, research trips were made to fish landing sites of each state and to established fish markets. Areas (Figures 1–2) which hitherto were inaccessible water-logged terrain, especially in Rivers and Bendel States were covered with speed boats made available by Federal and State Departments of fisheries. Data on total length and weight of each culturable species were collected for the fry, fingerlings and adults. Floating fertilized eggs, where located, were collected, and preserved in *Gilson's fluid*. Soil samples were collected from areas identified as nursery beds and salinity measurement taken from such areas. Fecundity studies of adult specimens were carried out from samples collected directly from fishermen and some from fish markets.

Landing statistics of spawning adults were also taken. Using LeCren (1962) and Pitcher and Madonald (1973) estimation methods (Table 1) the number of fish eggs laid in our waters was estimated. The final figures of fingerling survival and abundance in our waters were arrived at by calculating 20% of the total number of eggs laid as corrected by the study group. The variables against successful spawning of the species in their natural environment were properly taken care of.

The identification of fry and fingerlings of the desired species was made easier by the Taxonomic keys provided by FAO and other workers.

## RESULTS

The most desired fish species for culture in Nigeria, their peak periods for the collection of their seeds from the natural environment are listed in tables 2–6.

### I. Mulletts.

*Liza falcipinnis*, *Liza grandisquamis*, *Mugil cephalus*. For centuries, growing of mullets in ponds or confined environment has been the common practice in South-East Asia, India, the Pacific basins, the mediterranean East European countries and many parts of Central America. From available literature, Irvine (1947) listed seven species of Mulletts for Ghana, Daget and Utis (1965) listed five for Ivory Coast, Pillay (FAO/UN, 1965) identified four species for the coast of West African between 20°N and 15°S, while Fagade and Olaniyan (1973) listed six species for Lagos lagoon and also indicated *Liza falcipinnis* as the most abundant.

Since the technology of growing and spawning of mullets in ponds and indoor hatcheries has been well developed in other regions, the species offers a very good prospect for commercial farming in West African sub-region. From the work of Sivalingam (1975), Ezenwa, (1973 and 1977), mullets have been found to grow very well in polyculture systems with the common carp, *Cyprinus carpio*; the catfish, *Chrysichthys nigrodigitatus* and the cichlids, *Tilapia* spp.

With a view to accelerating the culture of mullets in Nigeria, the research study identified three major species namely *Liza falcipinnis*, *Liza grandisquamis* and *Mugil cephalus*. A total number of 12.5 million mullets fingerlings of the three species could be collected annually from the Nigerian coastal waters; 3 million for Lagos State 2 million for Ondo State; 2 million for Bendel State; 3.5 million for Rivers and 2 million for Cross-Rivers State. These figures were grossly under estimated if one looks at the number of eggs per mature female mullet. As many as one million eggs are released by one adult female mullet and in established hatcheries, three males are needed to accomplish a successful fertilization of the eggs, (Rober and Walter, 1975).

In the Lagos area, along the shorelines of the lagoon and the isolated pools at the harbour mouth, *Liza falcipinnis* was very abundant all year round but more in June and July. The other two species, *Liza grandisquamis* and *Mugil cephalus* are found more at the mouth of the major rivers that flow into the sea and shore lines of creeks, estuaries and lagoon systems. They are dominant during the high Salinities 20‰ of the year; March–May and October to December. *Liza grandisquamis* also tolerates low salinities (1‰–5‰).

Appropriate gears for collection of mullet fingerlings during their peak periods with minimum stress are shore seines, drift nets, and cast nets.

## 2. The Catfishes

- (1) *Chry. nigrodigitatus*
- (2) *Clarias lazera* (Mud catfish)
- (3) *Heterobranchus bidorsalis*
- (4) *Heterobranchus Longifilis*

There is the possibility of a mono-culture catfish industry in Nigeria because of the rapid growth and diverse species available in the country. The detailed biology of the most desired species *Chrysichthys nigrodigitatus* (Lacepede) has been given by Ezenwa (1978 and 1981). The fingerlings are found to be more abundant in fresh water and in the low salinity brackish water lagoons and estuaries of the Country, during the period May–September of each year. Eight million fingerlings could be collected annually from the natural environment by use of fish traps and hook and line. The species keeps to the bottom of the ponds, feeding on the surface layers of the soil. It therefore grows well in poly-culture systems with either *Liza falcipinnis* or with *Tilapia guineensis* which are surface feeders.

**Table 1. Population estimation of number of eggs laid by the Catfish *Chrysichthys nigrodigitatus* in Warri/Burutu (Creeks) Estuaries (July - August 1982)**

Age group	Mean Length (cm)	Mean Number eggs	No. of spawning females sampled	Estimation of total eggs laid		
				*Lecren (1962) simple multiplications methods	*Pitcher and Mac Donald (1973) correct integral	*Ezenwa et al (1985) 50% reduction method
1	34	10,000	1560	15,600,000	20,280,000	7,800,000
2	45	20,000	850	17,000,000	22,100,000	8,500,000
3	55	25,000	620	15,500,000	20,150,000	7,750,000
TOTAL				48,100,000	62,530,000	24,050,000

N.B. \*Lecren (1962) estimated total number of eggs laid, by multiplying mean number of eggs by number of spawning females.

\*Pitcher and MacDonald, (1973) used 30% under-estimation errors of Lecren (1962).

\*Ezenwa et al (1985) used 50% reduction values of Lecren (1962) due to ecological problems against natural spawning.

\*In tables 2-6, figures of fish seeds obtained were based on assumption that 20% of total eggs laid survived as fingerlings for collection.

Table 2 – Culturable fish seeds in Lagos State

Species	Locality	Time of year	Estimated Population (million)
Mullets <i>Liza falcipinnis</i> <i>Mugil bananensis</i> <i>Liza grandisquamis</i>	Shore lines of Lagos lagoon and Tarkwa bar	April–July	3
<i>Chry. nigrodigitatus</i>	Badagry, Lagos and Epe Lagoons	May–August	1
<i>Clarias lazera</i>	Badagry and environs.	June–September	1.0
<i>Heterotis niloticus</i>	Badagry, Epe and Lekki and Environs	July and August	1.0
<i>Tilapia guineensis</i> <i>Sarotherodon galilaea</i> <i>Tilapia zilli</i>	Shore lines of Lagos, Ojo, Lekki Epe lagoon system	March–July	3
<i>Tarpon (megalops) atlanticus</i>	Shore lines of Lagos Lagoon	April–May	0.1
<i>Lutjanus goreensis</i> (red snapper)	Tarkwa bay and Shore lines of Lagos Lagoon	March–June	0.05
<i>Pomadasys jubelini</i> (grunter)	Tarkwa bay and shore line of Lagos Lagoon	January–March	0.01
<i>Elops lacerta</i>	Tarkwa Bay and shore lines of Lagos Lagoon	June–July	0.15
<i>Penaeus notialis</i> (Shrimps)	Tarkwa bay and shore lines of Lagos Lagoon	April–July	2

Of recent, doubts have been raised by fisheries taxonomists as to the correct identity of three other species of *Chrysichthys* reported in Nigerian fresh and brackish waters,

- (a) *Chrysichthys auratus longifilis*?
- (b) *Chrysichthys walkeri*?
- (c) *Chrysichthys furcatus*?

Examination of the gonads by Sivalingam (1972); Ezenwa, (1974, 1978, 1981) gave an indication that *C. auratus longifilis* and *C. walkeri* are probably one species. The external characteristics of the head of what is thought to be *C. walkeri* may be the breeding characteristics of the male of *C. longifilis*.

Specimens with these characteristics are present throughout the year and more abundant in low brackish water areas of the lagoons and estuaries (1%–3%). During the fry and fingerlings stages, they are often confused with those of *C. nigrodigitatus*.

A similar question, again, on taxonomy, is raised about *C. furcatus*. Ezenwa (1981) reported that during the breeding season, the sides of the adult male of *C. nigrodigitatus* become extended laterally forming a pouch-like structure, and as a result the snout assumes a semi-circular "C" broad shape. Specimens called *C. furcatus* could possibly be the adult mature male of *C. nigrodigitatus* since they are often very rare in catches of fishermen.

Another group of more desired catfishes belong to the family claridae. The most important species are:—

- (i) *Clarias lazera* (mud - catfish)
- (ii) *Heterobranchus bidorsalis*
- (iii) *Heterobranchus longifilis*.

To a casual observer, *Clarias lazera* has identical external features with *Heterobranchus* spp. They are now widely cultured in fresh water fish farms. Growth rate has been reported to be very rapid at Enwazor's Fish Farm, Onitsha Anambra State. *Heterobranchus longifilis*, cultured with *Tilapia zilli*, has recorded a growth rate of 2kg. in 12 months, much faster than the mud catfish, *Clarias lazera*.

Similar results have been noted at Nigerian fish farms limited, Patani, in Bendel State. (Ezenwa, 1982/83, personal observation).

*Clarias lazera* and *Heterobranchus* spp. are found to live in swamps and Rivers. They are very common in swampy areas of the major Rivers of the country. The gonads are well developed between June and September for *Heterobranchus* spp. Fry and fingerlings are most abundant during the receding floods (November, —January).

The fingerlings of *Clarias lazera* (Mud—catfish) are available all year round but most abundant in June, July, and August in the tributaries and swamps of the major rivers of the country

### (3) Selected Predators.

- (i) *Tarpon atlanticus*
- (ii) *Elops lacerta*
- (iii) *Lutjanus goreensis* (snappers)
- (iv) *Pomadasy jubelini* (grunter)
- (v) *Gymnarchus niloticus*

Table 3 — Culturable fish seeds in Ondo—State

Species	Locality	Time of year	Estimated Population (million)
<i>Tarpon (megalops) atlanticus</i>	Shore lines of coastal areas: (Aiyetoro)	February-May	1
<i>Liza falcipinnis</i> <i>Liza grandisquamis</i>	Shore lines of coastal areas	March—June	2
<i>Chry. nigro digitatus</i>	Rivers lagoons: estuaries.	June—August	2
<i>Tilapia zilli</i> <i>Tilapia guineensis</i> <i>Sarotherodon galilias</i>	Rivers and shore lines of coastal areas	April—October	3
<i>Clarias lazera</i> <i>Heterobranchus spp</i>	Tributaries of River & swamps	June—September	1.5
<i>Gymnarchus niloticus</i>	Shore lines of Rivers and Tributaries.	August—October	1
<i>Heterotis niloticus</i>	Shore lines and swamps of Rivers	June—August	1

At the present level of fish culture development in Nigeria, the best culture system suitable for Nigerian fish farms is the stocking of fast growing predators with the fast-reproducing cichlids *Tilapia* spp. in the appropriate ratio. For the past five years, the Institute carried out trials on the best predator for brackish water fish farms. *Tarpon (megalops) atlanticus* has been found to grow up to 1kg. in three months when grown with *Sarotherodon galilias* (Ebietomiyeand Ajana 1982); 1.6kg in six months (Ezenwa and Aiegbeleye, 1984) incorrect stocking ratios of 1:16 i.e. fingerling (12–16cm T.L.) together with 8 breeding females and 8 males. The fingerlings of *Tarpon atlanticus* are very abundant in the coastal waters of Ondo State around Aiyetoro in the months of April, May and June. They come into Lagos lagoon areas during the peak rainy season. Its distribution seems restricted to the Western part of the coastal waters including Bendel State. It was not identified in the eastern zone of the country throughout the period of study. Since it tolerates fresh water conditions, plans are at hand to transport their fingerlings to fresh water ponds.

In the Eastern and Western parts of the coastal waters, the other equally fast growing predators — *Elops lacerta*; *Lutjanus goreensis* (shapper) and *Pomadasys jubelini* (grunter) are very abundant, January — March, at the shorelines of coastal waters at Bodo, in Rivers State and Ikot Abasi, and Oron, in Cross River State, Burutu/Warri estuaries in Bendel, Aiyetoro and environs in Ondo State and Tarkwa bay and Lagoon systems in Lagos State. The species, *Gymnarchus niloticus*, is very popular in fresh water ponds in Nigeria and grows very rapidly in *Tilapia* ponds. The species lives mainly in swamps, where during the floods, build spawning nests of grass. Fingerlings are very abundant in the major rivers and their tributaries by October, November and December annually.

#### (4) Cichlids.

- (i) *Tilapia guineensis*
- (ii) *Tilapia (Sarotherodon) galilias*
- (iii) *Tilapia zilli*.

The three cultivable species of *Tilapia* studied in this survey are abundant in fresh and low brackish waters of Nigeria, *Tilapia guineensis* is less prolific than *Sarotherodon (Tilapia) galilias* and is common in areas where vegetation is abundant. The former grows better in ponds and in the wild attains a growth range of 1kg — 1.5kg.

Both species have been recorded in waters where salinities are up to 30‰.

*Tilapia zilli*, is predominantly found in fresh water but is reported to be abundant in very low brackish water (0.5% – 1.5‰) areas of the country from Badagry lagoon, Epe lagoon, Warri creeks and estuaries; and parts of Rivers and Cross River States with such low salinities. *Tilapia* generally are plankton and detritus feeders and readily accept all locally available food materials like groundnut cake, palm kernel cake, rice bran etc.

Fingerling collection from the wild is by means of traps and shore seines.

**Table 5 – Culturable fish seeds in Rivers State**

<i>Species</i>	<i>Locality</i>	<i>Time of year</i>	<i>Estimated Population (million)</i>
<i>Mugil cephalus</i> <i>Liza grandisquamis</i> <i>Liza bananesis</i>	Shore lines of the coastal areas, lagoons, estuaries, creeks.	March–July	3.5
<i>Chry. nigrodigitatus</i>	Major Rivers and tributaries.	May–September	1.5
<i>Elops lacerta</i>	Shore lines of coastal areas	June–July	0.5
<i>Lutjanus</i> spp (snapper)	Bodo, Opobo Baguma, etc.	May–June	
<i>Pomadasys</i> (grunter)	Shore lines of coastal areas	January–March	0.5
<i>Clarias Lazera</i>	tributaries and swamps of major Rivers	June–September October–December	1.0
<i>Hetero branchus</i> spp			
<i>T. zilli</i> <i>T. guineensis</i> <i>S. galilaea</i>	Shore lines of coastal areas & major Rivers	April–October	3.5
<i>Heterotis niloticus</i>	Major Rivers	June–July	
<i>Distichodus</i> spp	Major Rivers	June–July	1.5
<i>Penaeus notialis</i> (shrimps)	Shore lines of coastal areas	March–May	1.5



Table 6 – Culturable fish seeds in Cross River State

Species	Locality	Time of Year	Estimated Population (million)
<i>Mugil cephalus</i> <i>Liza grandisquamis</i> <i>Liza bananensis</i>	shore lines of the coastal areas e.g. Ikot Abasi Oron, Itu etc.	March–July	2.0
<i>Chry. nigrodigitus</i>	Shore lines of Cross Rivers and tributaries (Itu & Oron)	June–September	1.5
<i>Tilapia zilli</i> <i>Tilapia guineensis</i>	Shore lines of the coastal area	April–September	3.5
<i>Sarotherodon galilaea</i>	Rivers and tributaries		
<i>Pomadasys spp.</i> (grunter)	Shore lines of the coastal areas	February–April	0.5
<i>Lutjanua spp</i> (snapper)	Shore lines of the coastal areas	June	0.5
<i>Gymnarchus niloticus</i>	Shore lines of Cross River at Itu and Tributaries	July–October	1.5
<i>Heterotis niloticus</i>	–do–	June–August	1.05
<i>Distichodus spp</i>	–do–	July–August	1.0
<i>Clarias lazera</i> <i>Heterobranchus spp</i>	Major Rivers tributaries and swamps	October–December	1.5
<i>Penaeus notialis</i> (shrimps)	Shore lines of coastal areas	April–July	1.5

(5) Fish species for weeds and grass control in ponds.

- (i) *Heterotis niloticus*
- (ii) *Distichodus brevipinnis*
- (iii) *Distichodus rostratus*

Many ponds in Nigeria are often covered with weeds and grass during the rainy season. Some pond owners have for the past ten years expressed interest on the exotic grass carp. It has been stocked in Nigerian Fish Farms Limited, Patani and recommended for all pond owners with problem of too much weeds and grass. Specimens caught during the survey were dissected and the long intestine were found to be filled with grass. In natural environment, *Distichodus brevipinnis* *D. rostratus* generally live along the grassy shores of rivers, their tributaries and swamps. During the floods (June, July and August) fingerlings are abundant in the catches of fishermen especially around Forcados River, River Niger, Excarvos and Calabar River and Cross River. Few dissected specimens from Forcados Rivers, indicated very large ovaries that contained many eggs.

The fingerlings of *Heterotis niloticus* are abundant in major rivers, tributaries, and swamps in June, July and August. The species grows very well in ponds and reservoirs with problem weeds. It spawns very easily in such environment. Spawning was recorded in 1982, 1983 by the survey team at Nigerian Fish Farms Limited, Patani.

*Penaeus notialis* (shrimps).

Interest in shrimp culture has increased among Nigerians for the past five years. Request for shrimp culture have come mainly from residents of the coastal belt where the larvae of the shrimps come into the creeks with the tide. Although technology in shrimp culture is non-existent in the country, efforts have been made by the Institute to culture the incoming larvae with mullets and Tilapia. Results obtained have been encouraging (Sivalingam and Ezenwa, 1973). Data from this survey indicated an abundance of shrimp larvae to sustain any commercial culture pending the establishment of shrimp hatchery in the country. Peak period of abundance of juveniles in lagoons, creeks and estuaries in Nigeria falls between May and July. During this season, they are generally caught in traps by fishermen. The juveniles are more abundant in the lagoons during high tidal periods. An estimated seven million juveniles could be collected annually from the coastal waters.

## DISCUSSION

Fish production through Aquaculture in some countries has contributed to a considerable extent towards meeting national demand. In United States of America, it is 11% of the overall fish production, in China 50%, and Israel, 25%. The figure in Nigeria is 0.4%. If Nigeria is to raise her present production level of 20,000 tons (Okpanefe et al 1984) to 100,000 tons of fish through aquaculture by the year 2,000 certain key priority areas have to be developed. Top on the list is the full exploitation of seeds of desired species from their natural environment.

To raise two tons per hectare of table sized fish from ponds in Nigeria needs about seven thousand fingerlings at our present level of fish culture development. To meet the projected figure of 100,000 tons of fish through Aquaculture in the next fifteen years, the country needs an established pool of 350, million fingerlings annually. How can we meet this figure. Over 50% of this requirement must come from the wild while 10% from indoor and pond hatcheries. Data from the present survey have proved that 100 million fish seeds can be collected annually from both fresh, brackish and marine waters of the country.

The major highlights of the research survey include fish seed migration along the various ecological zones as shown in figure 3 isolation of fish species, and overlapping of feeding habits.

The Nigerian water environment is classified according to salinity level from the works of Olaniyan (1957), Moore (1963), Ikusemiju (1973) Ezenwa, (1978, 1981). What is regarded as Marine environment has a salinity of above 30‰; High brackish water (20–29.9‰), mid-brackish water 0.5–9.9‰, fresh water (0.0–0.5‰). Certain cultured fish species are euryhaline e.g. mullets, *Liza falcipinnis*; *Tarpon atlanticus* (predator); the catfish, *Chrys. nigrodigitatus* (up to 30‰); and *Tilapia guineensis* and *Sarotherodon Tilapia galilaea* (up to 30‰). The fish seeds of the mentioned species are most abundant in the low brackish and fresh water conditions. They could easily be conditioned to live in fresh water ponds. The seeds of *Mugil cephalus* and *Liza grandisquamis* prefer the high salinity zones (25% – 32%). Such seeds are more abundant at the mouth of harbours, estuaries, lagoons, and shore lines of the coastal belt.

It was also observed by the research team that there is an incidence of over-lapping of feeding habits of the desired species. The seeds of mullets, *Tilapia* spp. and shrimps are essentially plankton and detritus feeders. There is therefore serious competition for food. In the Lagos area, the fingerlings of the more desired and fast growing *Tilapia guineensis* are gradually phasing out and being replaced by the more prolific *Sarotherodon galilaea*. The ratio of abundance of the two species a decade ago was 10:1 (Sivalingam and Ezenwa, 1973) in favour of *S. galilaea*. The ratio was found to be 20:1 (Ezenwa and Alegbeleye, 1984). Similar competition was observed in the three species of mullets but not to a very serious extent.

Certain ecological restriction of the cultured species were also observed. The fast growing predator, *Tarpon (megalops) atlanticus* seems restricted to the Western zone of Nigeria while *Elops lacerta*, *Lutjanus* and *Pomadasys* are more abundant in the Eastern zone of the coast. This type of distribution reduces the incidence of severe competition for food.

Certain key factors affecting population abundance of desired fish seeds were identified. Use of explosives and over-fishing, destruction of juvenile schooling areas by modern coastal development as happened in Lagos areas (1974–1980) have significantly reduced the members

available for collection by farmers. Oil pollution is very common in Bendel, Rivers, and Cross River areas. Industrial and human wastes are dumped in lagoons, estuaries, creeks and the major rivers. The nursery grounds of most of the cultured species are destroyed and the nation loses considerably in terms of fish production. The nature of the bottom sediments along the coast is identified as a factor which affect population abundance of fish seeds. The coastal area is made up of sand, silt clay, and very rocky portions. Some nutrients available in the soil are utilized for plankton formation. If absent in the soil, abundance of seeds will be reduced. Tilapia and mullet fingerlings pick up detritus from the muddy areas, hence their large numbers in Lagos and Delta areas of the coast. Some demersal species like *Lutjanus* spp. (snappers) tend to keep close to rocks when such shelter is available (Sivalingam, 1974). Their fingerlings can be collected from small bays and crevices along estuaries.

The key areas of future research will include the development of gears for collection of the seeds and transportation facilities, since over 80% are located in most inaccessible water-logged areas of the coastal waters.

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Fig. I Map of Three Coastal States, Lagos, Ondo, and Bendel Showing the Lagoon Systems and Major Rivers.

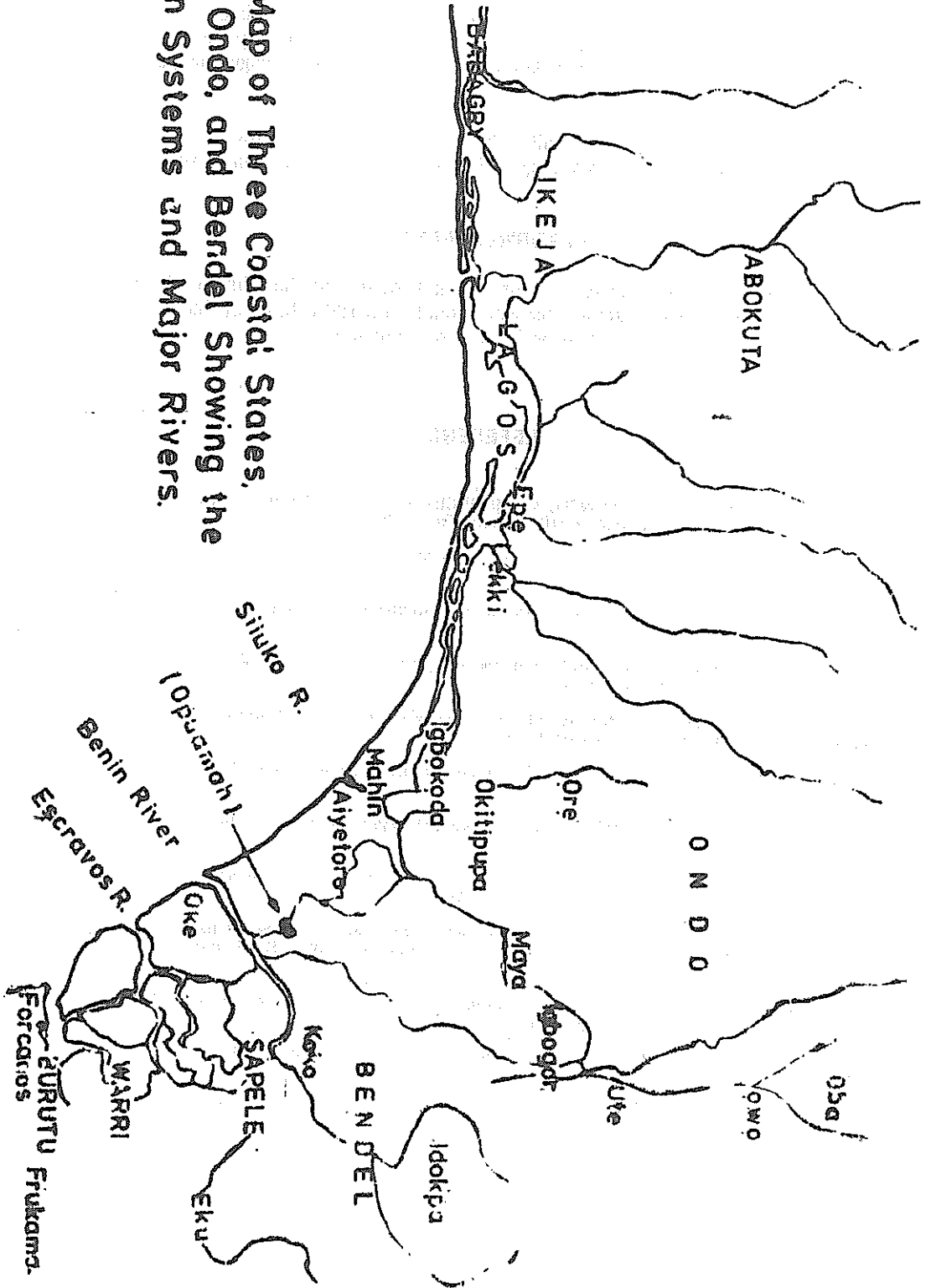
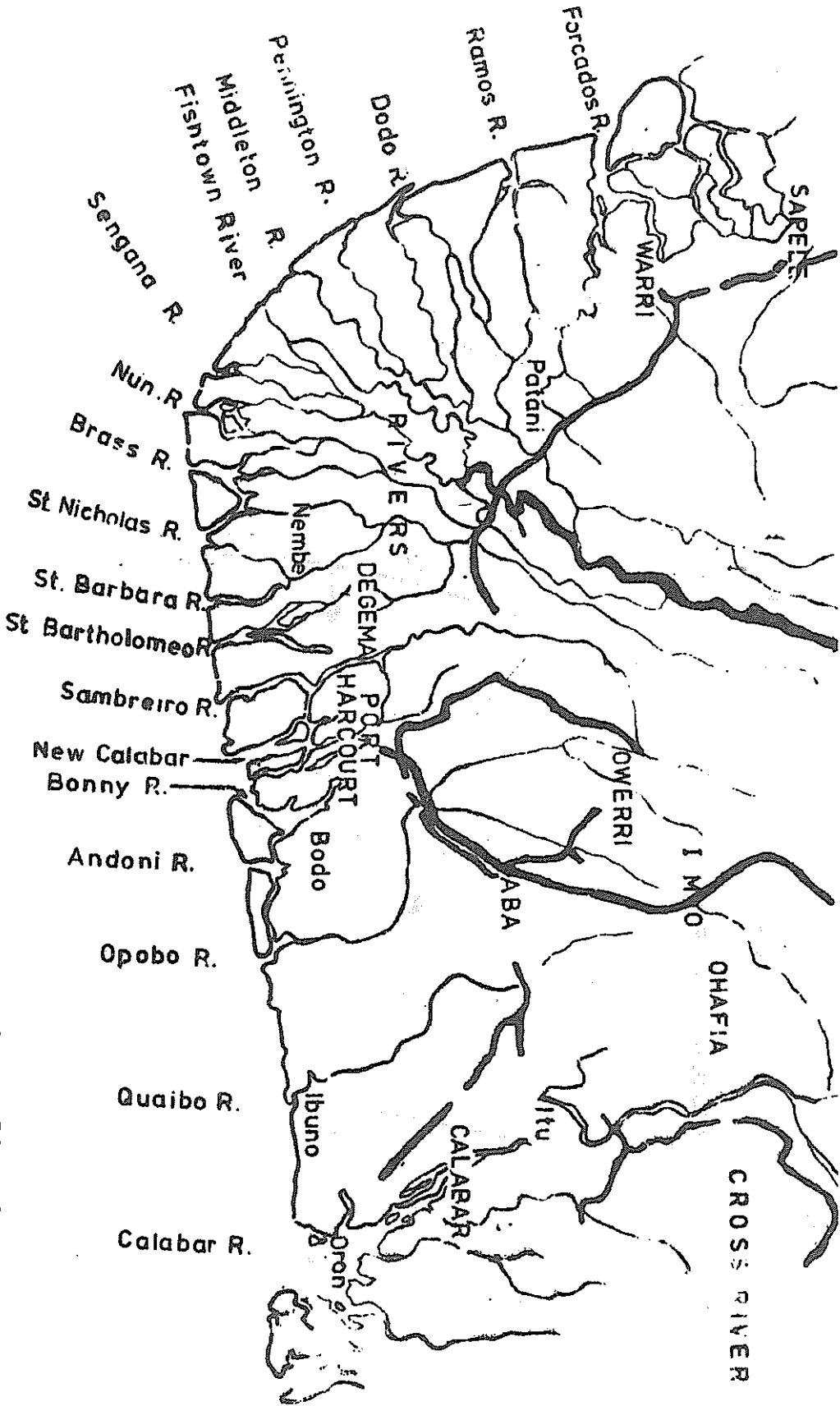


Fig. 2: Map of Two Coastal States, Rivers and Cross River Showing Lagoon, estuaries, and Major Rivers.



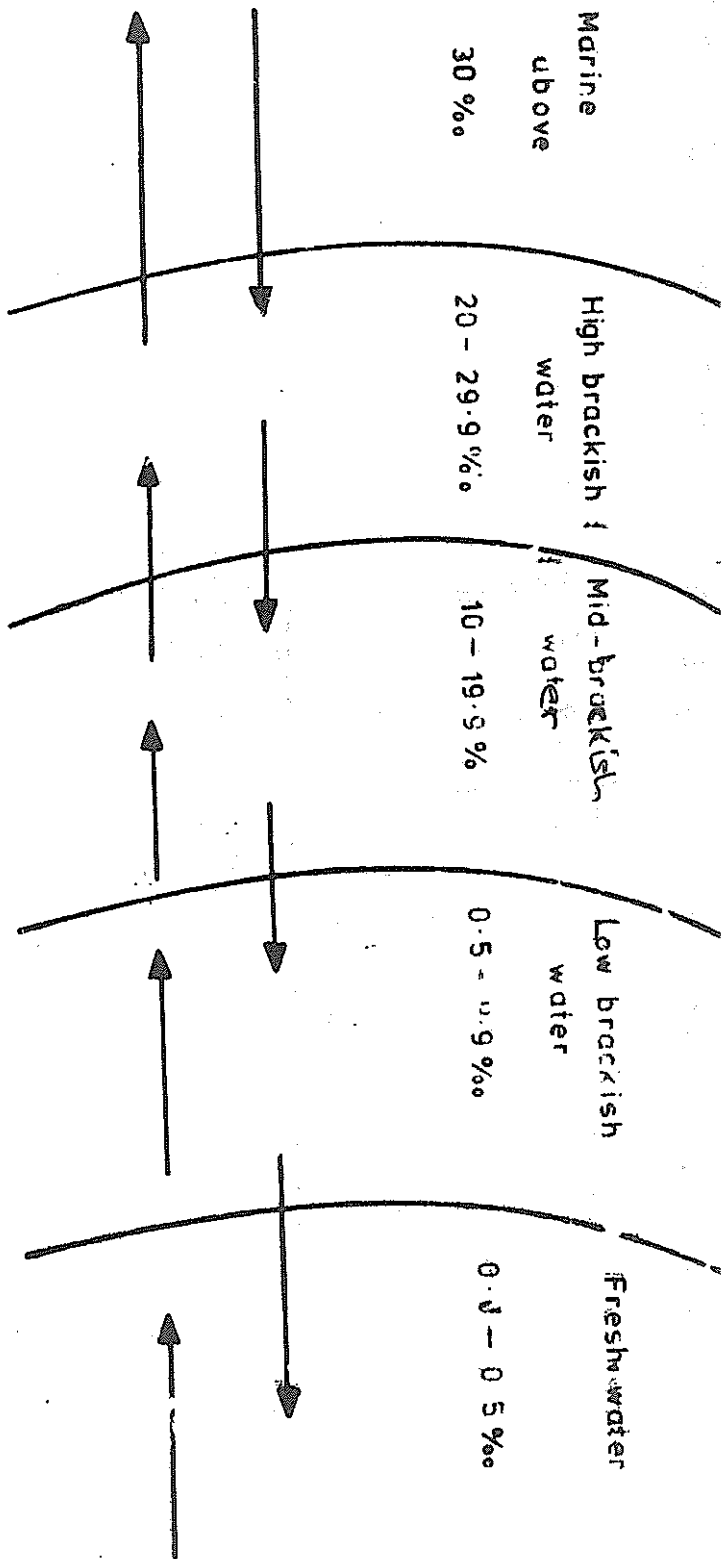


Fig. 3 Fish migration – Showing various ecological zones along Nigerian Coast.