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Problems of development and management of ocean resources

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PROBLEMS OF DEVELOPMENT AND MANAGEMENT OF OCEAN RESOURCES IN NIGERIA

by

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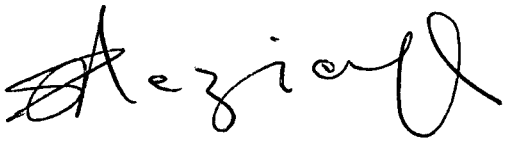
The contents of this paper reflect my personal views and are not necessarily endorsed by the UNIVERSITY.

Signature: 

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Dedicated to my mum, Iweanyi.

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Problems of Development & Management of Ocean Resources in Nigeria

Abstract :

Nigeria, a coastal state with 853 Kilometres long coastline in the eastern seaboard of the Atlantic Ocean, occupies a strategic position both in terms of shipping activities and also economic activities related to the exploitation of marine resources.

The barrier-islands/mangrove fringed coast offers splendid conditions for a variety of tropical fish species as well as crustaceans and these have provided the means of subsistence for the many coastal inhabitants.

In addition to the exploitation of large deposits of aggregates offshore, the country has also been associated with hydrocarbon exploitation since the mid-1950s. Hydrocarbon resources have proved to be the country's economic mainstay in recent years.

The new legal regimes of the sea imposes far greater responsibilities on coastal states for the development and management of ocean resources.

This thesis examines some of the problems associated with the exploitation of ocean resources in Nigeria, and this, in the light of Nigeria's recent accession to the 1982 UN Convention on Law of the Sea. Chapter one reviews the basic hydrography and geological structure of the area while the characteristics of the fisheries as well as their development and management are discussed in chapters two and three.

Chapter four looks at the specific problem of sharing the fisheries resources in Nigeria's EEZ with neighbouring countries in the Gulf of Guinea. The strategies for

development and management as well as the need for cooperative conservation measures are discussed.
Chapter five reviews the offshore potentials of non-living resources as well as the current management measures being applied.
Multiple sea-use conditions and conflicts, especially between hydrocarbon exploitation and the fragile mangrove ecosystem, and the fisheries resources, are reviewed in chapter six while chapter seven discusses the value of law in relation to the enforcement of management measures. It also stresses the need for education of the public and also the various officials of the enforcement agencies.

The growing economic interests on the ocean calls for greater understanding of the marine sciences. The status of marine scientific research in Nigeria, as well as the need to incorporate research findings in management strategies are also discussed in chapter eight.
In chapter nine, a suggestion for a marine policy is provided and an attempt is made at defining an integrated marine policy. A brief review of the countries with such integrated coastal/ocean development strategies is also provided.

In conclusion, the thesis outlines the manpower requirements for the development of the technical and managerial expertise necessary for the effective exploitation and regulation of Nigeria's ocean space.

Chapter 1

Introduction

1.1 Geography

The Federal Republic of Nigeria (fig.1) lies almost at the eastern end of the broad sweep of the West African coastline and is demarcated by latitudes 4 degrees and 14 degrees North and longitudes 3 degrees and 15 degrees East.

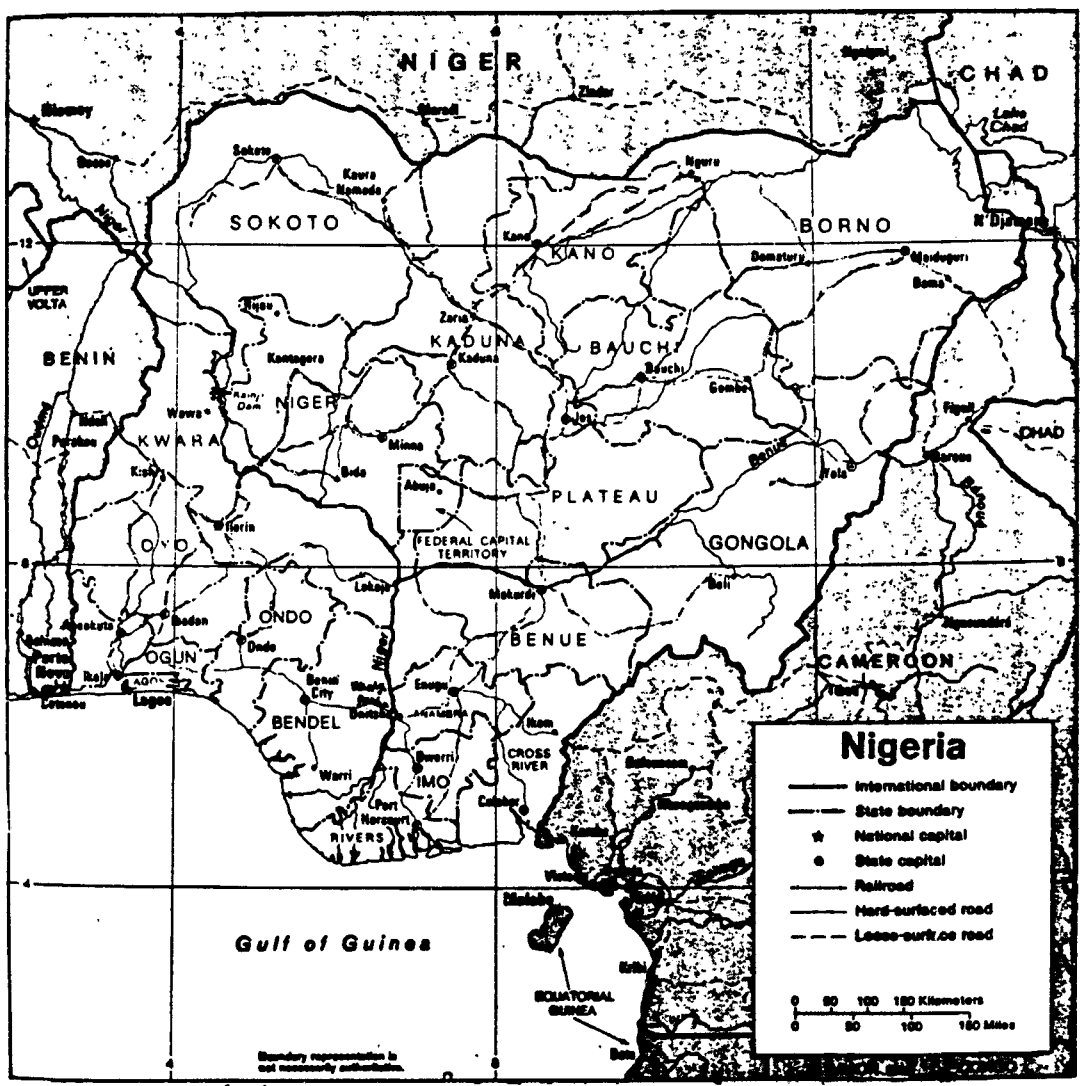


Fig. 1 Map of Nigeria.

The country is bounded on the west, north and east by the French-speaking republics of Benin, Niger and Cameroon respectively and on the south by the Atlantic Ocean.

The 853-kilometre -long coastline is characterised by being relatively straight and with few natural indentations. A strong longshore drift along the surf-beaten coast gives rise to the formation of sand bars ,blocking enterances to harbours and necessitating constant dredging and sand-removing operations (Akin L Mabogunje,1984). Its other feature is a large river delta which is flanked by a series of barrier islands and mangrove -fringed lagoons with few outlets to the ocean (Adejuwon J. O ,1970).

With its generally low relief and location well within the tropics, Nigeria has a climate which is characterized by relatively high temperatures (annual maximum approx. 32 degrees Centigrade) throughout the year.

The hydrography of Nigeria is dominated by the River Niger, which enters the country from the north-east and flows south into the Atlantic Ocean through a wide and very complex delta region.

1.2 The Gulf of Guinea : Basic Hydrography & Geological Structure.

The geographically distinct regional sea of the Gulf of Guinea (fig.2) includes all the West African coastal areas and also adjacent areas extending from the northern boarder of Mauritania to the southern boarder of Angola (FAO,1980).

This area has been the subject of study of several expeditions by countries outside the area, e.g. the Woods

Hole Oceanographic Institution, U.S.A, study of the geophysical and geological nature of the East Atlantic continental margin, studies by the Kiel Institute, Federal Republic of Germany, and the Bedford Institute of Oceanography, Canada. There have also been extensive studies by various West African based institutes such as the French ORSTOM Institute which has a permanently manned station in the Ivory Coast and the Congo, and the Nigerian Institute of Oceanography & Marine Research which is based in Lagos .

Coastal features, Continental shelf Bathymetric resources.

The continental shelf is relatively narrow in the north of Senegal and Mauritania but broadens off Guinea-Bissau and off Nigeria, Ghana and Sierra Leone where it exceeds 100 nautical miles, narrowing again to less than 10 nautical miles off Angola (See Table 1). The coastline especially that round the Gulf of Guinea is low-lying and has many lagoon systems, some of which are only connected to the sea at certain times of the year.
In broad terms the seabed depth and structure are reasonably well charted e.g. off Senegal and the Gambia (Marshall,1977) but there are areas of detail especially in the delta regions and immediate coastal zone, e.g. off Guinea-Bissau which are ill defined.
The main circulatory pattern show in the Gulf of Guinea an overall eastward anticlockwise movement dominated by the Guinea current but with an inshore southerly flow, which in northern summer months reaches just south of the equator.

1.3 Hydrographic regime in relation to biological resources.

A summary of this relationship has been provided by Williams (1968). The most significant feature in biological

terms is the existence for part of the year at least, of a thermocline between the Tropical Surface Water (TSW)

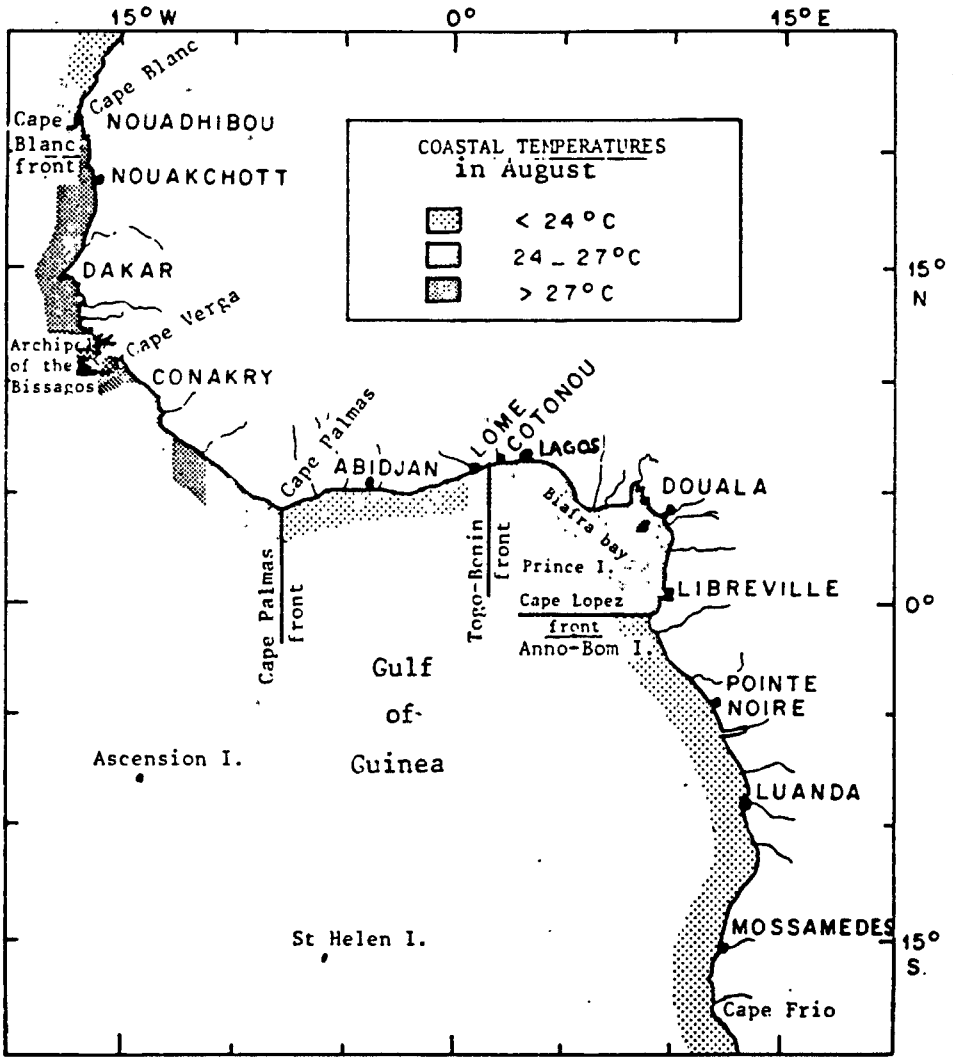


Figure 2 - Location of the superficial layer and upwelling zones (surface T° > 24° C) during the Northern summer

and the South Atlantic Central Water (SACW). The upper limit of the thermal discontinuity is the sharpest, and it lies generally around the 25 degrees (C) isotherm; the lower limit approximates to the position of the 19 degrees (C) isotherm. The thermocline inclines downward offshore and is generally at an average depth of 20 to 35 metres over most of the region. In regions where hydrographic climate vary with season, the thermocline does not persist throughout the year but it can be found in some regions all year round.

The Gulf of Guinea (see fig.2) has been classified into five basic hydrographic zones :

a. North Transi8tional Zone (NTZ) extending from Cape Blanc in Mauritania to Cape Verga in Guinea.

b. Western Tropical Zone (WTZ) extending from Cape Verga to Cape Palmas in Liberia

c. Central Upwelling Zone (CUZ) from Cape Palmas to Cotonou in Benin.

d. Eastern Tropical Zone (ETZ) from Cotonou to Cape Lopez in Gabon.

e. Southern Transitional Zone (STZ) from Cape Lopez to Cape Frio in Angola.

The Tropical Surface Water of the Gulf of Guinea is warm and has a low salinity T > 24 degrees C, S<35‰, and can reach a thickness of 30 to 40 metres.
Along with the appearance of seasonal upwellings, during which the colder water that lies just beneath comes up to replace the warm layer on the surface over the

shelf,the vertical and horizontal frontiers (the fronts and thermocline, respectively) are subject to seasonal movements which manifest themselves locally, by oscillations in the thickness of this superficial warm layer (including its temporary disappearance) and, in its extension by shifts in position all along the coast of the northern front and the southern front and the upwellings which follow them in the direction of the poles (upwelling associated with the Canary Island current system and upwelling associated with the Benguela current system) (see fig.3).

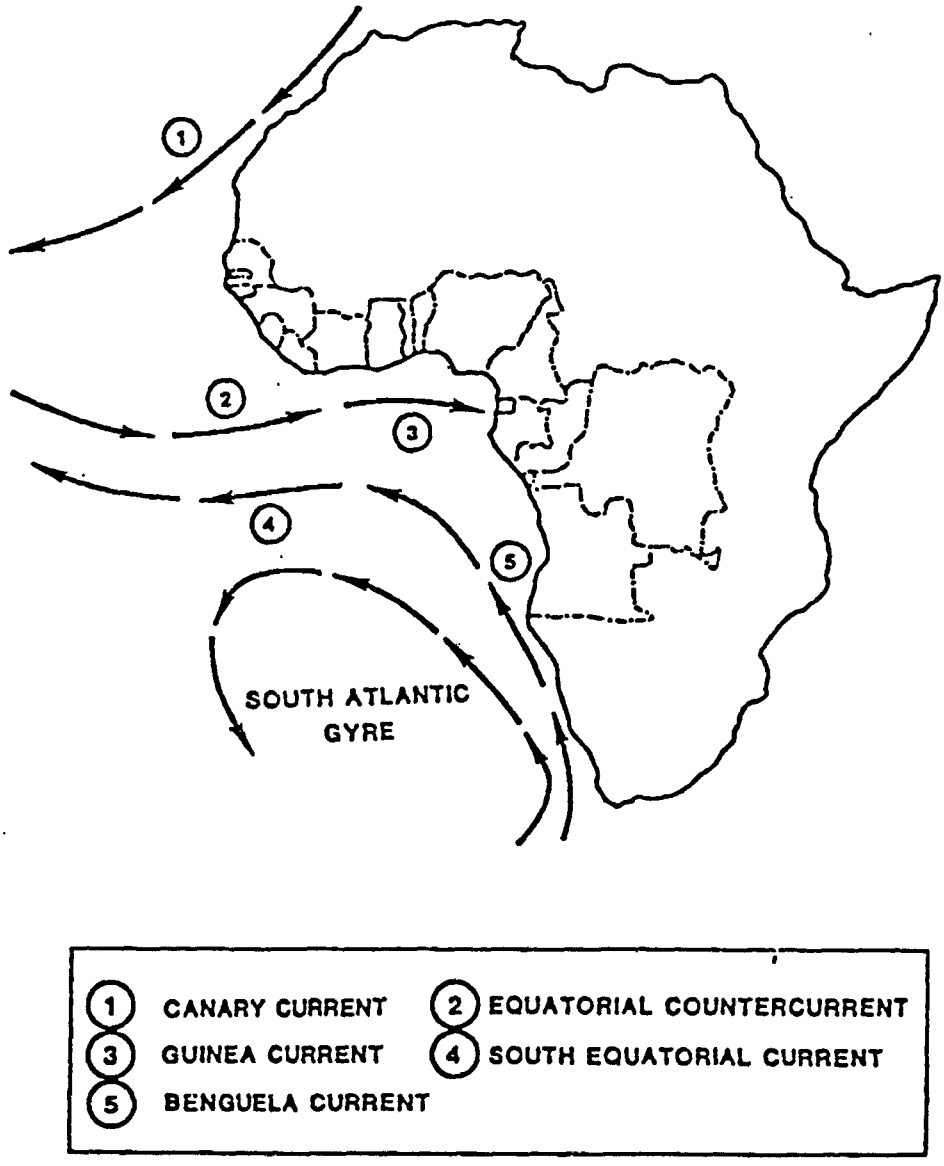
These seasonal variations condition the whole hydro-climatology of the region. The position of the fronts would seem to be related, at least indirectly , to the movement of the Inter-Tropical front and the strengthening of the Trade Winds (Berrit, 1973).
During this period when the southern trade wind crossing the Equator changes into the southwest monsoon, the shape of the coast, from Cape Palmas to the mouth of the River Niger offers favourable conditions for the appearance of upwellings in this area (Op. cit).
In this region temperature ,which is always high, varies little throughout the year (about 4 degrees C), while the salinity remains rather low in connexion with the heavy rainfall.

With regard to the primary and secondary productivities, the dynamics of the frontal structures and the thermocline comtribute to the existence of reserve zones which are exceptionally rich.
Essentially, there two rich zones that correspond (to the north of Cape Verga and to the south of Cape Lopez) to the shifting areas of the northern and southern

sub-tropical fronts. These two areas enclose the considerably poorer Gulf of Guinea that is enriched seasonally by local upwellings. Nigeria's ocean space lies in this region of the Gulf of Guinea.

FIGURE 3

MAJOR OCEANIC CURRENTS



SOURCE: IMCO/UNEP "The Status of Oil Pollution and Oil Pollution Control in the West and Central Africa Region". UNEP Regional Seas Reports and Studies, No. 4, UNEP 1982.

TABLE 1

GENERAL DATA ON COASTAL GEOGRAPHY

COUNTY	COASTLINE (excluding islands km)	CONTINENTAL WIDTH (nautical miles)	SHELF AREA (thousand km^2)
Mauritania	667	13-79	33.9
Senegal	718	8-50	23.8
The Gambia	70	41-50	3.7
Cape Verde	-	-	3.0
Guinea Bissau	300	40-105	45.0
Guinea	350	70-110	50.2
Sierra Leone	570	15-80	30.0
Liberia	537	10-35	18.4
Ivory Coast	500	11-20	12.2
Ghana	528	13-50	27.3
Togo	48	8-15	1.2
Benin	120	14-15	3.1
Nigeria	853	18-35	37.9
Cameroon	346	17-50	12.9
Equatorial Guinea	380	12-30	10.5
Gabon	739	8-40	35.4
Sao Tome and Principe	-	-	2.0

SOURCE: FAO, CIDA/FAO/CECAF Seminar on the Changing Law of the Sea and the Fisheriesof West Africa, FAO/TF/INT 180(a)(CAN).

1.4. Nigeria's Ocean Space.

On the basis of present Nigerian ocean-related programmes and policies, the ocean can be divided into these separate jurisdictional zones. These zones are:

1.4.1.The Territorial Sea

This is the segment of the ocean space over which Nigeria asserts full sovereign jurisdiction, although some residual international rights, such as the right of innocent passage , are provided in this area.
The Territorial Waters (Ammendment) Act 1971 provides that " the territorial waters of Nigeria shall for all purposes extend to 30 nautical miles of the coastal waters of Nigeria (measured from low water mark) or of the seaward limits of inland waters ".

1.4.2. The Contiguous Zone

Article 33 of the U.N. Convention on Law of the Sea provides that :

" In a zone contiguous to its territorial sea, described as the contiguous zone, the coastal state may exercise the control necessary to :

(a) Prevent infringement of its customs, fiscal, immigration or sanitary regulations within its territory or territorial sea;

(b) Punish infringement of the above regulations committed within its territory or territorial sea ".

The contiguous zone may be extended up to a distance of 24 nautical miles from the baseline from which the breadth of the territorial sea is measured.
Nigeria's Territorial Sea thus covers and goes beyond the contiguous zone.

1.4.3. The Exclusive Economic Zone.

The U.N. Convention on the Law of the Sea grants coastal states the right to establish an exclusive economic zone.
This was precisely what the military administration of Nigeria did through the instrumentality of " The Exclusive Economic Zone Act 1978 "
Section 1 (1) of the Act denominated

> " a zone to be known as the Exclusive Economic Zone , which shall be an area extending from the external limits of the territorial waters of Nigeria up to a distance of 200 nautical miles from the baselines from which the breadth of the territorial waters of Nigeria is measured ".

1.4.4. The Outer Continental Shelf.

The Petroleum Act 1969 defines Nigeria's continental shelf to mean
(section 14(1)) " the seabed and subsoil of those submarine areas adjacent to the coast of Nigeria the surface of which lies at a depth not greater than 200 metres (or , where its natural resources are capable of exploitation, at any depth) below the surface of the sea, excluding so much of those areas

as lie below the territorial waters of Nigeria "

This definition follows the double criteria of geographical configuration and exploitability adopted by the 1958 Geneva Convention to which Nigeria is a party.

It does not fix any outer limit of the continental shelf. In this approach it differs from the Law of the Sea Convention which in article 76(6) admits the possibility of a continental shelf extending up to 350 nautical miles (Obinna B. Okere, 1982).

With a coastline of 853 kilometres, the total sea area enclosed within Nigeria's EEZ limits is 210.9 thousand square kilometres. Compared with the total land area of 923.8 thousand square kilometres, it follows that Nigeria's ocean space is approximately 23 per cent its land area .

Chapter 2

Living Resources

2.1 General Characteristics of Resources & Fisheries.

From the previous chapter it could be seen that the fish production of the area is far from being everywhere so low , and so stable throughout the year, as could a priori, be suggested by the classical patterns of the ecology of tropical regions (Troadec & Garcia, 1980).

The preceding information shows that over the continental shelf, where resources are concentrated, seasonal variations in the environment can reach , in the sectors which benifit from seasonal upwelling, a degree that is quite comparable (>12 degrees C for example) to those found in temperate zones.

These hydroclimatic variations can even be quite brusque at the time of the passage of a front or the thermocline, with the new seasons comming in very quickly and all of a sudden (Troadec & Garcia). These variations are reflected by changes in the specific composition of the catch, in the abundance of the various species, and in their capturability, which will be more or less greater depending on the upwelling.

They also bring about movements of the stocks parallel to the coasts.

In the Gulf of Guinea that is covered, at least seasonally by the superficial warm layer, the following can be noticed (Fager & Longhurst, 1968, Longhurst, 1969):

. a group of coastal populations (0 - 50m) that inhabit the warm superficial layer in the permanent warm water sectors & the shifting layer of

the thermocline in the alternation sectors;

- a group of deep-water communities that succeed the first in depth.

Recent investigation by the Nigerian Institute of Oceanography & Marine Research also confirms this relationship (Amadi A.A. 1982).

2.2. Distribution of Resources

A first inventory of West African fish resources was carried out on the occation of the symposia at Abidjan in 1966(UNESCO/FAO/OAU,1969) and Tenerife in 1968 (Letaconnoux and Went, 1970).
Subsequently, Longhurst (1971) attempted an assesment of the clupeid resources in the region , and then Gulland (1971) looked at the number of species as a whole. Attempts have also been made recently (1981) by the Nigerian Institute of Oceanography & Marine Research to map the fish resources of the Nigerian EEZ.

2.2.1. Coastal Pelagic Resources

From Mauritania to Angola nine species - mostly clupeids and carangids - are of particular interest because of their economic importance. The round and flat sardinellas(Sardinlla aurita and s. maderensis), the bonga (Ethmalosa fimbriata), the cunene horse mackerel and the yellow horse mackerel, the Spanish mackerel are found throughout the area (fig. 4). It is known that the artisanal fishery, which is important in Nigeria, catches flat sardinellas to the West of the country and bonga off the Niger and to the East (Bayagbona, 1974).

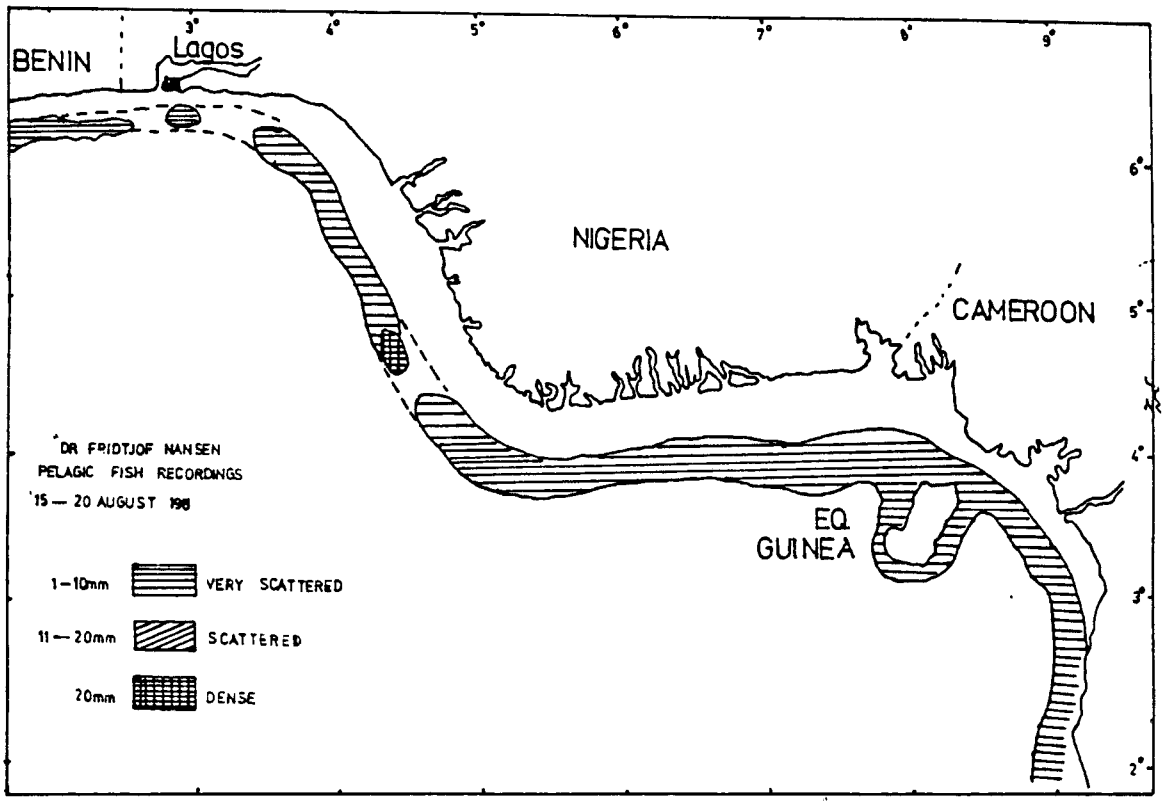


Fig. 4 Pelagic Fish Recordings

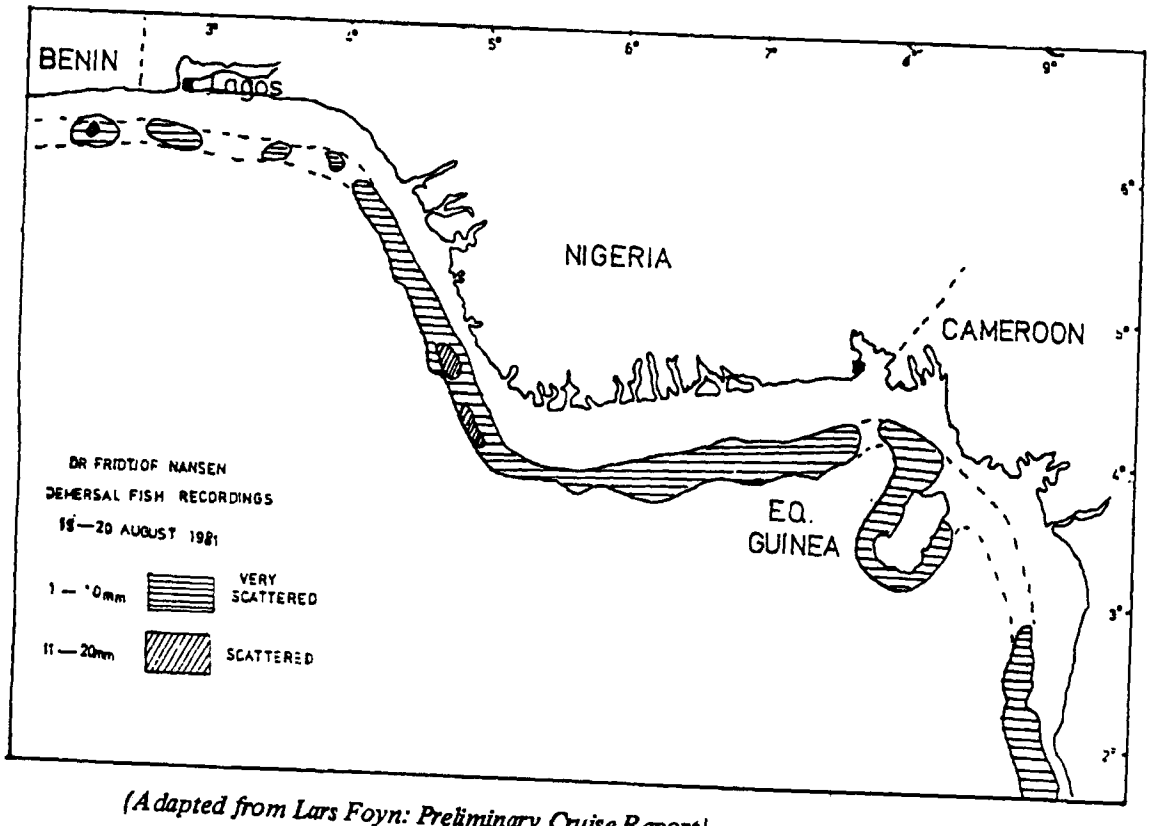
2.2.2. Demersal Fish Resources

The distribution of demersal species on the bottom depends on the nature of the sedimentary covering and the hydrographic conditions which determine in this region, the presence of two large groups of demersal communities (Longhurst,1969) . The most characteristic community is that of the croakers which all live on soft bottoms. A v-ariety of these live in the low saline facies (river estuary zones). The next important community is the deep water sparids and also the snapper community (see fig.5).

2.2.3. Species on soft bottoms

The tonguefishes are characteristic of muddy bottoms or sandy/muddy bottoms. They are the subject of an important

fishry of the large pink shrimp which occupies much the same biotope. Also the West African croakers are characteristic of sandy/muddy bottoms closer to the coast.
Other species of soft coastal bottoms are : the sea catfishes (Arius spp.), the sicle fish (Drapane africana), the small carangid and the clupeid (Ilisha africana).



(Adapted from Lars Foyn: Preliminary Cruise Report)

Fig. 5 Demersal Fish Recordings

2.2.4. Species on hard or sandy bottoms

The more important species that are encountered among the coastal communities on hard or sandy bottoms include:
The porgy (Pagrus erhenbergi), which has a maximum abundance in water depths of between 20 and 30m. There is also the grouper (Epinephelus aeneus) which is widespread

on all the continental shelf from 10 to 100m depth.It is highly appreciated and is caught both by the trawler fleets and by the artisanal fishery using handlines.

2.2.5. The deep water species

These live offshore, beyond the thermocline on sandy/muddy bottoms starting at a depth of about 70m. Two species of Dentex are found in abundance beyond 70m. The other distinct species is the Brotula barbata which lives between 70 and 200m and although provides good yield around Senegal, it is still of secondary economic importance in the Nigerian fishries (Williams, 1968).

2.2.6. Pink shrimp resources

Four major shrimp species are found in the Nigerian coastal waters. These include the pink shrimp (Penaeus duorarum), zebra shrimp, brown shrimp, and red shrimp.
The pink shrimp which dominates this fishry is distributed all over the area in varying concentration. The main Nigerian shrimping ground lies east of longitude 5 degrees East to the Nigerian/Cameroon boarder. This area which includes the Niger Delta, is characterised by a broad coastline, with readily identifiable river mouths, soft mud deposits, estuaries and lagoons (fig.6).

2.3.The Multi-Species Problem

The multispecies nature of the tropical populations is another essential trait of the stocks and fisheries in the region. The complex mosaic of species, and even populations that go into the composition of the ecosystems, and that are simultaneously exploited by the same fleets,

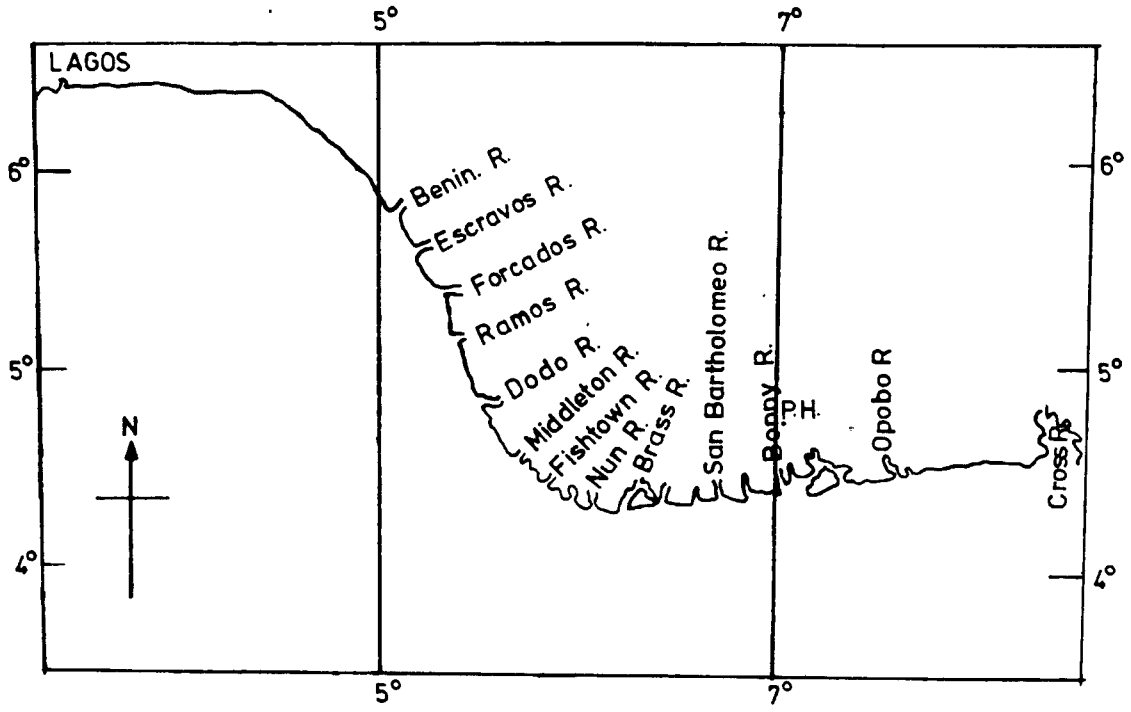


Fig. 6 The Nigerian Coast line Showing river mouths which mark the main Shrimping ground.

offer the fishermen a variety of targets and options. The great scope that is available to them ,at least theoretically, as regards the distribution of their activities over various species that are all equally accessible, makes it practically impossible to estimate the actual effort exercised on each species taken individually.

Moreover, the large number of species to be estimated makes the analytical approach, species by species, particularly costly in view of the inadequate research facilities currently available.

Furthermore, the effects of changes in the schemes of exploitation of the constituent species (because of

inter-species relationships) on the specific composition and overall productivity of the ecosystem are only now beginning to be discerned qualitatively. The impossibility of gathering the detailed and precise data that are needed (particularly on the actual effort exercised on each of the main constituent species) has meant that, up to now , the problem can only be approached in an empirical fashion.
The problem really arises for demersal stocks whose multispecific character is much more marked for hard-bottom populations, than for populations on sandy bottoms which are usually more homogeneous in character (Troadec J.P. & S.Garcia (eds), 1980).

Another consequence of the location of upwelling phenomena in the two sectors adjacent to the Gulf of Guinea is the bipolar distribution of the abundance of fishery resources in the area. The same climatic factors (location of the trade winds in relation to the zones with heavy rainfall) are at the basis of the diametrically opposed distribution of resources and human population and, as a result, markets.

The more dense human populations are found along the edge of the Gulf of Guinea while the bottoms that are richest in fish are situated along the desert coasts of the African continent (Mauritania, south Angola/Namibia). This lack of synchronization between areas with a big production and those with a high consumption has conditioned the whole plan of exploitation and utilization of resources in the region (Gulland et al, 1973).

Chapter 3

Fisheries Development And Management

FAO Publication on Pakistan -

3.1. Introduction

Protein of animal origin is in very short supply in Nigeria. Factors considered responsible for the low level of supply of protein of animal origin are diseases, parasites, climatic conditions and low genetic potentials of indigeneous breeds. This situation strongly emphasizes the need to supplement animal protein with fish protein. Demand for fish in Nigeria is estimated to increase from 1,018,000 tonnes in 1985 to double this quantity by the year 2000 (Okpanefe, 1982).

3.2. The main fisheries

There are three main fisheries which compete in the exploitation of the fish resources in Nigeria's offshore territory. These are artisanal fishery, local industrial fishery and large-scale fishery. The first two mostly bears on the clupeids while the deep sea fishery is carried out by countries foreign to the area, and concerns both the mackerels and the chub.

3.2.1. Artisanal Fisheries

The artisanal gear is characterized by its extreme diversity (castnets, surrounding and floating gillnets, longlines, and also beach seines). They are generally handled from canoes and have scarcely evolved, at least in their principles, except for the recent adaptation of the ring-

net seine to the canoe. On the otherhand, the motorization of the canoes has profoundly modified the character of the artisanal fishery by permitting the fishermen to follow the movements of the fish, find new areas for fishing, diversify their catch, and reduce travel time. This fishery uses the gillnet on the bonga and the flat sardinella (Bayagbona, 1974). Most of the catch in clupeids (which is in the order of 30,000 tonnes) is also attributed to this fishery.

One of the problem here is the dispersion of the landing points all along the coast which makes the qualitative and quantitative assessment of landings extremely difficult. Furthermore, fish preservation, handling and storage methods in this fishery are traditional, characterized by lack of precaution against spoilage and contamination. This results in a loss of about 45 percent in the original weight of fish caught. In 1983, for instance, the loss of 45 percent in the total artisanal production of 501,139 tonnes represented 225,513 tonnes valued at N 112,758 (U.S. $ 113,000) ,(Tobor J.G.,1984). Measures which have been suggested in order to reduce such losses include :

- rural electrification and the provision of ice-making plants;
- cold storage facility; and
- good access roads to facilitate evacuation of catch to the markets.

3.2.2 Local Industrial Fisheries

Local industrial fishery in Nigeria provides employment for about 4,000 people (Agro-Fish Report,1981). This fishery makes use of small trawlers (10 -30 metres in

length). There are currently 49 shrimpers and 46 inshore crafts, plus a further 86 vessels (on charter to various companies) engaged in this fishery.
Fish production from this fishery amounted to 15,052 tonnes mostly of fin fish , and 3,525 tonnes of shrimps in 1982. The above figures only account for approximately 2% of the total annual fish production (as against approx. 97% contribution from the artisanal fishries).

3.2.3. Distant-Water Fishery

Nigeria is yet to develop distant-water fishery. However, distant water fleets of foreign countries notably from Europe have been known to compete for the resources in Nigeria's EEZ.

Types of fisheries

3.2.4. Shrimp Fishery

Exploitation of shrimp species offshore Nigeria began in 1965 and spread to the entire Gulf of Guinea between 1965 and 1970 (Troadec J.P. & S.Garcia, 1980).
The exploitable area in Nigeria has been estimated to cover 2,500 square miles (Raitt and Niven, 1965). The sector is regularly fished by the Nigerian and Cameroon based fleets and, from time to time, by the Ivorian fleet.
Landings in 1974, not counting the artisanal fisheries, were assesed at 250 tonnes for the Lagos sector (Obakin,1970) and 500 tonnes for the entire estuary system. Projected annual production from this fishery is 3,760 tonnes (FAO, 1969). Catch and effort statistic for the Nigerian fleet for the years 1970 -1976 show the CPUE (catch per unit of effort) remaining stable whearas effort doubled from 4,000 to 8,000 fishing days. This

might mean that the fishery is still in its initial stage of development and that the stock is far from being fully exploited (Bayagbona, 1976).

Country	1970	1980	1981	1982	1981/82(% change)
Angola	368.2	77.6	123.5	104.4	-15.5
Cameroon	19.2	39.3	40.3	43.1	+6.9
Cape Verde	5.1	8.8	11.1	10.4	-6.3
Congo	15.2	19.6	17.4	17.9	+2.9
Gabon	4.5	26.4	38.7	50.0	+29.2
Ghana	141.5	184.1	190.6	184.0	-3.5
Guinea	5.6	17.5	17.5	17.5	0
Ivory Coast	66.5	62.7	64.9	77.5	+19.4
Mauritania	47.6	23.9	27.4	27.0	-1.5
Mozambique	7.6	31.6	31.6	31.6	0
Namibia	711.2	237.5	254.1	201.8	-20.6
NIGERIA	105.9	292.4	313.1	323.4	+3.3
Senegal	169.2	250.2	206.7	212.9	+3.0
SierraLeone	29.6	34.2	39.6	45.5	+14.9
SouthAfrica	511.1	615.1	607.0	623.6	+2.7
Tanzania	18.3	39.3	36.0	36.0	0
Togo	6.4	5.6	6.8	11.0	+61.8
Others	100.7	70.2	73.1	74.7	+2.2
TOTAL =	2,341.5	2,036.0	2,099.4	2,092.3	-0.3

Table 2 : Nominal Catch by Country : Sub-Saharan Africa

Source : FAO, Yearbook of Fishery Statistics.

But recent studies (Adetayo J.A, 1982) show a sharp decline in the annual catch. The reason for this decline is put at progressively increased effort on the species since 1969 as well as local environmental factors (as discussed in chapter one). Incidentally, records for this fishery have been kept since 1969 by the Federal department of Fisheries.

Shrimp fishery in Nigeria is export oriented with Japan, the U.S.A. and Britain being the main importers.
In 1973 it earned 4 million Niara (U.S.$ 4M) from the export of 1359 tonnes. The earnings for 1977 and 1978 were 6 million and 5.5 million Naira respectively at the wholesale price of 3,000 Naira (U.S. $3,000) per tonne.
Bayagbona (1979) has estimated the annual potential revenue to be about 12 million Naira (U.S.$12m) given an annual producyion of 3,500 tonnes.
In order to maintain this export potential, management measures should seek to :

- Restrict the size of fleet and thereby the effort, and
- Effective inspection and gear restriction to comply with the Sea Fisheries Act of 1971 and the Sea Fisheries(Fishing Regulation) Act of 1970, section 2 of which states that " trawlers shall not use a codend with stretch mesh size of less than 44mm when trawling for shrimps in areas approved for shrimping in Nigerian waters ".

3.3.Development of a Tuna Fishery

Improved research and discussions (since 1980) between the Nigerian Institute of Oceanography & Marine Research (NIOMR) and other neighbouring countries, Euro-

pean and American experts serving on the International Commission for the Conservation of Atlantic Tunas (ICCAT) have shown that there are exploitable stocks of tunas off the Nigerian coast. Of the five major species taken in the Atlantic, two of these, the yellowfin and the bigeye are available to the Nigerian fisheries. Another species also available to the fisheries is the skipjack as increasing large catches suggest that they have not yet reached the maximun sustainable level. In addition it is known that profitable catches are already being made by foreign vessels fishing off the Nigerian coasts (Wise J.P. & Ajayi T.O, 1981).

One other factor to be considered in evaluating which tuna species is the most most desirable target for the Nigerian fisheries development is the relative market prices. Both the yellowfin and the bigeye are slightly higher priced than the more available skipjack. Thus in 1980 , U.S. prices for the yellowfin and bigeye was U.S.$1,300 per short ton and for the skipjack, U.S. $1225 per short ton.

3.3.1. Capture Method

Established and traditionally efficient methods of capturing tuna and tuna-like fishes are Longlines, Pole & Line with live bait (otherwise designated Baitboat Fishing), as well as Purse Seining.
Although Longlines are highly selective for good sized fish,the catch rates are few and scattered. Besides, Longlines are more suitable for deep waters whereas the Gulf of Guinea tuna stocks support a largely surface fishery. Pole & Line fishing with live bait from bait boats has been very successful off West Africa .

The availability of suitable bait in the artisanal fishery plus the low capital investment makes this method the most suitable for the Nigerian tuna fishery (Op.cit).

Purse seining method on the otherhand, has been very successful elsewhere in West Africa but the initial high capital costs and the considerably longer training requirement makes it less attractive at the time being. The projected annual production target of 1,500 tonnes will initially be aimed for the local market.

3.4. Fisheries Development Objectives

The benefits to be gained from fishries are numerous. An expanded fishry can often increase incomes and emploiment, improve diet of many people by increasing domestic protein supplies, generate forein exchange earnings, conserve natural resources and promote a more equitable distribution of benefits by providing low-income groups with the means to become productive.

A key objective in the development of fisheries is to raise incomes in the small-scale artisanal sector. It is known that fishing families tend to work arduously and under conditions of great risk, yet their incomes are typically below those of other groups in rural areas.

Several factors account for such low incomes. First, as fishing activities expand, free entry into the sector tends to exhaust the resource with inevitable consequences. Second, the unique skills the fisherman develops are not readily transferred to other sectors during slack seasons, or when production drops sharply. And the fishermans attitude toward his work in which he views it as a way of

life poses an obstacle to his shifting to sectors unrelated to the sea. Third, the limited extent of capital expansion ensures a low rate of growth in productivety : small-scale fishermen are locked into low-level subsistence in a way that is similar to the fate of small-scale farmers deprived of technological change (The World Bank, 1982).
Finally, because the major capital equipment - the boat - cannot be divided or expanded, it cannot , therefore, provide emploiment for additional family members.

3.5.Development Constraints

One of the main problems in fisheries development is that the resource is mobile and many species migrate across national boundaries. Agreements, therefore , must be reached between nations about the quantity of the catch to be allowed, or common fishing zones must be established.
There is also the problem of credit facilities to the fishermen because the banks consider the boat - which is usually the fisherman's only collateral - a risky investment. In addition to the problems associated with marketting, there are also elements in the economy, or in governmental institutions, that could limit the development of fisheries.

For example, there may be vested interests, such as firms that have enjoyed long-standing control over the sector, that may be threatened by the development of new fishery projects. In such a case, severe conflicts could materialize that might restrict access to the fish resource, or to critical inputs. Middlemen who currently control the flow of credit might attempt to impede measures to rationalize the system if they sense competition.

In this regard, regulations must be drawn up and institutions formed that can mediate in disputes ; they must also be armed with sufficient authority to enforce their rulings (The World Bank, 1982).

3.6.Development Options & Strategy

Faced with the above constraints, the options available for the development of fisheries include :

- Expanding inshore fishries by increasing the number and size of boats as allowed by the natural endowment of the country's resource;
- Developing aquaculture as a key activity in the rural economy by integrating it with agriculture or other activities;
- Providing infrastructure facilities , including ports and landing piers , fish hatchries, ice plants, cold storage plants, transport systems, marketing centers, and distribution networks;
- Improving marketing chains;
- Upgrading extension and research services and training programs;
- Strengthening the admistration of fisheries;
- Strengthening the institutions that provide credit, establish land or water rights, and regulate fishing rights;
- Establishing fishing community organisations such as co-operatives.

3.7.Technological Factors In Fisheries Development.

Fishing is still a hunting activity. It is in fact a high technology activity. Fishing technology - as the term implies - deals the ways and means of fish capture . This

involves the whole range of fishing gear and methods , the related features of vessels , instrumentation, fishing strategy and tactics , as well as biological and environmental aspects that have a direct bearing on fish capture (see fig.7).

Compared with sister disciplines - such as fisheries biology, hydrography , fish utilization and processing technology - fishing technology got off to a late start in the 1930s, gaining more general recognition in the early 1950s. There are many countries today - among them the U.S.A., Japan, Poland, West Germany, and the Soviet Union- where the subject is taught at university level (Joachim Scharfe, 1982).

In many developing, the functions of the fishing technology unit or service are being handled in an ad hoc manner by government officers, who often have limited expertise in fishing matters. Sometimes these countries hire outside consultants or accept technical assistance projects to solve specific problems. But these approaches lack comprehensiveness and continuity; while the immediate problem may be solved, there may be neglible long-term evaluation and follow-up, undermining the original solution to the point of collapse (Op.cit).

Outside consultants often are not well versed in the cultural, social, and economic aspects of the local fishing situation, so they are often unable to offer meaningful solutions to problems. And because the government officer in charge of fishery operations may not have full subject matter competence, there is often a gap in understanding on both sides contributing to an unsuccesful transfer of technology (Op.cit).

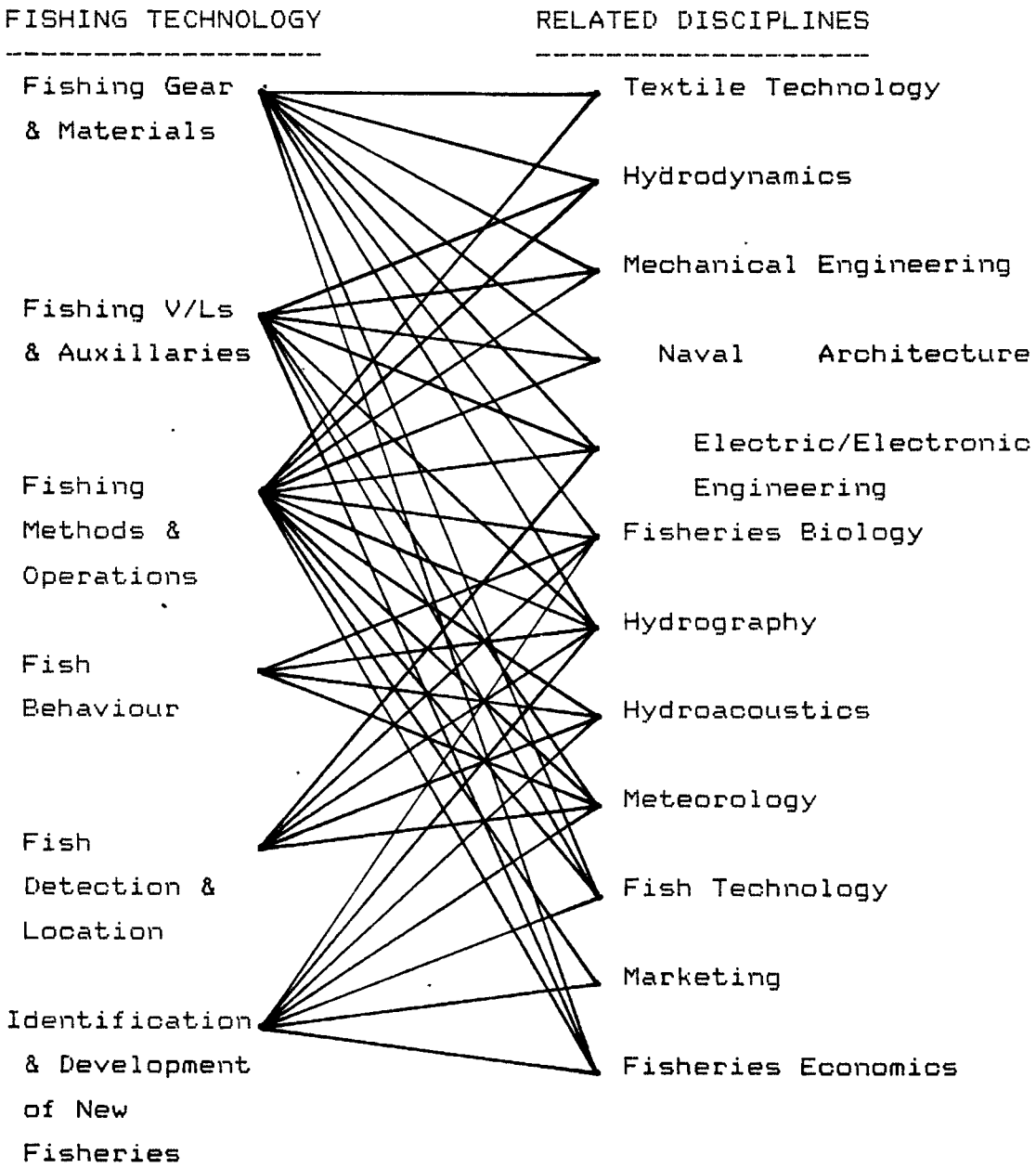


Fig.7 . The main interrelationships between fishing technology and related technical and scientific disciplines (FAO, FIIT).

The recognition of past mistakes in this field has led to widespread agreement that technological aid must be both

appropriate and acceptable to the target community. The general criterion for appropriateness is the extent to which the innovation can contribute to long-range development targets - for example, increased production, improved efficiency, foreign currency earnings, employment opportunities,as well as the provision of better working conditions and safety. Technical considerations will include simplicity, reliability, sturdiness, and also ease of operation.

Some of these issues are currently being studied in the Nigerian Institute of Oceanography & Marine Research.

3.8. Fishery Management Needs

Improvements in the knowledge of resources and their exploitation depends on the setting of priorities in research (FAO, 1980). Among the urgent needs for fisheries management in Nigeria include :

- the need to improve the collection, transmission, and dissemination of statistics on fishery;
- the study of the patterns of distribution and migration of stocks;
- economics and social aspects of management (starting with the determination of the optimum levels of exploitation), the multispecies approach to the evaluation of demersal communities, and the determination of the age of pelagic species (which is a condition for their evaluation by means of analytical methods).

3.8.1. Regulation of Rates of Exploitation

This is the only measure that will permit the adjustment of catches to the productivity of stocks and thereby, obtain in the long term, catches which will remain close

to the maximum of the excess production. Its objective is to control fishing mortality, F. As this parameter cannot be measured directly -that is in real time - it has to be controlled indirectly by interventions on :

- fishing effort, f (by the limitation of fishing effort) or on
- production Y (by the application of quota systems).

Thus for equilibrium, F=Y/B=qf

where B=biomass

q=capturability (which remains constant)

3.8.2. Regulation of net mesh size

The current situation in the matter of mesh regulation can be summerized as follows :

(a) the mesh of the nets used in the main fisheries in the region (fish and shrimp trawls, beach seines, and other towed gear, as well as fixed nets used by the artisanal fishery for shrimp) are generally too small for a rational exploitation of the main target species;

(b) national legislation on the subject of mesh size often has to be publicized and the existing dispositions are still often inadequately applied ;

(c) a certain number of conclusions on the evaluation of mesh size are the result of single species studies. When the catch of the species being studied is accompanied by important by-catches, these conclusions are not necessarily applicable to the fishery as a whole. This is the case , for example, in the simultaneous fishery of hake and shrimp on the shelf slope of the northern sub-tropical sector

of the Gulf of Guinea (Troadec & Garcia,1980).

The action to be taken should therefore, aim at :

(a) having national legislations reflect the recommendations of CECAF and the national studies that have been made on this subject, and the immediate putting into effect of those regulations that can be immediately applied : for example, mesh sizes of 60mm for the fishing of cephalopods as well as for the fishing of tropical and sub-tropical coastal communities (0 - 50m);

(b) undertaking investigetions to determine the specific composition (in number and weight), of the catches and discards in the multispecies and multigear fisheries , and the capture of juveniles by beach seines.

3.8.3. Closed Seasons

The results that can be expected from closed seasons, in sea and lagoon, wheather simultaneous or not, have been studied for shrimp in Ivory Coast (Garcia, 1977,& 1978); and the results depend very much on seasonal variations in capturability. The advantage of this kind of regulation would appear to be moderate when one considers that it is quite complicated to apply the surveillance and inspection facilities of the coastal countries which are still very modest (FAO,1980).

3.8.4. Protection of Nursery Areas

Most of the nursery areas feeding the coastal stocks are found in the littoral areas within the field of operations of the artisanal fishery. This is the case of more

or less amphibiotic species such as shrimp and certain croakers, as well as sea bream, mullet, sardinella, bonga, various carangids, and rock lobster. The exploitation of the juveniles of these species by artisanal fisheries is often considerable (Troadec & Garcia,1980).

The nursery areas should also be protected from indirect attacks such as pollution. Furthermore, the localization of areas of concentration of juveniles should be taken into consideration when selecting sites for industrial plants that may pollute, or urban developments.
The management of river basins (such as irrigation or antisaline weirs) is also liable to affect the biotic capacity of certain nursery areas and thus the recruitment of species such as penaeid shrimp, bonga , and perhaps the flat sardinella.
Finally, from a purely economic point of view, the increase in the pressure of fishing on juveniles brings about a reduction in the unit value of catches by lowering the average size of the individual.

Chapter 4

Problems of Managing & Sharing of Living Resources

4.1. Introduction

By long tradition, fishermen throughout the world regard the right to go fishing as one of fundamental, almost religious, significance, despite overwhelming evidence that the right of everyone to go fishing freely inevitably results in the erosion of such rights. While the destructiveness of competitive fishing under open access conditions is now almost universally recognised, the problems associated with conversion to a system of controlled property rights have proved to be extremely difficult (Crutchfield, J.A, 1986).
The fish resources in Nigeria's EEZ are being heavily exploited not only by vessels based in Nigeria, but also those of neighbouring countries, as well as vessels from as far afield as Europe.

4.2.Instability of Natural Systems

Fisheries are subject to wide variations in yields as a result of changes in the complex marine environment. These changes in yield-effort relations (and therefore in cost per unit of catch) may reflect changes in the total number of fish; their accessibility (i.e. concentration in schools and/or distance from shore); and catchability (i.e. under some conditions fish may be more difficult to catch even though numbers and concentrations are identical). These changes in supply conditions, reflecting primarily very large changes in the size of spawning groups

recruited successively to a commercial fishery make it extraordinarily difficult to plan fishing operations as a more conventional business operation (Anderson,L.G,1977)

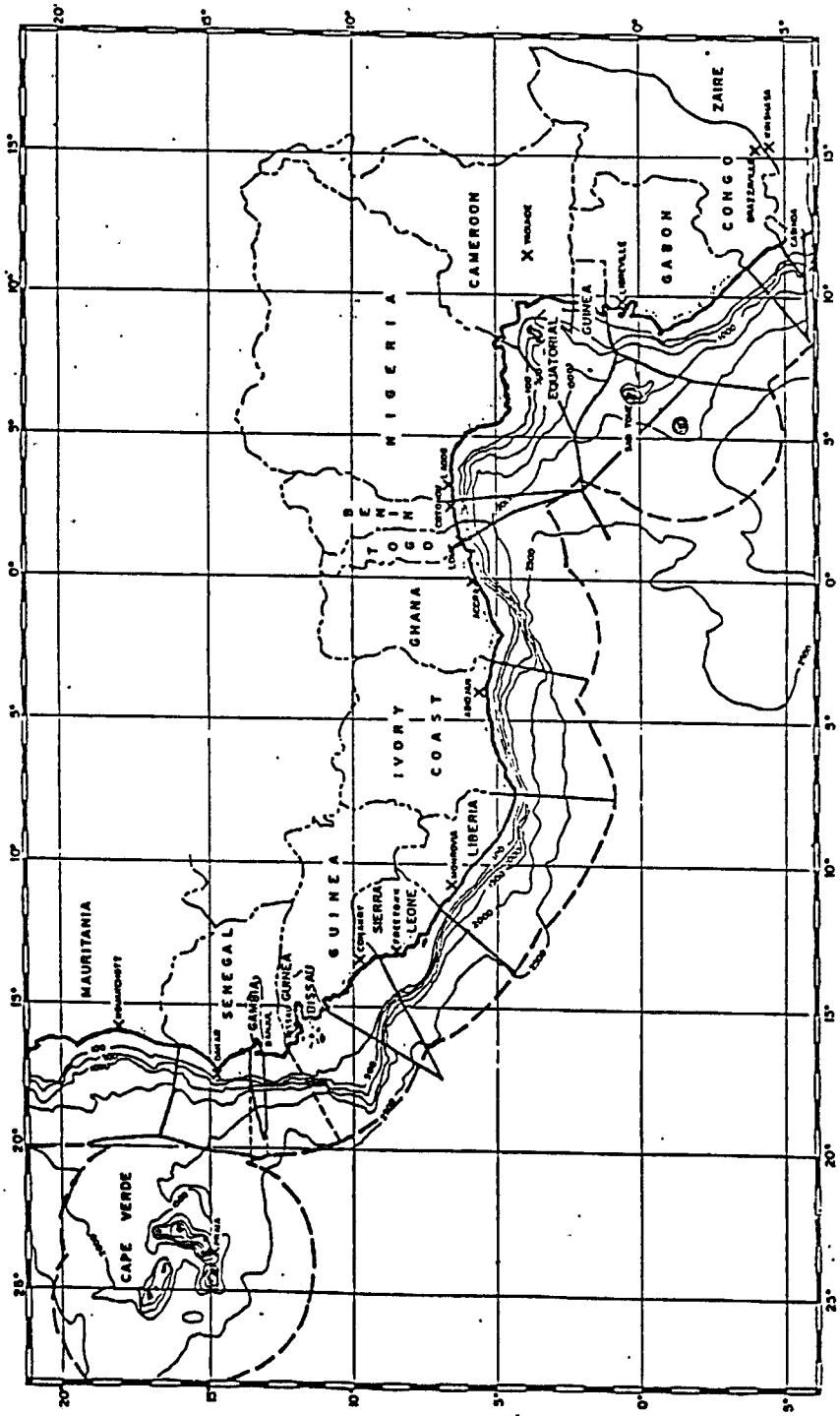


Figure 8. Boundaries in West Africa.

4.3. Managing & Sharing of Fisheries Resources

The Gulf of Guinea is an example of an important fishing region with shared pelagic stocks. Others include the highly productive coastal upwelling zones off Chile, Peru and Ecuador in South America, and off Mexico and the United States in North America.

The problems of the management of shared resources and of their allocation have, in many cases, been shown to be interrelated (Gunnar Saetersdal, 1983).

The first priority for fully exploited stocks must be to establish a system of joint, overall management of the resource in its entire area of distribution and in accordance with the generally accepted criteria for rational usage and conservation. Ordinarily, such systems will include the setting of a TAC (Total Allowable Catch) for the stock on an annual basis. The next step, the allocation of this TAC to the coastal states in whose zones the stock occurs, could then take the form of establishing subquotas by zones.

In attempting this direct approach in the North Atlantic, a number of difficulties have been encauntered. the simplest solution would seem to be to base the allocation on historical fishing, splitting the total TAC in proportion to the yield in the various zones, using current statistics or the means of a recent period.

However, there are fundermental objections against basing the decision concerning the allocation of the resources merely on the fishing pattern of some recent years. The havestable part of a fishery resource represents only one component of a resource complex which in addition consists of a reproductive phase and recruiting and growth phases. Furthermore, the whole resource complex is of

course dependent on the system of productivity at lower trophic levels.
The geographical distribution of these various phases and of the system of primary production in the sea does not necessarily coincide with that of the fishable part of the population.

Other problems that may arise when dividing TAC into sub-quotas by zones relate to the state of the stock in question. Exploitation pressure may cause changes in the distribution and migrations of the population and will thus affect the allocation problems. For example, in the north Atlantic, the area of distribution of the Atlanto-Scandian herring has been reduced from the oceanic perts of the Norwegian Sea and Barents Sea to the coastal banks and fjords of Norway following the collapse of this stock at the end of the 60s.

A further problem of quota-allocation systems based on zones of shared stocks is that the geographical distribution of the fishing operations may have consequences for the management and conservation of the stocks. A case in question is represented by the stocks of Arctic cod and haddock in the Barents Sea, where the juvenile and pre-recruit fish dominate in the economic zone of the U.S.S.R, while the adult components are predominantly found in Norways zone (Saetersdal,1983).

These examples demonstrate that the complex and often varying nature of fisheries and fish resources seriously complicates adaptation to a rigid system of economic zones, particularly in areas where resources are shared.
The new and difficult task in such areas is to apportion rights to the resources. Such allocations will have to be

based on a number of criteria of which the following may be the most important :

a) The occurence and migrations of the fishable part of the stock.

b) The occurence of juvenile and prerecruit fish.

c) The spawning areas and the distribution of egg and larvae.

d) The history of the fishery including the distribution of catch, rate of exploitation, and fishery regulations.

e) The state of exploitation of the resource.

Information on this type may then form the basis of negotiations for a long-term, proportional allocation of the potential yield.

4.4. Regional Agreements & Other Arrangements.

A common method of granting access is by a direct licencing system. The foreign fisherman will often have the assistance of his government in seeking a licence, and in some instances, a bilateral access agreement will be negotiated concerning the issuance of licences to nationals of a particular state. A major advantage of such an agreement is that it is often possible for the coastal state to cast some of the administrative and enforcement burden onto the foreign state. This can be done, for example, by specifying in the agreement, the number of licences that will be issued, the number of fishing days allowed, species that may be fished for and in what quantities, and leave

the foreign state the task of distributing the licences and sharing out the resources allocated.

The coastal state may also be able to put some of the enforcement burden onto the foreign state, for example, by making it responsible for punishing breaches of the licence conditions, or even more generally, coastal state laws and regulations concerning foreign fishing , and by providing the foreign state with the incentive to encourage compliance by, in effect, allowing one state the right to secure access for its nationals so long as they comply with coastal state requirement (FAO, 1980)
Despite these advantages, the requirement of a bilateral agreement may entail less flexibility, as the negotiation of the agreement can be a time consuming and protracted exercise (Edeson W.R.,1985).

For many countries, the need to have a bilateral access agreement is written into the domestic law. This is also reflected in the Nigerian EEZ Decree 1978 (Okere, 1982).
The United Nations Law of the Seas Convention envisages an important role for sub-regional and reagional co-operation in fishries matters and recent moves in this direction in the Gulf of Guinea is noteworthy.

The Ministerial Conference of Central & West African States, set up in 1975 by 25 member countries in the region, has as one of its objectives

> "...to bring together all the countries in the region and to formulate common maritime policies to safeguard their interests ..."

The most recent move in this direction was on 21 June 1984 when a convention relating to the regional development of fishries in the Gulf of Guinea (southern section)

was completed. Participating countries were The Congo, Gabon, Equatorial Guinea, Sao Tome and Principe, and Zaire. Parties are to cooperate, among other matters, on the development of a concerted attitude toward activities of both foreign and national vessels; harmonizing national fishery legislation; promoting training, scientific research, and protection of the marine environment; and adopting a common fishery policy in selected sectors.

The Food and Agricultural Organisation is also helping to develop a training program for members of the West African region in the Fishery Committee for the Eastern Central Atlantic (CECAF).
CECAF's subcommittee on Management of Resources within Limits of National Jurisdiction considers harmonization of laws; the apportionment of quotas with respect to shared stocks; and coordination of control and surveillance over ships operating in areas under national jurisdiction.

Chapter 5

Non-Living Resources

5.1. The Continental Shelf

The continental shelf and slope are simply the submerged edges of the continental masses. The shelf is the gently inclined portion of the continental mass that runs from the ocean waterline outward to the abrupt change in inclination that marks the beginning of the continental slope. The slope then falls off very steeply into the deep ocean basins (Fig.9).

The characteristic feature of the Nigerian continental shelf is its formation from drowned river valleys (Allen,1964). This accounts for the occurence of large deposits of sand and aggregate resources offshore and also oil and gas deposits in and around the Niger Delta.

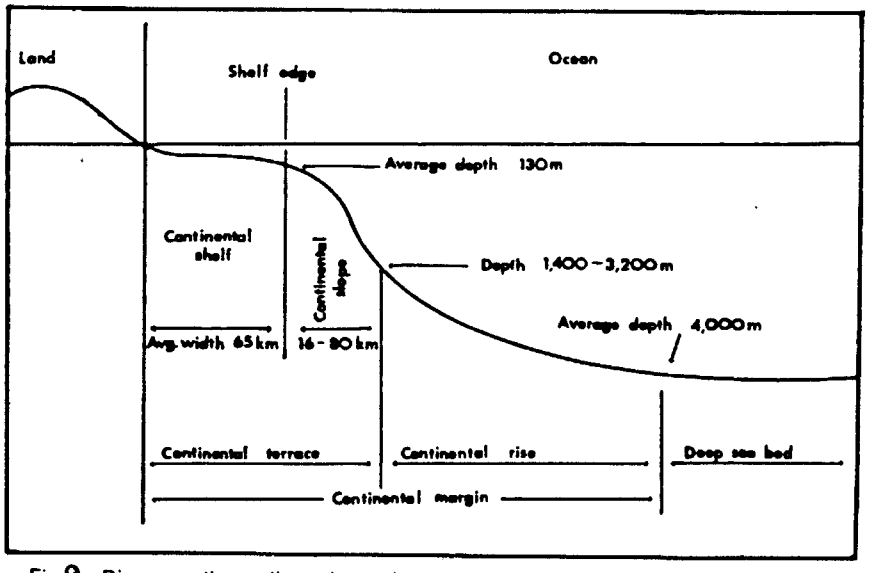


Fig.9 Diagrammatic continental margin profile. Numbers represent worldwide averages.

5.2. Aggregates and Placer Deposits

Perhaps the most obvious mineral resources of the marine beaches of Nigeria's coastal region are silica sand and gravel.

Sand facies extend from shore for distances of 3-32 km and downward to maximum depths from 4-44m (Allen,1964). Apart from their use as aggregates in concrete and as filler material in construction works, sand is also important in foundry moulds as well as in glass making while gravels serve for grinding stones and as filter aids.

At present, offshore commercial dredging is still in the developmental stages but as land sources dwindle with increased pressure on the environment, attention will shift to the billions of tonnes of reserve aggregates resources offshore.

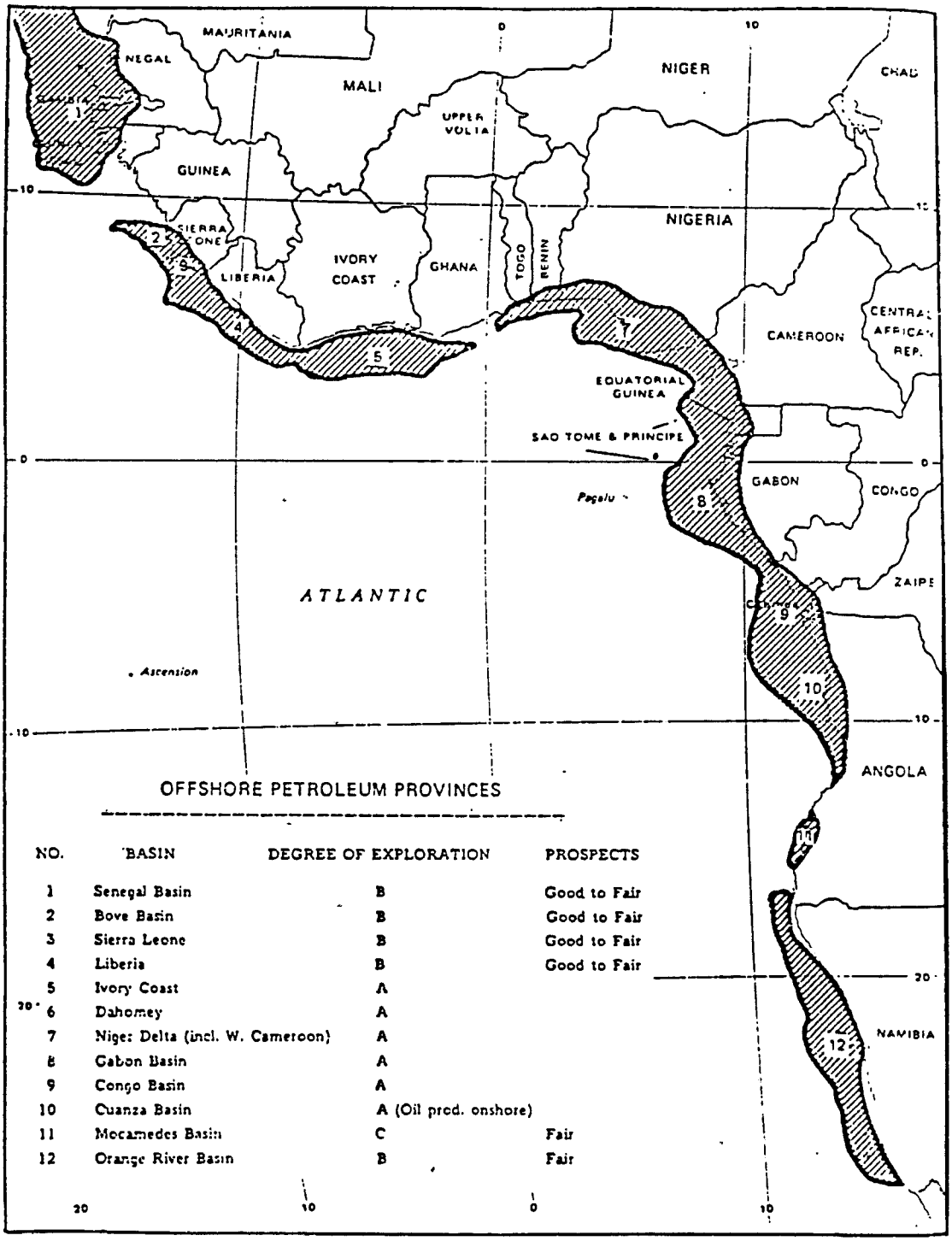
Also, from the geology of inland Nigeria, it is most probable that other placer metallic minerals like gold, platinum, monazite, titanium and cassiterite would be present in the marine beaches and continental shelf of the country, probably in mineable concentrations. Other important minerals found in the surficial deposits of the shelf include : a) phoshorite, a mqjor industrial source of phosphates and of immense importance in the manufacture of chemical fertilizers;

b) glouconite, a source of potash for use in agricultural fertilizer and also a source of potassium and potassium compounds;

c) calcerous shell deposits - these could be mined for used in the manufacture of cement and lime. They also serve as decorative materials and for jewelry.

FIGURE 10

OFFSHORE EXPLORATORY ACTIVITY



OFFSHORE PETROLEUM PROVINCES

NO.	BASIN	DEGREE OF EXPLORATION	PROSPECTS
1	Senegal Basin	B	Good to Fair
2	Bove Basin	B	Good to Fair
3	Sierra Leone	B	Good to Fair
4	Liberia	B	Good to Fair
5	Ivory Coast	A	
6	Dahomey	A	
7	Niger Delta (incl. W. Cameroon)	A	
8	Gabon Basin	A	
9	Congo Basin	A	
10	Cuanza Basin	A (Oil prod. onshore)	
11	Mocamedes Basin	C	Fair
12	Orange River Basin	B	Fair

Sources : World Oil, Oil and Gas Journal and The World Energy Conference

In Britain, offshore mining of sand and gravel has been an active industry for over a century. The recovery of offshore alluvial deposits of tin in Southeast Asia using large bucket-ladder dredges is another example of foreign mining, as are the recovery of diamodiferous gravels from offshore Southwest Africa and gold and platinum placers offshore Japan.

The main marine sand and gravel producers in 1977 were the United Kingdom and Japan, with 14.8 and 41.3 million metric tons of production respectively. Denmark, The Netherlands, the United States, Sweden, Thailand, and Hong kong also utilize offshore sand and gravel (Earney,1980). Proximity to the market area is very important with sand and gravel because of its low value per ton. Thus the total U.S. sand and gravel production of 816 million short tons in 1980 was valued , at an average price of $2.81 per ton, at $2.3 billion (U.S. Bureau of Mines, 1980).

5.3. Oil and Gas Resources

The shallow water environment immidiately contiguous to continental Nigeria has been associated with the exploitation of petroleum resources mostly from the porous sandstones in the growth fault system of the Agbada formation (A.Chidi Ibe, 1982). Much of the discoveries are essentially extensions of onshore fields. However, evidence (Allen,1964,1965; Burke,1972) suggests the occurence of potentially richer petroleum zones in water depths beyond the limits of present exploitation (see fig.10). These plays are associated with a Tertiary Canyon system analogous to the Avon, Mahin, and Calabar canyons which indent the present day continental shelf and slope.

5.3.1. Development

In 1956, the Anglo-Dutch consortium, Shell D'Arcy, made the first commercial oil discovery at Oloibiri in the Niger Delta(fig.10) Two years later, commercial production started at a rate of 5,100 barrels per day. Output rose steadily to 415,000 barrels per day in 1966 but dropped to 142,000 bpd during the civil war. Following the end of the war in 1970, production reached 560,000 bpd and in 1972, production reached 2 million barrels per day and Nigeria became a major producer.

With other companies i.e. Mobil, Gulf, Agip (ELF), Texaco/Chevron, joining in the Nigerian oil business, production soon reached an all-time high of 2.4 million barrels per day in 1979.

(Table 3) Offshore Crude Oil Production (Barrels/day in '000)

Country	1970	1975	1980	1981	1982	1983	'82/83 % change.
Angola	96	143.2	99.0	134.0	87.7	142.5	62.5
Cameroon					103.6	93.4	9.8
Congo		37.3	27.0	79.0	86.7	94.9	9.5
Gabon	29	179.9	177.9	113.4	102.5	130.0	26.8
Ghana			2.0	1.8	1.3	1.2	-8.3
IvoryCoast			5.8	9.8	9.4	21.3	126.6
NIGERIA	275	431.3	579.1	455.0	371.4	306.1	-17.6
Zaire			21.6	19.0	21.5	21.3	-0.9
TOTAL =	400	791.7	910.4	812.0	784.1	810.3	3.4

Source : Offshore

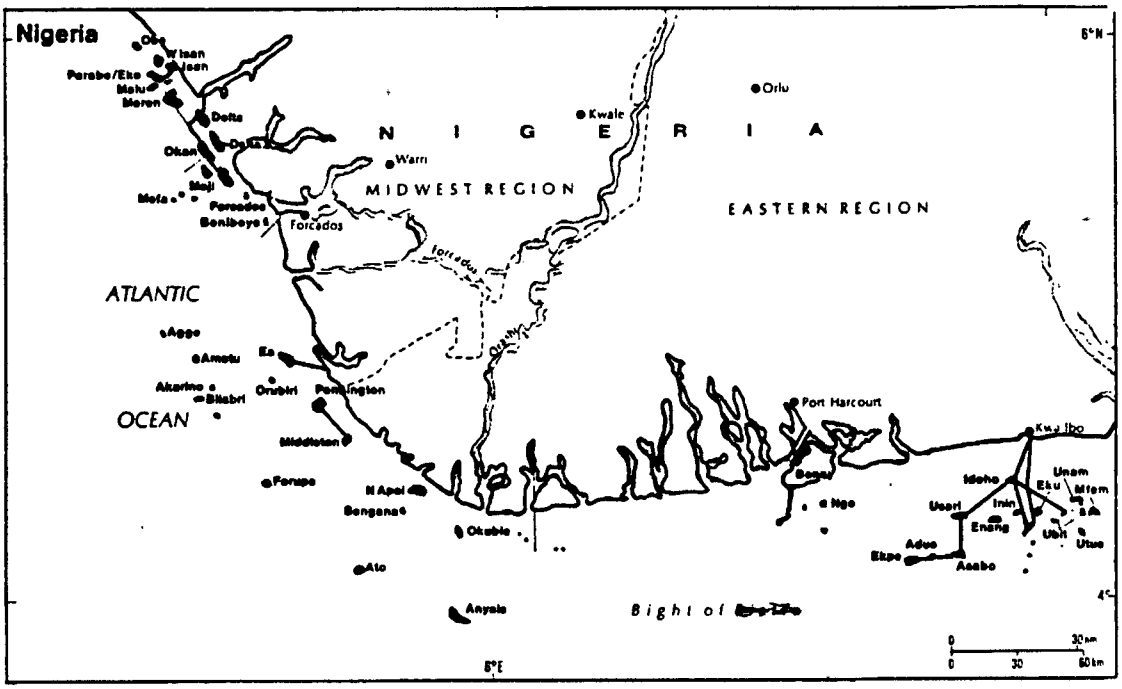


Fig. **11** Map of the Niger Delta showing some of the Offshore oil installations

Today, however, the situation is different. Oil production has decreased as a result of global oil glut which has not only forced down oil prices but also led Nigeria to limit output to 630,000 bpd by March 1982. Production fluctuated around that figure till March 1983 when the Organisation of Petroleum Exporting Countries (OPEC) acted to halt the market drift by imposing oil output ceilings. Nigeria's quota of 1.3 million bpd was later raised to 1.45 million bpd in August 1984.

Nigeria's crude oil reserves is estimated at 20 billion barrels, to last 30-35 years at current rate of depletion.

Further explorations in the industry have slowed down due to the current oil glut and also the oil companies' comp-

laint of lack of incentives for exploration. The problem here boarders on the profit margin issue which in 1983, was increased by 100% . This leaves the oil companies with 1.8% and the government with 98.2 % profit on a barrel of equity oil. The producers feeling was summed up by Carl Burnett Jnr., former Managing Director of Mobil, when he remarked : " A slim margin for producers might appear to meet the government's objectives of maximizing revenues. Inevitably, however, this leads to a fall-off in exploration and development activity ." (Nwokedi J,1985).

5.3.2. Management

Over the years, government participation in Nigeria's oil business has grown as the commodity turned out to be the nation's main foreign exchange earner. Initially, government involvement was restricted to collection of revenues from licences (prospecting / production), royalties and taxes. However,measures were taken to safeguard the transport infrastructure for the export of crude oil. These include : The Oil Pipeline Act 1965,

The Oil in Navigable Waters Decree 1968,
The Oil Terminal Dues Act 1969
The Piers Act, as well as several Orders establishing the other facilities.
(See Mbanefo L.N,1983).

Nigeria joined the Organisation of Petroleum Exporting Countries (OPEC) in July 1971 and accordingly, set up the National Oil Corporation along with the Ministry of Petroleum Resources to not only protect the nations interest in oil business, but also to implement the policies of the organisation.

The governments participating interest in the oil companies has continued to grow and it now controls 60 per cent

equity shares in all the companies and as much as 80 per cent in Shell, the dominant producer of the nations oil.

As part of efforts to optimise the human and infrastructural resources available in the country, the government, by Decree 33 1977, created the Nigerian National Petroleum Corporation (NNPC) from a mearger of the Nigerian National Oil Corporation and the Ministry of Petroleum Resources. The NNPC is charged with the responsibilities of axploring, prospecting, acquiring, processing and production of petroleum products. It also undertakes the merketing of petroleum products.
Thus, in order to maximize returns from oil, the policy posture has shifted from that in which the government merely collected royalties and taxes. Internal self-sufficiency in the supply of petroleum products is ensured by the operation of three government-owned refineries in Port Harcourt, Warri and Kaduna, with a combined capacity of 260,000 barrels per day. A fourth refinery with a capacity of 150,000 barrels per day in being built in Port Harcourt and is expected th be operational in 1987.
There are over 3,000 kilometres of pipelines and 21 depots to facilitate country-wide distribution of products.

Also under construction are the petrochemical plants sited at Kaduna and Warri. These plants will manufacture polypropelene, carbon black, detergents and other raw materials for use in other industries. It is envisaged that when the petrochemical plants are in full operation, Nigeria will be able to produce 90 per cent of its raw materials locally and save about 40 per cent in foreign exchange (Nwokedi,1985).

5.4. Natural Gas Resources

Nigeria has an estimated 95 trillion cubic metres of natural gas reserve. About 90 per cent of associated gas produced with oil is being flared. However, efforts to minimise this waste has intensified by the government's review in January 1985 of the Gas Re-injection Decree of 1979. It is now mandatory for oil companies (which had not implemented their re-injection programmes) to pay a fine of 2 Kobo ($0.02) on every 1,000 cubic metre of gas flared in their area of operation. There is also a proposed Liquefied Natural Gas (LNG) project in Bonny, Rivers State.

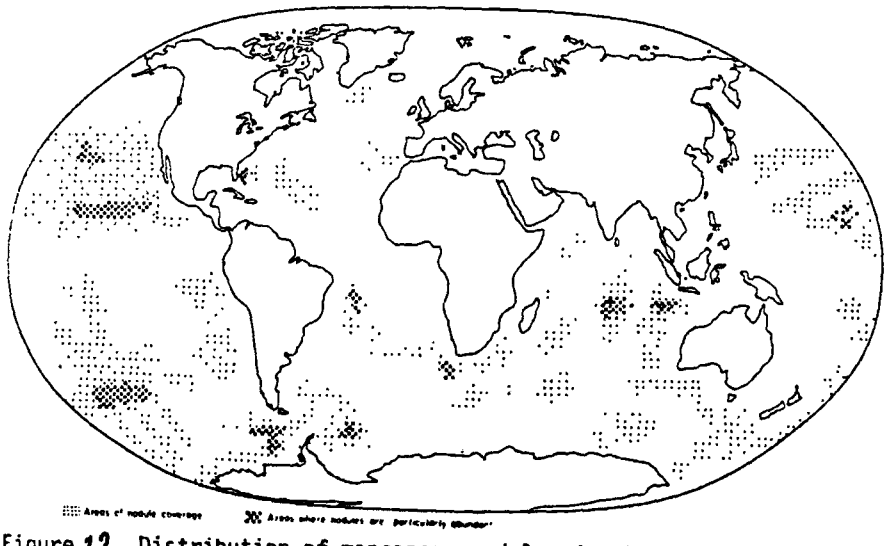


Figure 12. Distribution of manganese nodules in the World Ocean (after Rawson and Ryan 1978, and other sources).

5.5. Deep Ocean Minerals

The pelagic sediments, notably calcareous oozes, siliceous oozes and red clays that are found in this terrain have

commercial value and could be mined as complements to the land derived limestone, silica sand and clay deposits respectively.

But by far the most important minerals on the deep sea floor are manganese nodules (fig.12). First discovered during the Challenger Expedition (1873-76), nodules vary in abundance on the ocean floor and are found in abundance in areas shielded from terrigenous sediments (Brown & Crutchfield eds,1982).The deep seabed offshore Nigeria is not rich in these resources but where improved research indicates otherwise, the production and management of such nodule resources will likely come under the guidelines provided by the International Seabed Authority (UNCLOS 111,1982).

5.6. Sea Water

Most naturally occuring elements or components containing these elements are found dissolved in the oceans. Only a few however, occur in recoverable quantities. These include magnesium, magnesium salts, bromine, fresh water, heavy water,and common salt. The ocean is the world's largest source of heavy water (deuterium oxide) which is used as a moderator in heavy water fission reactors and is an important constituent fuel in nuclear fusion research.

Internationally, Canada, Norway, India and Argentina are operating heavy water production facilities from sea water sources.

Sea water is an almost unlimited source of bromine with an estimated 10 thousand billion tons at a concentration of 65 parts per million. Bromine is used in the form of ethelene bromide, a gasolene addition. Other uses include fire retardants, anti-bacterial agents, and in agriculture.

Magnesium is present in vast quantities at an average con-

centration of 0.13 per cent by weight. Magnesium metal is most valued for its use in metal alloys which are light but strong. Demand for magnesium therefore is tied closely to the demand for titanium and aluminium and fluctuates with demands from the aircraft and aerospace industry (Brown & Crutchfield , 1982).

Although the methodology for the extraction of potassium, calcium sulphate, gold and silver has been petented, the future production of these minerals from seawater in Nigeria is still remote because of the high costs involved and the availability of alternative land sources.

5.7. Energy From The Ocean's Waters

Energy resources specific to ocean water are concentrated in its tidal, current, and wave forces, in its temperature differences and its chemicals dissolved in it.

Conceivably, each source might eventually be utilized, but at present only the tidal source is used on a large scale (Skinner B.J & Turekian K.K, 1973).

5.7.1. Tidal Power

Tides arise as a result of the lunar and solar gravitational interactions with Earth. Of the two, the effect of the Moon, because of its close proximity, dominates. The Sun's tidal attraction is only about half as large as the Moon's attraction. The major tidal cycles are, therefore, principally paced by the Moon, but the frequency is altered and the amplitude modulated by the complex interactions of the Earth-Moon-Sun system.

On the continental margins,especially where the water depth decreases rapidly, tidal amplitudes are high and frictional effects are equally large because of the large ratio of basin bottom area to water volume. Consequently,

a large amount of energy is dissipated.

This is hardly a new realization. Coastal dwellers have been using estuarine tidal waters to turn paddle wheels and drive pumps and mills for centuries, particularly in regions with favourably high tidal amplitudes, such as the Bretton coast of France and parts of Holland, Ireland, and England.
With the development of electrical generators, the tidal energy that was used for so long as a source of mechanical energy could finally be converted to an energy form capable of the wide distribution that is characteristic of modern energy utilization. The method of producing tidal hydro-electric energy is essentially the same as that used in hydroelectric plants on rivers -- water flows from one height to a lower one and turns a turbine as it does so.
There is, of course, a difference in that with tides there is a two-way water flow and a short periodicity with which the head of water is established, whereas stream flow, properly regulated by a dam system, is unidirectional and constant.

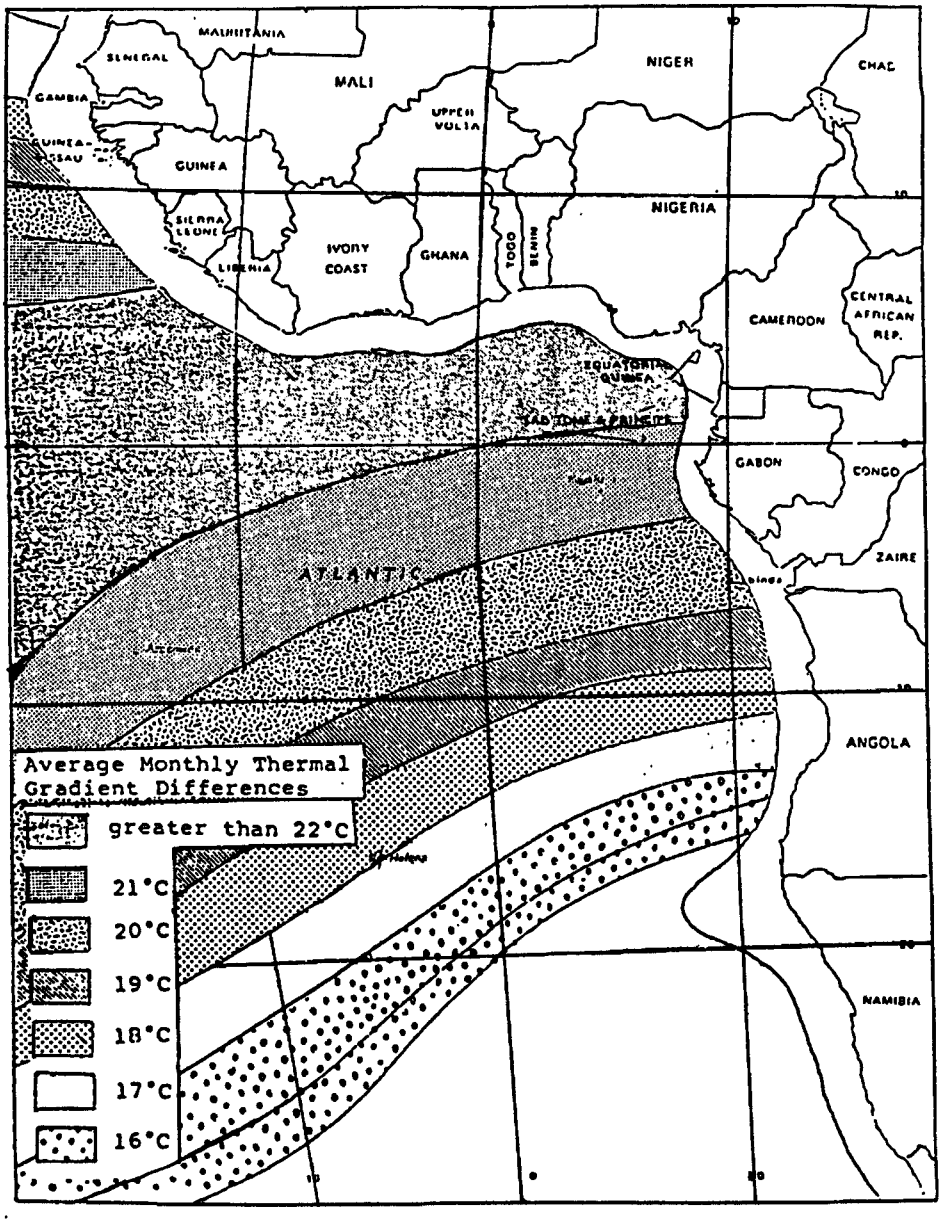
These differences cause great practical difficulties, and the development of large-scale tidal exploitation has been hindered as a result. The technical problems are being tackled, and many have been successfully solved, at the present time in at least two locations, the Rance Estuary in Brittany and Kislaya Bay near Murmansk in the U.S.S.R .
In the case of Nigeria, the limitations for harnessing tidal energy are the low tidal ranges (i.e. < 5 metres) as well as economics.

5.7.2. Thermal Energy
The ocean behaves like a huge heat engine through its cir-

culatory pattern (Skinner & Turekian, 1973). Although it is impossible to extract heat energy directly from the ocean, it is possible to use the temperature difference between the bottom and surface waters for the transfer of heat that can be usefully harnessed. Surface water tempe-

FIGURE 13

OTEC POTENTIAL IN WEST AFRICA REGION



Source: "Ocean Energy Potential of the West African Region," UNEP/IG.22/INF.7 (1981).

ratures in the Gulf of Guinea are high (25 degrees C or more) while near-bottom temperatures are consistently below 5 degrees C.(See Fig.13)

The first attempt to utilize the vertical temperature gradient of the ocean as a power source was made by a French engineer in 1928 near Liege in Belgium. The success of the Leige experiment led, eventually, to a much more ambitious scheme tried near Abidjan in the Ivory Coast after the second World War. Although the Abidjan scheme was an economic failure, it did establish beyond doubt the feasibility of such a scheme.

Chapter 6

Multiple Sea-Use & Conflicts

6.1.Management of Multiple Sea-Use

From the discussions in the previous chapters, it can be seen that human activities have an ever growing impact upon the sea. Some of these activities seriously deplete ocean life, others threaten fragile habitats, and many activities are in conflict with one another.
The need to manage sea use in the interest of the ocean environment and to the best advantage for present and future generations has been recognised for many decades, but the concept of management belongs largely to the years since 1945. Earlier attempts consisted for the most part, in formulation of laws to govern maritime activities such as navigation and coastal fisheries (Couper A.D, 1983).

In the days of sail and early steamships, the casualty rate and loss of life were very high. Navigation safety became a priority and from the 19th and early 20th centuries there were introduced collision avoidance rules, loadline rules, provision for lighthouse services, buoyage systems, improvements in pilotage, coastguard and lifeboat services, as well as safety regulations applied to ship design.
After the Second World War came radio-position fixing networks and radar, then satellite navigation systems, improvement of hydrographic surveying, ship routeing schemes and legislation governing pollution from ships. Also, with the aid of an international legal framework and fishery commissions, some steps were taken to deal with the widespread problems of overfishing, particularly in the North Atlantic and North Pacific.

More recently, the Exclusive Economic Zones established by coastal states has been the principal means of establishing resource rights and controlling pollution from land and vessels, and providing alternative uses of the national sea areas.

The priority aims of sea use management include : the reconciliation of conflicting uses, the maximizing of yields from living resources commensurate with their conservation, the preservation of endengered marine species, and the protection of fragile ecosystems. Sea use management may also include the social dimensions of ensuring improvements of the livelihoods of those dependent on the sea i.e. the many fishing communities in the Niger Delta.

The concept of sea use management is not, however, widely adopted due to the difficulties of coordinating activities between opposite and adjacent states (Couper,1983). But even within national sea areas, problems of cooperation between the various departments dealing with the sea may prove difficult. Maritime administration in Nigeria is still (as in many countries) conducted within land departments ; fisheries, for example, although elevated to full departmental status, is grouped with agriculture ; marine hydrocarbons under energy; and shipping under transport.

Among the Western European States, France is notable for its recent short-lived experiment in creating a Ministry of The Sea which transfered shipping, port and fisheries interests from the then Department of Transport, but did not encompass all maritime affairs (Smith, H.D., 1985).

At the international level, landmarks of management

activities were the voyage of the CHALLENGER in the early 1870s and the establishment of the International Council for the Exploration of the Sea (ICES) in 1902. Other international bodies, notably agencies affiliated to the United Nations, such as the United Nations Environment Programme (UNEP), the International Maritime Organisation (IMO), the Food and Agricultural Organisation (FAO) have a wide ranging role in sea use management. Also a number of non-maritime organisations have strong maritime interests, i.e. the World Meteorological Organisation (WMO).

The only really important Supra-National entity is the European Community with its Common Fisheries Policy (Wise M, 1984). The European Community is also moving into marine pollution control through its environmental interests, with special emphasis on land-based sources. Shipping and port activities are also receiving increasing attention, and it is likely that offshore oil and gas extraction will be influenced by the future development of energy policy (Smith, 1985).

6.2.Sea-Use Conflicts

The need to approach the use of the sea in a holistic way is particularly apparent in coastal waters where conflicting uses are most acute. The matrix (fig.14) shows the main conflicts which can arise. Too often, short term expediency for immediate gains overrides long term planning, to the detriment of many users and resources and the environment itself (Couper,1983).

6.2.1. Pollution

The concern in Nigeria for the problem of pollution is reflected in three symposia on "Petroleum Industry & the

Nigerian Environment", of which two volumes have been published (Nigeria, 1979;Thomopulos,1983) and a third is in preparation.

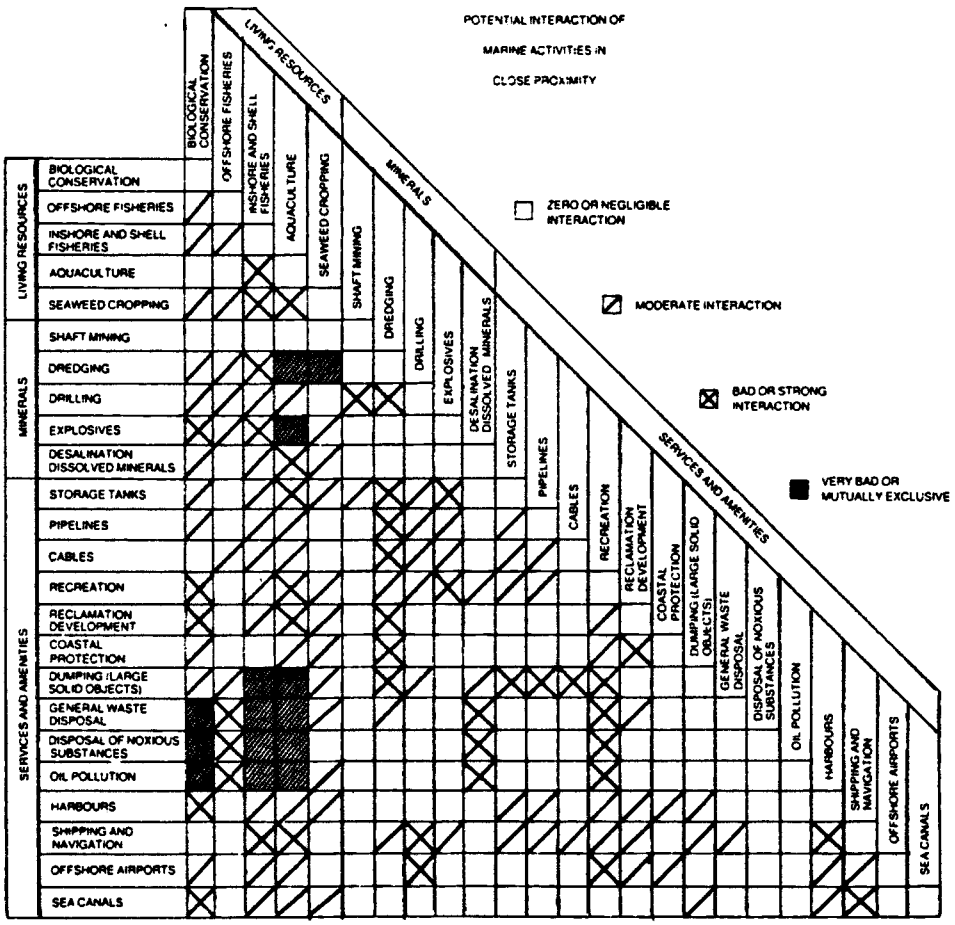


Fig. 14. *Potential Interactions of Marine Activities in Close Proximity*. Source: Economic and Social Council, United Nations (ECOSOC), *Uses of the Sea*, Doc. E/5120 (New York: ECOSOC, April 25, 1972), p. 55.

From 1976 to 1980, 784 spills were reported (Awobajo,1983),of which 588 were of minor scale and 11 involved more than 1500 tonnes. The total oil spilled was calculated to be 293,020 tonnes. This in addition to the considerable amount of oil pollution from ship and oil tanker operations in the coastal waters.

6.2.2. Sewage

According to recent estimates Nigeria has about 82 million inhabitants (FAO, 1985). The capital, Lagos, has a population of 4 million inhabitants and a theoretical annual charge of 95,000 t/a of BOD (Biochemical Oxygen Demand) and 136,000 t/a of suspended solids.
According to a national report (Nigeria,1982) the prevailing situation in most Nigerian towns and cities is very unsatisfactory as central sewage systems are almost non-existent. However, small modern sewage plants can be found in large establishments and institutions in larger towns.
The obvious effect of the discharge of untreated sewage into the waterways is bacterial contamination, eutrophication and reduction in oxygen content. Thus the Lagos lagoon once very productive in fish, is now considered a bad place for fishing (Adeyanju, 1979).

6.2.3. Industrial Effluents

It has been estimated that about 75 per cent of the industrial activity is situated along the coast with about 50 per cent in Lagos (CIFA/OP 12, 1985). The total theoretical industrial charge is estimated at 17,000 t/a BOD and 24,000 t/a suspended solids (UNIDO/UNEP,1982). The most relevant contributors to pollution are breweries,

textile industries, pulp and paper mills and petroleum refineries.

6.3. Effects of Offshore Resource Developments on Mangrove Swamps.

Mangrove swamps dominate most of the Nigerian shoreline and especially in the Niger Delta (fig.15). They provide nurseries and feeding grounds for many commercially important species of fish and crustaceans. The stilt roots, lower trunks and mud surface usually support a varied fauna of oysters, snails, barnacles, crabs and invertebrates. The upper part of the mangrove trees (plates 1 & 2) are an essentially terrestrial environment with a varied but little known fauna of birds, mamals and insects (Baker J.M,1982). Mangrove swamps may be subjected to the following variety of disturbances : oil spills of various sizes following tanker accidents; blow-outs, and spills from damaged pipelines.

In the Niger Delta, pipeline leaks in the eastern zone of operations accounted for 28 per cent of the total oil spill occurences during the period 1977-79 (Oyefolu & Awobajo,1979). It is reported that the leaks in the western zone of operations is comparable.

Other oil industry activities which affect mangrove swamps include the cutting of pipeline routes, and also gas flaring. An overall impression from the limited literature is that the acute short term effects of petroleum hydrocarbons are likely to be high mortalities of invertebrates, defoliation of mangroves, and death of seedlings. In the longer term, oil is likely to weather comparatively quickly and both mangrove and invertebrate re-colonization have been observed (Baker,1982).

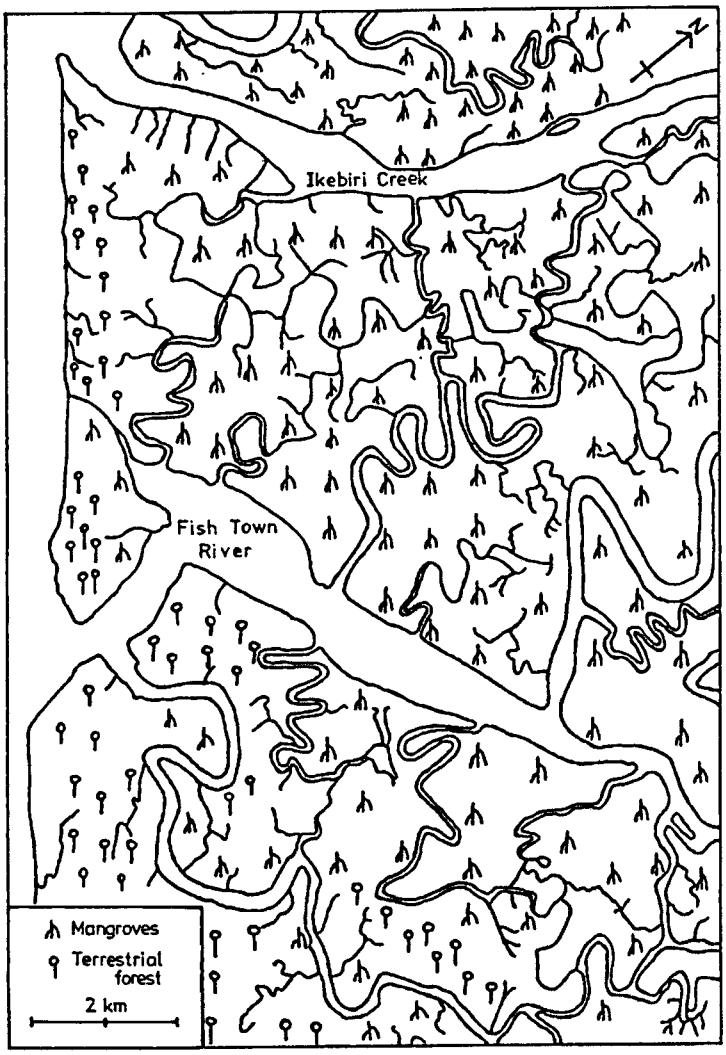


Fig.15 Map illustrating a small part of the Niger Delta mangrove swamps.

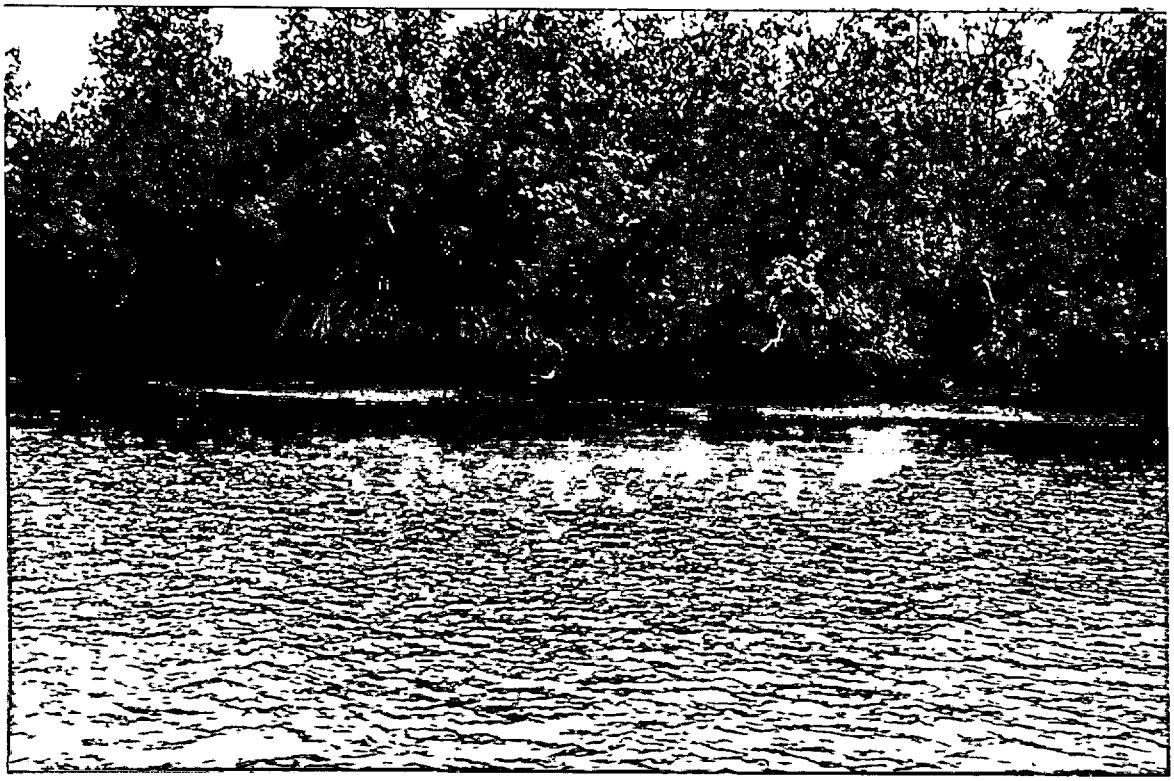
6.3.1. Spill Clean-Up

Much time, effort and money have been spent on developing physical methods of containing oil and recovering spilt oil floating on water, but these operations are still difficult to organise effectively and for this reason disper-

sants may play an important role (Jenifer M. Baker, 1982). It is however difficult to decide how best to deal with oil slicks in shallow tropical waters (as in the Niger Delta). There is a world-wide interest at present in the aerial spraying of offshore floating slicks with dispersant concentrate - this could minimize the possibility of oil being stranded in mangrove swamps, but dispersed oil would enter the water column where its effects are unknown. Also unknown are the effects of misdirected or wind-blown dispersant sprays on the various mangrove species.

Once oil has entered a swamp there may be strong pressure to spray the slicks in the larger creeks. This is because the creeks are likely to be the main highways, carrying canoe traffic (see plate 3) between villages and fishing grounds, or from village to village.
The effects of such treatments are unknown but there is the possibility of dispersed oil being carried further into the swamps by tidal action and eventually sinking into the sediments (Baker,1982).

Physical removal of oil and oily substrates, either on a large scale using bulldozers or on a small scale using buckets and spades, is commonly used in amenity sand and shingle areas in temperate regions, but this method is not usually considered suitable for soft mud or salt marsh substrates. Appropriate machinery cannot easily be manoeuvered along these types of shore, and removal of surface layers of sediment would probably mean removal of many animals such as worms, and root systems of plants. These comments apply equally to mangrove swamps, where the aerial root systems are likely to be particularly vulnerable to physical damage.



Plates 1 & 2 Delta Mangrove Swamps

(Photo by the author)

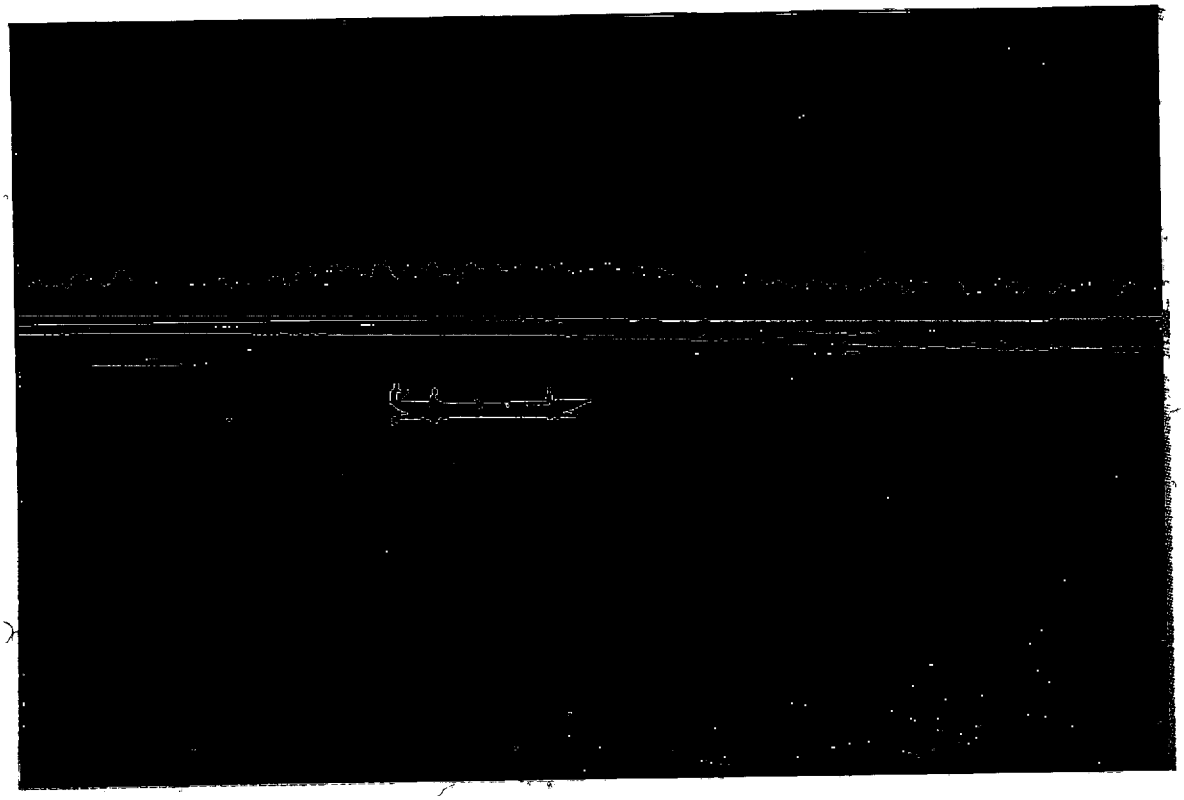


Plate 3 Canoe traffic in the creeks.
(Photo by the author)

6.4. Effect on Fisheries

During the exploratory phase for offshore oil and gas, seismic transects are run in the zones where the probability of finding oil-bearing structures seems high. The use of explosive charges for this surveys results in fish kills. However, fish kills from such operations has been reduced to a minimum because of the use of advanced acoustic and sound-generating equipment.

Other effects of offshore hydrocarbon exploitation on fisheries are :

. Potential reduction in the supply of skilled mariners in the fishery. Higher wages and better working conditions in offshore supply vessel operations can attract

away the more highly skilled individuals and " bid up" wages in the fishery.

- Disruption of the marine environment.
  Onshore facilities (table 4) can so disrupt nearshore and estuarine environments that important breeding grounds are distroyed. In this regard, pipelines are the major villian. The trenching and massive earth moving required can significantly alter wide areas of the benthic habitat and even destroy traditional fishing grounds (Peter Harrison,1983).
- Another effect is the creation of general "debris" around oil - and gas producing and transporting equipment.Fishermen have argued for many years that discarded or misplaced equipment results in extensive damage to nets and many lost days in active fishing.
- There is also the problem of loss of access as it is not allowed to fish too close to fixed structures (minimum distance 1 km)

Support bases act as general werehouse, storage , and assembly points for the myraid products needed by offshore rigs/platforms. Everything from muds , pipes , and cement used in drilling to heavy machinery, fuel and food passes through the base. Warri, Escravos and Bonny are the main supply bases in Nigeria.
Construction yards can be of several kinds, ranging from rig/ platform assembly and construction to the more traditional shipbuilding facilities which produce supply boats, pipe-laying barges, and the like.

The table below shows the kinds of onshore facilities which affect the marine environment in one way or the other.

Support :	Temporary service bases Permanent service bases/ Heliports General support facilities.
Construction & Repair:	Pipe coating yards Repair & Maintenance yards Steel platform construction yards Concrete platform construction yards.
Installation:	Platform installation service bases Pipeline installation service bases.
Product Transport:	Pipelines & Landfalls Marine terminals.
Refining & Processing:	Partial processing plants Gas-processing & treatment plants Refineries.

(Table 4). Kinds of Onshore Facilities.

Although this facility is still in the developmental stages in Nigeria, it is envisaged that in future, it will be sufficiently developed to cater to the needs of the industry.

But perhaps the most conspicuous of all coastal uses related to offshore oil and gas development are facilities used to process , treat , and transform raw hydrocarbons.

These facilities can range from gas-processing plants, which separate natural gas liquids (NGL) from "wet gas" to produce "dry gas" for onward shipment and/ or local consumption, to integrated refinery and petrochemical complexes. Any refinery or processing plant requires massive amounts of flat load-bearing land, consumes large amounts of water for cooling and processing purposes, and can contribute to the rapid deterioration of the coastal environment (Peter Harrison, 1983).

6.5. Dredging : Ecological Impacts

Dredging, the excavation of bottom material, and filling, the deposition of materials onto the bottom, are construction techniques used widely in the coastal zone. Dredging may be performed to create and maintain canals, navigation channels, turning basins, harbours and marinas (i.e. the on-going dredging operations in Lagos/Apapa port, and also in the ports of Port Harcourt, Calaber, Warri, Sapele and Koko),to lay pipeline, and to obtain a source material for fill or construction. Filling relates to the deposition of dredged materials , either for the specific purpose of creating real estate or for disposal of the by-product (dredge spoil) produced during dredging.

Dredge and fill activities adversely affect the estuarine system in a variety of ways. They can create short- and long-term changes in water currents, circulation, mixing, flushing and salinity, add to the water turbidity, siltation, pollution, and lower the dissolved oxygen.
The most obvious effect of dredge and fill is the direct destruction of habitat. Submerged bottoms or coastal wetlands, along with their associated organisms are directly destroyed by these processes.

In addition to the direct loss of habitat that accompanies dredge and fill, the removal, transportation, and deposition of sediment create and disperse large quantities of silt and debris. The larger sediment particles quickly settle out of the water column, but the finer particles can be carried for extensive distances - over .5 mile - before settling out. In such a fashion, the effects of dredge and fill can extend far beyond the project boundries (Edward T LaRoe, 1983).

Moreover, the finer sediments are easily resuspended by tidal and wind currents. Suspended silt creates a number of adverse environmental impacts. As it settles, it physically smothers bottom dwelling plants and animals; while suspended it can actually smother fish by clogging their gill structures (LaRoe, 1983).
The fish and other mobile organisms not killed are usually driven from the area. The behaviour of the remaining organisms can be severely modified. High turbidites reduce vision and can mask odours, both important to the survival of many fish.

Also, the silt, which is suspended during dredge-and-fill operations, decreases light penetration into the water. This in turn reduces photosynthesis (which is related to light intensity) and results in decreased productivity and a lowered dissolved oxygen concentration.

6.5.1. Flushing Rate

The combined influences of freshwater flow, tidal action, wind, and oceanic forces result in the specific pattern of water movement or circulation found in the estuarine

system. Tide is usually the dominant force in water movement. Its amplitude varies within the system, decreasing inward from the ocean through the estuaries and into the tributaries.

Water movement varies with the shape, size, and even the bottom material of individual parts of the system. Circulation forces tend to be lesser and flushing rates poorer when tidal amplitudes are low and the basin is deep. Thus any disruption that seriously reduces flushing allows a build-up of pollution and also may permit the salinity to increase to levels that will be adverse to the biota (Clark J.R., (ed),1983). Hence management measures should be sensitive to the pattern of circulation and the flushing rate in the coastal areas. Strong constraints should be put on shoreland development and piont-source discharges.

6.6. Marine Resources Management Problems

The impacts of marine resources development described above provide the stimulus for activating an institutional system. The extent and form of this action, as expressed in a specified resources management strategy, depends on the institutional structure and value system of society and competing demands for scarce resources to produce other goods and services desired by society (Blair Bower & Dan Basta, 1982).

Thus the problem of marine resources management is to determine the "best " mix of products and services to be produced over time, where "best" satisfies an objective such as maximum net social benefits over the time horison considered. This process involves a multiplicity of functions which include various aspects of analysis and planning, research, exploration, monitoring, leasing, cons-

truction and cleaning up. These in turn are carried out by a multiplicity of agencies with direct and indirect responsibilities for assorted pieces of the action.

In addition, there is a multiplicity of private and public "actors" engaged directly in productive activities, i.e. shippers, commercial and recreational fishers, minerals including oil and gas extractors, liquid and solid residuals disposers.
Given the above, two questions can be posed. How do governmental agencies react with one another, and how do they relate to the private and public actors ? What effect does this complicated institutional milieu have on the economic efficiency of management of any given region? These questions require understanding the effects of man's activities on the ocean ecosystem and the linkages among activities.

An approach towards this understanding is currently being undertaken by Government Research Agencies such as the Institute of Oceanography & Marine Research (NIOMR) in Lagos, as well as marine related research carried out by universities such as the Universities of Lagos, Ife, Calabar,and Port Harcourt.
Thus the interest and awareness of the public of activities in the marine environment, and especially those which are detrimental to the environment, is rapidly increasing.

6.7. UNEP Regional Seas Programme : West African Region

In accordance with resolution 2997 (XXV11) of the UN General Assembly, the United Nations Environmental Programme (UNEP) was established " as a focal point for environmental action and co-ordination within the United Nations

System ". The Governing Council of UNEP defined this environmental action as encompassing a comprehensive, transectoral approach to environmental problems which should deal not only with the consequences but also with the causes of environmental degradation.

Two elements are fundamental to the Regional Seas Programme :

a) Co-operation with the Governments of the region, and

b) Co-operation of the technical work through the United Nations system.

The components of a regional programme are outlined in an "action plan" which is formally adopted by the Governments before the programme enters an operational phase. Each action plan consists of three standard components as adopted by the United Nations Conference on Human Environment (Stockholm, 5-8 June 1972) and endorsed by subsequent meetings of UNEP's Governing Council.

They are :

a) Environmental assessment - the assessment and evaluation of the causes, magnitude, and consequences of environmental problems.

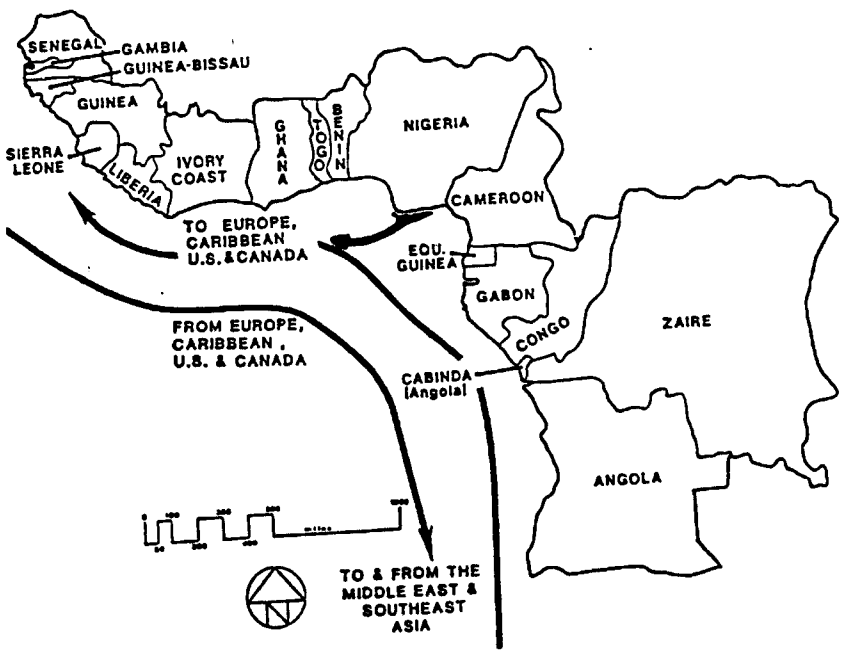
b) Environmental management - rational exploitation of living resources, utilization of renewable sources of energy, management of freshwater resources, disaster preparedness, and also co-operation in cases of emergency.

c) supporting measures - the national institutions are the institutional basis for the implementation of the action plan.

For the West African region (figs.16 & 17), concrete preparatory activities for the development of a comprehensive programme began in 1976. In 1977 an IMCO/UNEP workshop was held in Douala on the problem of pollution from ships in the region, and in 1978, FAO, IOC, WHO, and UNEP jointly sponsored a scientific workshop in Abidjan.
This has been followed by meetings in Libreville (1979) and more recently (1983) in Dakar. When the programme is fully operational, the assessment, management, as well as legal components of the problems associated with marine resources exploitation in the region will be much easier to deal with .

FIGURE 16

TANKER TRAFFIC THROUGH THE WEST AFRICA REGION



Source: "The Status of Oil Pollution and Oil Pollution Control in the West and Central African Region," UNEP Regional Seas Reports and Studies, No. 4, 1982.

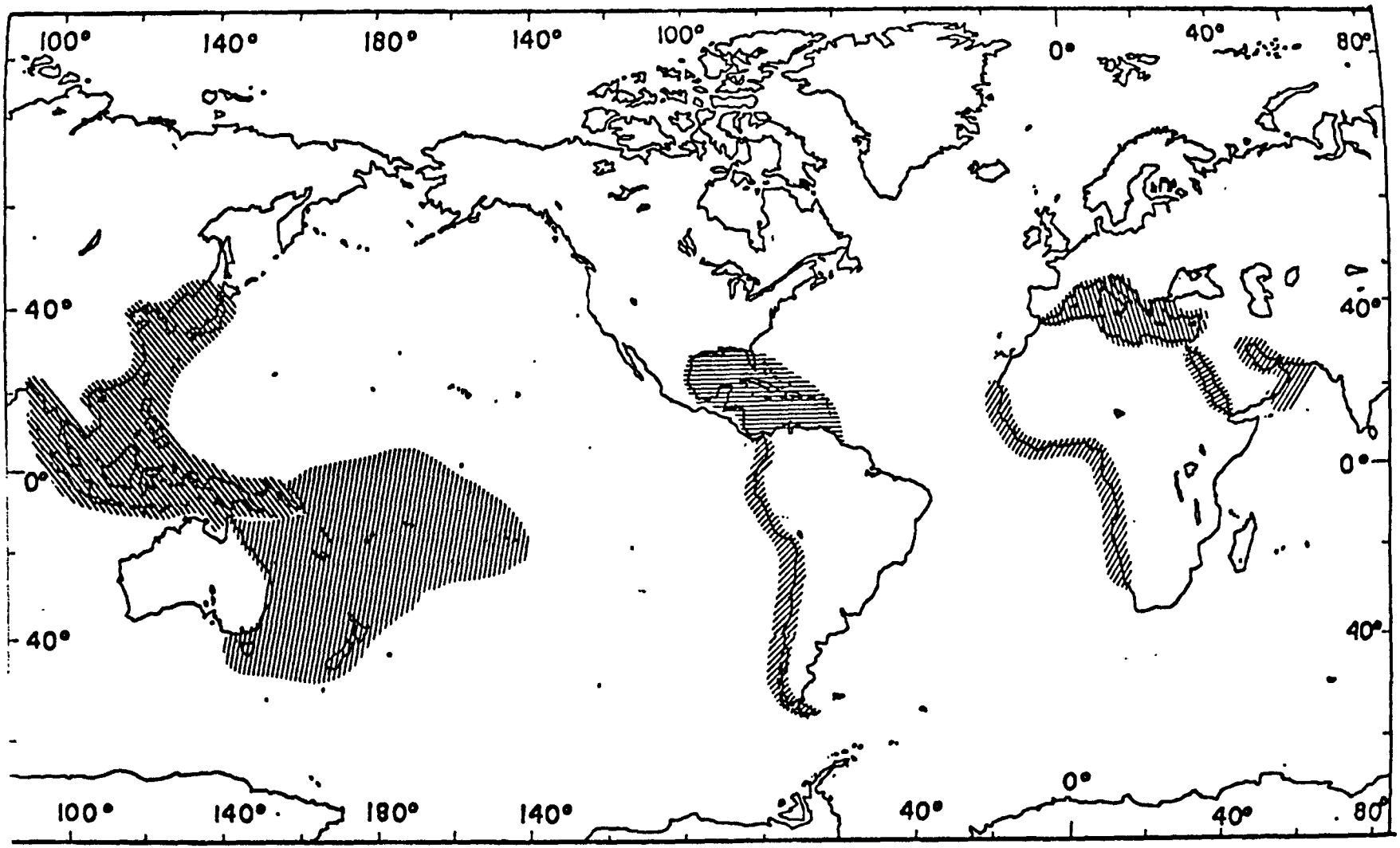


Figure 17: UNEP Regional Seas Programme Areas

Chapter 7

Value of Law & The Need For Education

7.1. Background : Law of The Sea

A new law of the sea emerged at Montago Bay , Jamaica , in 1982 with the conclusion of the U N Convention on the Law of the Sea (UNCLOS III). The Convention establishes a comprehensive framework for the regulation of all ocean space (Gold, Edgar; 1985). It is divided into 17 parts and 9 annexes, and contains provisions governing inter alia, the limits of national jurisdiction over ocean space, access to the seas, navigation, protection and preservation of the marine environment, exploitation of living resources and conservation, scientific research, seabed mining and other exploitation of non-living resources, and the settlement of disputes. In addition it establishes new international bodies to carry out functions for the realization of specific objectives, such as the International Seabed Authority.
Nigeria ratified the Law of the Sea Convention on August 14 1986.

7.2. Maritime Legislation in Nigeria

Maritime legislation in Nigeria provides a regulatory regime in three basic areas :

a) Navigation - Starting with the Ports Act 1958, which set out the legal instrument establishing the ports, the Merchant Shipping Act 1962 and its subsequent regulations provide the necessary statutory control on ships and other crafts navigate in Nigerian waters, as well as lines which are registered in Nigeria. pect of

The limits of jurisdiction is set out in the Territorial Waters (Ammendment) Act 1971 ;

b) Ocean Resources - The importance of maritime resources, especially as the economic mainstay of many coastal states, had earlier been given due recognition by the Second United Nations Conference on the Law of the Sea (Obinna B. Okere, 1982) especially by the Geneva Convention of 1958 to which Nigeria is a party. But it was not until 1969, through the instrumentality of the Petroleum Act 1969 that Nigeria defined its policy with respect to the natural resources of the subsoil and seabed of the Continental Shelf. Similarly, the Sea Fisheries Act 1971 and also the Exclusive Economic Zone Act 1978 establish jurisdictional limits and regulatory measures regarding the exploitation of living marine resources.

c) Administrative Matters - These include such regulatory measures necessary to protect the marine environment i.e. the Oil in Navigable Waters Act 1968.

Thus the overall characteristics of maritime law can be stated to be : to protect a variety of interests at many levels without undue interference in the essential aspect of international maritime commerce and marine resource development.

7.3. Enforcement

Article 220 of the Law of the Sea Convention outlines measures to be taken by the coastal State in respect of

violation of its laws and regulations adopted in accordance with the Convention or applicable international rules...(UNCLOS III). In relation to the Nigerian territorial sea, The Territorial Waters Act 1967, section 2, vests Nigerian courts with jurisdiction to try any offences commited within Nigerian territorial waters and to punish the offender for it " as if he had committed it in Nigeria ".

This section

" (a) shall apply whether or not the act or ommission in question is committed on board or by means of a ship or in, on or by means of a structure resting on the seabed or subsoil, and

(b) in case of an act or ommission committed by a foreigner on board or by means of a foreign ship , shall apply notwithstanding that the ship is a foreign one ".

In respect of activities carried on within the Territorial Sea and the Exclusive Economic Zone, Nigeria has " sovereign and exclusive rights " over the exploration and exploitation of national resources, both living and non-living within this zone (Okere, 1982).

Similarly, the Sea Fisheries Act 1971 makes it an offence for any person to fish within Nigeria's territorial waters without a licence.

But the assumption that with the passing of a law, control will readily follow is not always right (FAO, 1978) In fact the passing of a law merely means that if the person, ship, factory or any other concern continues to violate, it is in effect, breaking the law. What is important is whether or not the infringement of the law is detected and what penalty is paid as a result. In

short, a law is needed to provide a mechanism by which control can be exercised but unless that control requirement is understood and can be enforced, the mechanism will be meaningless (FAO,1978).
For this reason and especially due to the constraints of funds and adequate resources to effectively monitor and enforce the above regulations, several cases of illegal fishing (boats/gear) as well as pollution from ships go on unchecked.

7.4. Monitoring & Surveillance

Monitoring is a procedure of sustained routine observation of a system with the object of knowing , at all times, the state of the system and , in particular, of detecting the appearance of a tendency to change of state (Proc. Pacem in Maribus X, 1981).
Technically, a monitoring procedure consists of the application of a set of techniques and practices in the observation and measurement of one or more state variables of the object system. The object system may be the entire ocean, an oceanic area, a resource or other complex.

A monitoring procedure, in providing evidence on the state of an object system, establishes the informational basis for management action, either to restrain exploitative activities which are having deleterious effects or to encourage or modify those activities so as to increase the benefits from them.
In this context, surveillance is a procedure to detect acts of ommission or commission which are contrary to approved regimes; that is to say, it is a watch over human activities with the objective of deterring undesi-

rable action, both preventively and by the application of sonctions in enforcement action (Pacem, 1981).
While the problems of ocean space are closely interrelated and need to be considered as a whole, the management of ocean space and its resources is divided in legal and political terms, into three major segments : ocean space under national jurisdiction, the high seas, and the seabed beyond the limits of national jurisdiction.

7.4.1. Ocean Space Under National Jurisdiction

Monitoring in this zone will include : the state of the environment, the state of living and non-living resources, traffic control and the safety of navigation, the safety of coastal installations, the enforcement of fiscal and customs rules, the prevention of smuggling, as well as the maintenance of health regulations.
It may require a number of different technologies, from scientific laboratories and research ships and buoys, to patrol boats, planes, airships, high flying planes, and satellites.
Surveillance may extend to :

(a) activities of nationals in ocean space under national jurisdiction and beyond the limits of national jurisdiction;
(b) activities of foreign nationals in ocean space under national jurisdiction in order to
- ascertain compliance with contractual obligations; and also
- prevent activities not covered by any contract.

7.4.2. The High Seas

Organisational infrastructure is presently lacking for

the establishment of monitoring and surveillance systems on the high seas. It is essential, however, that such systems be in fact established at the ealiest possible momont. For it is impossible to enforce rules and maintain the health of the ocean environment within zones under national jurisdiction, if rules are violated on the high seas just beyond the limits of national jurisdiction (Pacem, 1981).

The need for surveillance as a means of enforcement has been demonstrated in the frustrations of treaty and statutory provisions of IMO with its now considerable body of legal instruments on safety at sea and prevention or abatement of marine pollution.
The control of ships and there equipment is covered by the SOLAS, Load Line, and MARPOL (1973/78) Conventions; the control of discharges at sea is covered by the OILPOL and MARPOL Conventions and by the London Dumping Convention; the control of crew competence is covered by the 1978 Conventions on Standards of Training, Certification & Watchkeeping; while the control of navigation is covered by the 1972 International Regulations the Prevention of Collision at Sea.

7.4.3. The Seabed Beyond the Limits of National Jurisdiction

This zone is regarded as the International seabed Area and the Convention on the Law of the Sea gives authority to the International Seabed Authority. This body is responsible for the management of the resources of the Area for peaceful purposes, and the development of the Common Heritage for the benefit of mankind as a whole.

7.4.4. Cost Reduction

The cost of services and technologies can be reduced by

- the integration of systems at the national level, avoiding organisational duplication of efforts and taking advantage of the multi-purpose capacity of surveillance technologies.
  Means of surveillance thus can be utilized, simultaneously for transport of goods and persons and for communication, to increase cost/efficiency ratios;

- through bilateral agreements, i.e. between Nigeria and foreign fishing companies, providing for the placement of observers on foreign fishing boats, the cost of which is borne by the foreign company; or by placing of Black Boxes on ships entering ocean space under national jurisdiction.

- through co-operation on a subregional or regional basis;

- through co-operation with intergovernmental organisations such as Fishery Commissions (i.e. CECAF, CIFA), regional scientific centres (i.e. NIOMR) , or the competent agencies of the U N system.

In this regard, Nigeria's co-operation in the framework of UNEP's West African Regional Seas Programme should be encouraged.

7.5. Education

For management programme to be effective, people must be taught why a particular action is regarded as important.

With regard to marine pollution for instance, the man who carelessly throws a plastic sheet or bottle overboard may not realize that his action may cause the blockage of an engine cooling water intake in a ship at sea causing engine stoppage or failure.
The people who discard logs, or allow them to break loose from rafts, probably do not realize the effect that such a large object has on a frail fishing boat which bumps into it on a dark night (FAO,1978).

Industrialists must also appreciate the arguments for pollution controls by complying with the requirements for the installation of treatment plants.

However, education must not stop at the level of the public and the industry. It may be necessary to educate the necessary officials, enforcement officers, and also support staff. Such officials will include the Water Police, Customs, and the Navy.
It is also necessary that officials be taught to understand that pollution control actions cannot be considered in isolation, and that they must co-operate to ensure that solution of one problem does not create another one. The example of a ship prevented from washing its tanks at sea but with nowhere else to wash them is a case in point.

Other examples most appropriate to the Nigerian coastal area is the construction of port facilities without due consideration for the potential coastal erosion nearby; and the exploitation of timber resources and subsequent soil erosion; and river pollution by high suspended sediment loads, with subsequent alteration of marine habitats and loss of fishing or fish nursery areas.

Chapter 8

Marine Scientific Research In Ocean Development

8.1. Introduction

The marine sciences are a multidisciplinary field of research. There aim is to :1) gain greater understanding of the natural ecosystem often with respect to the prudent utilization of its resources ; 2) and the protection of the marine environment from the consequences of excessive exploitation and detrimental stress by dumping of waste.

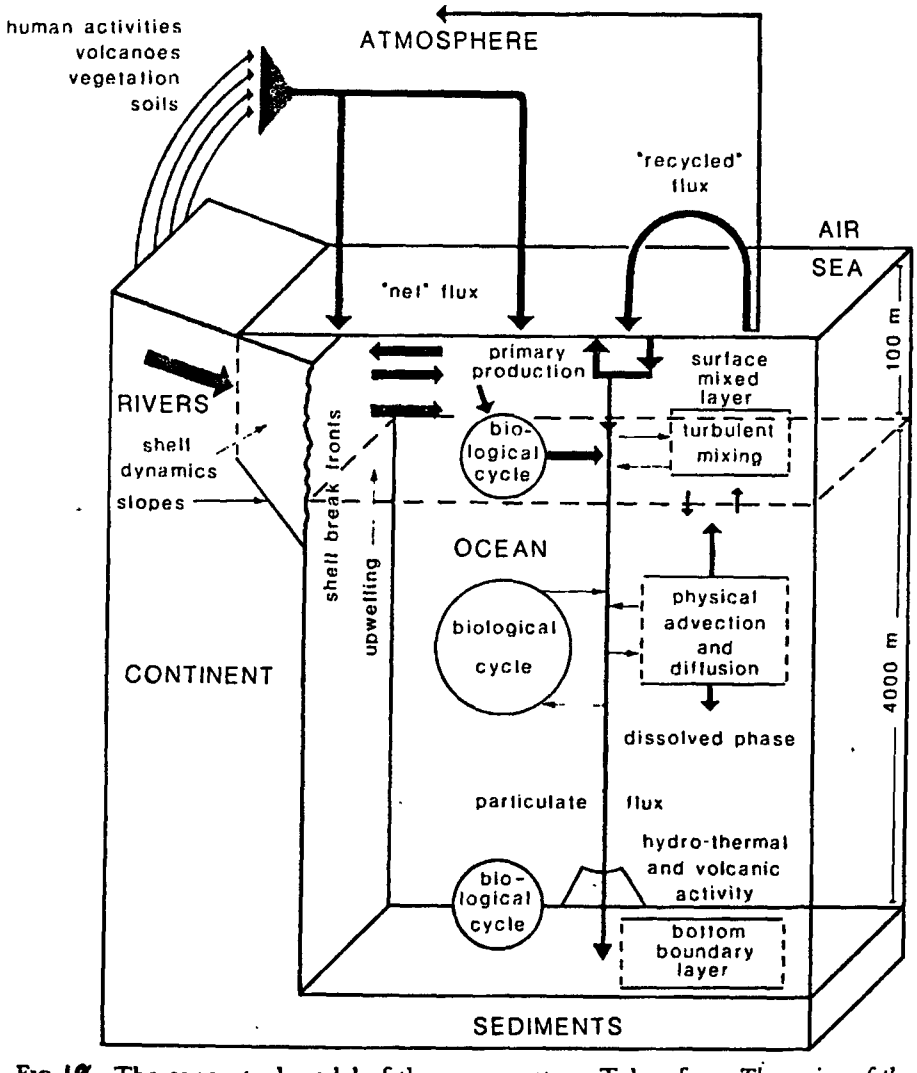


FIG. 18—The conceptual model of the ocean system. Taken from *The review of the health of the oceans*, GESAMP Reports and Studies, no. 15 (Paris: Unesco, 1982), p. 13.

Figure 18, taken from the GESAMP report on the health of the ocean, is a good illustration of the complexity of this great natural phenomenon.

The upper left-hand corner of the figure indicates the continent - the land and the coastal regions. These are the main sites of human activities and the sources of impact.
Man uses the surface of the ocean for his navigational exploits, for transport, communication and, including the upper 100 metre or so of the body of water, for most of fishing and mariculture activities, the production of food. Moreover, a significant part of the fisheries is located in the nearshore regions above the continental shelf. Another part of this whole body of the ocean is the seabed and subsoil. It has become a focus of interests ever since the technology of drilling for oil and gas in offshore areas became standerdized and since the technique for mining manganese nodules was solved technically, although not yet economically (Vladimir Pravdice,1983).

8.2. The Convention & Marine Scientific Research

The U N Convention on the Law of the Sea imposes a legal obligation on all concerned to promote and facilitate marine scientific research. The conditions for this support for science are simple : Research must searve humanity as a whole, which means above all that it is to be conducted exclusively for peaceful purposes. It strongly encourages international co-operation in marine scientific research on a regional level and also requires the strengthening of the global international institutions dealing with marine scientific research (UNESCO, IOC,

UNEP, and FAO) to enable them to assist developing countries in building their own scientific capabilities.

8.3. Marine Scientific Research In Nigeria

As noted previously, Nigeria's coastal area is endowed with a number of natural resources including crude oil, gas, trees (such as red mangrove and coconut) and fish. The exploitation of these resources contributes to the vast number of human settlements all along the entire 823 kilometre long coastline.
It is estimated that the total human population along the Nigerian coastline is about 1,500,000 out of which 969,000 or approximately 65 per cent are fishermen; most of the remaining 35 per cent engage in farming and exploitation of coastal trees for food production and canoe construction (U N ,1982).

The Nigerian Institute for Oceanography & Marine Research (NIOMR) established in 1974, undertakes research in the areas of oceanography, fisheries, matters relating to shoreline dynamics and also pollution problems.
With regard to marine pollution, the Environmental Planning & Protection Division of the Federal Ministry of Housing & Environment is currently undertaking a pilot project with the aim of :

(1) preparing a register of contamination sources;
(2) sampling and analysis of the quality and the quantity of contaminants;
(3) research on possible effects, and
(4) preparation and diffusion of effluent guidelines to control pollution at point sources.

Also, a four-year project has begun to study the impact

of pesticides on the Nigerian environment and the problem of pesticide residues as a basis for legislation (FAO,1985).

Other institutions working on pollution problems are the universities of the country. For example, the University of Lagos is working on microbial pollution of the Lagoon from domestic wastes, and the Universities of Port Harcourt and Calabar on an impact assesment of petroleum residues on the mangrove ecosystems of the Niger Delta. Also, the Nigerian National Petroleum Corporation is particularly active in this area by funding research and organising seminars on the subject " The Petroleum Industry & the Nigerian Environment" (FAO,1985).

8.4. Research & Information Services

Notwithstanding the above efforts on part of some institutions, marine scientific research in Nigeria is still very much in its developmental stages.

Advancement of knowledge of marine resources and the ocean area in general depends on research and information services. Thus according to the IOC (1982), " new scientific knowledge is built upon existing knowledge, and successful research calls as much for access to scientific literature and data as to ships and laboratories ".

To support the national research institution and experts, there must be a complete and competent information service in marine affairs (Odidi-Okidi, 1984). This will require information experts, complete with a system for the synthesis, storage and dissemination of information.

8.5. Operational & Developmental Services

As discussed in chapter 6, these services relate to those which support the offshore operations. However, offshore operations involve human beings working in an unusual environment with unique stresses. Therefore, a special range of medical services is reqiured. Because human beings are involved, there is a necessity for special skills in land-use planning to rationalize settlement and to expand social services, such as education and housing. Several other economic activities will automatically follow and , therefore, employment planning is a crucial management question. Planning for this purposes requires training, including comparative perspectives (Odidi-Okidi,1984).

8.6. Status of Manpower & Training in Nigeria

The discussion of the operations related to marine resource development suggests a range of expertise and manpower required for a country to fully benefit from these resources. The limited number of such personnel in Nigeria clearly indicates a greater need for advanced training in these fields.

This is further re-enforced by the report of the survey mission sent to African coastal states by the UNESCO and the Economic Commision for Africa (ECA) in 1980. It contends that there have been very few or no programmes of teaching or training to develop high-level professional manpower in the marine sciences. In the natural sciences, the main focus has been on undergraduate teaching, producing holders of B.Sc degrees or equivalent in boilogy, chemistry, physics, geology and mathematics.

Programmes leading to Ph.D degrees in the marine sciences are non-existent. And of those who have received advanced training directly in marine affairs, the majority are likely to have been trained in marine biology and fisheries (UNESCO/ECA ,1980).
Where there is no development of manpower and expertise, it can be expected that institutional infrastructure will not evolve either. There will be no research vessels, equipment or laboratories, and the vicious circle will continue (Odidi-Okidi, 1984).

For development to occur, the bottle-neck must be broken somewhere. In general, most have argued for the transfer of technology as a means of breaking the bottle-neck. The transfer of technology might break the bottle-neck only if the training of high-level manpower and expertise in the respective fields is undertaken first. In this case, the trained manpower would receive the technology or may, in fact,be able, through skilled engineering techniques, to modify the technology in order to adapt it to their own circumstances.

8.7. Some Schemes for Training

The interpretation of the notion of transfer of technology adopted above is the governing principle for the design of the scheme for the training of management in marine resource development. What is gained in the training course is part of the technology for management of the resources; at the same time, the individuals are prepared to receive any technological software and hardware that may reach the country. The training must prepare the individual to receive, adopt and diffuse the technology.
Training may fall into two broad categories : short cour-

ses and long-term training.

8.7.1. Short Courses

Short courses could be designed for the managerial cadre in place. Initially, they could be both interdisciplinary and multidisciplinary in character and provide general orientation. The purpose might be to build up the notion of the comprehensiveness and interrelated nature of marine resource management. This will also include opportunities for individuals to pursue a modicum of in-depth projects in areas of specific interest, or formal training. In this event, the basic professional background of participants will not matter.

They could be drawn from the disciplines of public administration, engineering, economics, geology, biology, law and chemistry, among others. The duration of the course depends on a number of factors; the level of the managers and their responsibilities are often the leading considerations. However, for an intensive short course, any duration of up to 10 weeks may be reasonable, provided it is cost-effective in terms of use of time and resources.

8.7.2. Long-Term Training

Long-term training would comprise professional training programmes and expertise for high-level research and development. The fields covered would include, inter alia, oceanography, geology, geophysics, maritime geography, and the like. It would be appropriate for these courses to be pursued to the doctorate and post-doctorate level.

8.8. Role of the United Nations

Through the machinery of the United Nations and its Regional Commissions and Specialized Agencies, resources can be secured and co-ordinated for both of the above levels of training. The short courses for instance may be well organised, economically, through the regional commissions. The courses can accommodate input from the United Nations Secretariat offices, such as the Ocean Economics & Technology branch, or the Intergovernmental Oceanographic Commission of UNESCO, or the International Maritime Organisation. One may also add that the training here in the World Maritime University (of IMO) is one of such high-level training.

Similarly, some countries, such as the USA, arrange for bilateral aid directly with the national government. Also, the governmental technical assistance agencies of West Germany, Japan, France, the United Kingdom, the Netherlands, Sweden, Norway, and Canada have provided funds and /or scientific and technical personnel for cooperative marine projects.

Chapter 9

Conclusions :

Legacy of The Past & Directions Towards A Marine Policy

9.1. Introduction

Marine policy problems in Nigeria are emphasized by the patterns of interaction between the various institutions responsible for specific ocean uses and also by those of the neighbouring countries in the Gulf of Guinea region. The trends and patterns of ocean use, the conflicts that have arisen within and between uses, and the technological advances and jurisdictional changes have altered the contexts of marine policy problems and the process of ocean management (Miles et al, 1982).

The need to extract hydrocarbons, different types of energy, minerals and other resources from the ocean has grown. These dynamic transformations have resulted in problems of adaptation for institutions, causing difficulties in both the utilization of marine potential and the implementation of suitable measures with regard to contamination and other changes in the ocean environment. Clearly, fisheries are the major issue. Patterns of use in marine transportation, including both trade and regulations designed to reduce the level of ship-generated oil pollution in the ocean, have significant regional implications though they are driven by different global dynamics. Nigeria accounts for more than 80 % of the total trade to the West African region (UKWAL, 1981).

Marine scientific research , especially as it relates to problems of management affecting living resources, climate change, and marine pollution, would benefit from a more systematic regional approach which would also strenghten the links between research output and management decisions. However, this area of use also suffers from fragmentation and uncoordinated approaches adopted historically by the participants.

The more significant multiple-use conflicts involve the incompatibilities of fish production and hydrocarbon exploitation, and the transport of petroleum versus fishing.

9.2. Major Limitations In Institution Building

In practically all countries, institutional growth and maturation have not kept pace with the expansion and diversification of marine related activities (Jean-Pierre Levy , 1984).

As a result, traditional institutional and administrative arrangementsare ill-equipped to undertake the complex management functions required under the present circumstances. An overall review of the Nigerian experience indicates that institutional limitations in marine and coastal development consists of the followiong :

(a) There is an absence of clear policy goals and priorities and an overall marine policy framework. Low priority is attached to the concept of marine resources development and uses seen as an integrated whole.

(b) There is a great and continued reliance on the sec-

toral approaches to marine development, and existing institutional arrangements reflects this approach. Such an approach encourages the development of marine activities on a project-by-project basis without adequate co-ordination within sectors and with an inadequate effort to integrate projects.

Generally, co-ordination and communication between agencies in different sectors is inadequate, even when they share common marine interests, resulting in fragmentation of efforts, duplication or overlapping. Even within sectors, responsibility for ocean activities tends to be located at a level in the bureaucratic hieravhy, with limited staff and budgetary resources.

(c) Policy-making and planning activities as they exist are carried out on the basis of a sparse information base. Objectives are infrequently re-evaluated in the light of changing technical, management or economic circumstances. The experience of Malaysia is a good illustration of this point. During the mid-1960s the Government of Malaysia created a large free trade zone. Its aims were : to attract foreign capital and technology, create industrial jobs, and earn foreign currency from export.

By 1975, the free trade zone of Prai in North-West Malaysia had become one of the largest in the world and,in the process, had attracted fishing folk from the entire region.

Subsequently, large numbers of trawlers acquired fishing licences and the result was a dwindling of catches. The other blow occured as a result of indescriminate dumping of the factory effluents

from the free trade zone into the shallow seas off the Prai area, polluting the waters and killing off large numbers of fish, crabs and prawns.

(d) Also, the legislative and regulatory framework for marine activities is not adequate to cope with the scale /complexity of such activities.

9.3. Concepts Of Marine Policy

The starting point of the development of marine policy concepts has been the enormous change that has come over the status and use of the seas by the nations of the world since 1945, and still more since 1970.
The legal regime of the oceans accepted as generally valid since Grotius, has given and is giving way to a movement to 'enclose ' substantial parts of the oceans for many purposes either within the individuals jurisdictions of individual coastal states or of the collective jurisdiction of regional groupings of states, first, so far as the resources of the seabed are concerned , then for fisheries, and now for a whole series of other purposes (D.C.Watt, 1980).

Various marine policy concepts have been developed in academic institutions notably in the United States and also in Europe.
Concepts employed are variously described as :

'Sea-Use Planning ' (The Netherlands),
'Ocean Management in Europe ' (Norway),
'Ocean Policy ' (University of Virginia),
'Ocean Law, Policy & Management ' (Dalhousie University , Canada),
'sea Use : Law, Economics & Policy-Making' (London

School of Economics, London),
'Marine Law & Policy ' (University of Wales, Institute of Science & Technology, Cardiff).

9.4. Marine Policy Formulation

The policy for marine resource development must be consistent with the national development policy. It must also comprise economic policies, human resource policies, and technology policies among others (Phactuel Machado Rego, 1984). This means that such a policy must result from the simultaneous consideration of two sets of criteria , derived in two different ways : first , that which projects the interests and objectives of the national development policy over the marine sector; secondly, that which seeks coherence and consistency with all the other sectoral policies in force.

In other words, the interests that the marine policy must attend to should be derived from the realization of its effective and /or potential contribution towards attaining the national goals.
However, its specific objectives can only be established by taking into consideration , in a very realistic and detailed way, the conditions and characteristics of the development processes of other economic sectors, the global structure and the means that could be made available at national level, to support its implementation.
When setting specific goals for the marine policy, consideration must be given, for example, to the level of general development of industrial activities in the country, the present situation as regards the transportation infrastructuree, as well as the availability and

quality of labour, for these are factors that influence the ability to attain those goals (P. M. Rego, 1984).

Furthermore, marine policy studies must express , explicitly, not only the availability of industrial infrastructure and services, the degree of mastery over other technologies in the marine sector, the existing capability for educating and training the people, needed, but also general and specific proposals aimed at providing , from these various other sectors and fields, the ways and means to implement the marine policy.

9.5. Marine Policy Integration

To 'integrate' means to unify, to put parts together into a whole. Integrated policy then means a policy where the constituent elements are brought together and made subjects to a single, unifying conception.
An integrated policy can be defined as one where all significant consequences of policy decisions are recognised as decision premises, where policy options are evaluated on the basis of their effects on some aggregate measure of utility, and where the different policy elements are consistent with each other. In other words, a policy is integrated to the extent that it recognises its consequences as decision premises, aggregates them into an overall evaluation, and penetrates all government agencies involved in its execution (Arild Underdal, 1980).
Thus the main advantage of policy integration will be the improvement of outcomes.

To date, eight countries have established programs sufficiently designed for integrated management of coastal resources : the United States, Sri Lanka, the Philippi-

O=Principal strategy
X=Complementary strategy
NA=Info. not available
SU=Seldom used

	FRANCE	USA	GREECE	INDONESIA	SRILANKA	THAILAND	PHILIPPINES
National Economic Planning	X			X		X	X
Broad Sectoral Planning		X	X	X			
Regional Seas	X		X	X		NA	NA
Nation /state-wide land use	O	O	O	X	O	O	O
Specialareas & regionalplans	X	X	X	O		O	
Shoreline exclusion	X	SU	X	X		NA	X
Critical area protection	X	SU	X	X		X	X
Impact assesment		X	X	X	X	X	X
Guidelines			X	O	X	X	X
Acquisition programs	O	X					
Coastal atlas-data bank		X	X	X	O	O	O

Fig.18 Strategies used in coastal resource management programs.(Source : Sorenson et al. 1985).

nes, Thailand, Indonesia, Greece, rance, and Australia (South Australia and New South Wales) (Sorensen et al.,1984). Also, the growing impacts of oceans concerns on land /ocean interface has stimulated several initiatives (i.e. Sri Lanka, Sweden, Brazil) for national ocean management with the potential to develop into broader marine management programmes (Sorensen et al.,1985).

9.6. Summary & Conclusions

The problems of development and management of ocean resources in Nigeria stem from the fact that the coastal region remains governed by the general legal regime applicable to land-use. The characteristics of the land/water interface are not taken into consideration. Therefore these areas are subject to laws governing land use, town and country planning, and terrestrial resource use. Furthermore, existing planning/management schemes are usually focused on a relatively narrow strip along the shoreline and coastal waters. Coastal area planning jurisdiction extends to the low water mark in Nigeria. Also, the fact that the different ocean uses are governed by sectoral legislation, without adequate coordination among related implementing institutions does not help much.

As the sea represents the last major frontier for development, it is necessary that the development and management of its resources are not handled in a peacemeal fashion.
It follows therefore, that the development of the technical and managerial expertise necessary for the effective exploitation and regulation of Nigeria's ocean space is of crucial importance.

This requires broad-based managers for public service, sufficiently skilled in a number of ocean-related disciplines to regulate and manage with an awareness of the multisectoral nature of ocean development, and of the interconnected and often conflicting requirements of different ocean uses. At the same time, more technical and unisectoral specialists will be needed both in government service (as the field personnel in management systems) and for private and parastatal enterprises.

With regard to fisheries, some progress has been made in recent years in the gathering of fishery statistics and by their transmission to CECAF. However, the poor quality of some , and the inadequate breakdown of others, together constitute the main stumbling block for the improvement and assessment of fishery potential in Nigeria's ocean space.
To achieve a continuous, satisfactory control over the main parameters of stocks and fisheries, effort needs to be made in three directions :

a) Expansion and consolidation of the CECAF statistical system,
b) Improvement of sampling of artisanal fisheries, and
c) The gathering of statistics on the fishery of foreign fleets.

Beyond provision of straightforward information such as the location of fish stocks and petroleum reserves, marine scientific research is required to establish the data bases and managerial models to allow for rational control of fishing quotas, pollution contingency plans, mariculture development as well as for other uses.
This calls for more training for ocean scientists and also marine administrators. But most essential on this

issue of trained personnel, is their utilization. This is important because often, trained personnel are egaged in jobs not exactly connected with their profession. This leads to a gradual loss of interest and consequently, lack of effort in discharging their duties. In some cases it may even lead to reaction.

To facilitate the development of ocean-based industries, onshore facilities need to be improved. Landing sites, storage and processing facilities, as well as transportation routes to the major markets are of vital importance to the future of the domestic fishing industry.
Above all, the guidelines provided by the Third United Nations Convention on Law of the Sea, which Nigeria has now acceded to, should be followed. The implications here are that the necessary legislations will have to be made together with institutional arrangements/organisation before the full benefits of Nigeria's accession to the Convention are realised.

Furthermore, the problem of lack of communication between institutions (and sometimes within institution) with related marine interests should be looked into. For this, it is recommended that a high-level (i.e. Deputy Permanent Secretary, Deputy Director or their equivalent) committee be set up so that solutions to common issues can be reached. This will also eliminate the problem of duplication of efforts from the various institutions and consequently a reduction in costs. Such a committee will also examine the case for a marine policy as discussed above as well as the ways and means of implementing this policy. In this connexion, the potential of Nigeria's coastal area for tourism will also be an influencing factor in the requirement for a sound management programme so

as to avoid the deleterious effects of the current piece-meal management methods.

Finally, a clear marine policy is required together with some degree of integration with other policies relating to the use of the ocean space. This will strengthen the marine sector and consequently enable it to contribute fully to the nation's economic growth.

APPENDIX

List of Abreviations

CECAF	Fishery Committee for the Eastern Central Atlantic
CIFA	Committee for Inland Fisheries of Africa
ECA	Economic Commission for Africa
EEC	European Economic Community
EEZ	Exclusive Economic Zone
FAO	Food and Agriculture Organisation
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
ICES	International Council for the Exploration of the Sea
IMO	International Maritime Organisation
IOC	Intergovernmental Oceanographic Commission
MARPOL	Convention for the Prevention of Pollution from ships
NIOMR	Nigerian Institute of Oceanography and Marine Research
OAU	Organisation of African Unity
OTEC	Ocean Thermal Energy Conversion
SOLAS	Convention on Safety of Life at Sea
UNCLOS	United Nations Convention on Law of the Sea
UNESCO	United Nations Educational Scientific and Cultural Organisation
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organisation
WMO	World Meteorological Organisation
WMU	World Maritime University

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