DEVELOPMENT AND THE ENVIRONMENT IN THE WESTERN INDIAN OCEAN REGION: PROBLEMS AND RESEARCH AGENDA.

By

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ABSTRACT

This paper examines the range of development problems prevalent in the states of the Western Indian Ocean. Then the problems are juxtaposed against the terrestrial and marine natural resources as well as the physical infrastructure to explain the possible role of the resources in the development process. Among the resources examined are fisheries and minerals and some of the problems inherent in their management. Thereafter, the environmental problems which arise in the course of the management efforts are examined. These include the degradation of marine environment, including pollution from land based sources and those arising from marine transportation, exploitation of marine resources and from engineering and military activities.

The final section outlines an annoteded profile of research agenda on both development and the environment.

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Whether the Indian Ocean separates or links the countries surrounding is an eternal question for which we do not insist on a firm and simple answer at this time. However, it is important to recognize that the the physical presence of the ocean and the reality of the states around it presents inevitable social and economic implications for the well-being of the countries. For instance, the very water of the ocean is a resource ; the living resources which inhabit the ocean are vital socio-economic resources; but then the living resources, like the water movements, do not respect the limits of national jurisdiction thus rendering them resources of stubborn characteristics for those who might want to take advantage of the socio-economic value.

Besides, the oceans also form a vital medium of transportation for the immediate coastal as well as distant states , whether coastal or land-locked. Such a quality also presents a number of regulatory and infra-structural issues for the coastal states of the India n Ocean because there are limits to which they can impose measures against those who navigate the ocean for commercial, social or military purposes.

Whether the waters of the oceans seperate or link the states of the region seems immaterial to the fact that the oceans store (or are so believed) a number of non-living resources which the coastal states might mine or otherwise extract for the benefit of their respective national development interests. Petroleum, oil, gas and salts are some of the non-living resources which are highly prized by the nation-states. Some of those resources may exist exclusively within the territorial or other areas of national jurisdiction, while in other instances their deposits may traverse the limits of national jurisdiction. Only actual exploration and prospecting can establish the magnitude and extent of any possible deposits. But the very act of exploration and prospecting must be preceded by a determinatio of the precise limits of national jurisdiction. And as is well-recognized a delimitation of the area of national jurisdiction is a unilateral act which only the respective state can do, but its validity with regards to other states is subject to international law and review.[1]

A number of recent developments militate that a series of careful reviews should be done of the developments within and around the Indian Ocean. Only a few salient examples will suffice here: First, there is a general recognition that except for Australia, New Zealand and South Africa, all the

all the countries around the Indian Ocean are low income or underdeveloped/ developing countires. Therefore, they are in dire need for enhancing their economic performance. Secondly, there is a general recognition that for the enhancement of their economic growth and socio-economic development there should be greater emphasis on co-operation among the same countries so-called(South - South cooperation) in the planning and investment in development goals. That requires, perfore. that the countries take stock of their resources, past experiences then plan for the precise future development goals and some of the strategies that would promote the mutual objectives.

Thirdly, a new United Nation Convention on the Law of the Sea was done at Montego Bay, Jamaica, on 10th December, 1982.[2] In contrast to the legal regime which evolved through customary practice and the 1956 Geneva Conventions.[3] The negotiation for the 1982 Convention enjoyed the participation and substantive input of the states from the Indian Ocean area.[4] They can legitimately claim that it is a modern and global convention - their own, and they should review how to benefit from its provisions. Legal regimes under the Convention have brought considerable areas of the sea under national jurisdiction and also emerged with new rules for the exploitation of living and non-living resources in areas beyond the limits of national jurisdiction. Yet as stated above the management of some of the resources require regional consultation and, often, cooperation because their natural behaviour or deposits will not respect the limits of national jurisdiction.

Fourthly, there is already an increasing awareness of the need for inter-state and regional cooperation among the areas around the Indian Ocean. The most auspicious of these are the regional programmes for the management of the marine environment initiated by the United Nations Environment Programme (UNEP). Although the Action Plans enjoy the technical support and initiative of UNEP, they are, in principle and practice, projects of the regional states.[5] The Kwait Regional Convention was signed in 1978, the Red Sea and Gulf of Aden Convention was signed at Jeddah in 1982 and the Eastern African Regional Convention was signed in Nairobi in June 1985. Besides, preliminary Action Plans have been adopted: for East Asian Region in 1981 and that for the south Asia Region is under preparation. All these are under the new general Oceans and Coastal Areas Programme Activity Centre of UNEP, which includes the efforts to initiate management of regional marine environment as well as the management of marine living resources for sustained development. At the core

of the catalytic role within UNEP is establishment and development of national and regional institutions which can take on the requisite research and management of the resources.

Fifth, a number of non-governmental organizations within the region have actually initiated research for future development action within the Indian Ocean region. The Issue-Based Indian Ocean Network was inaugurated at the Mahatma Gandhi Institute in Mauritius in September 1985 at the initiative of Mazingira Institute of Nairobi and Centre de Documentation de Recherches et de Formation Indianoceaniques (CEDREFI) of Mauritius. A representative of the International Centre for Indian Ocean Studies in Western Australia was among the participants. This is yet another indication of the growing need to identify topics and initiate research or possible areas of collaboration among the states around the Indian Ocean.

Finally, it will be recalled that in 1961 a group of colonial states created the Indo-Pacific Fisheries Council to facilitate exchange of fisheries related information and to enhance their capacity to fish the waters. That effort was followed nearly ten years later by the establishment, within the Food and Agriculture Organization of the United Nations (FAO) of the Indian Ocean Fisheries Commission as the framework for studies and exchange of information on biology, stocks, surveys, economics and technology of fisheries in the Indian Ocean.

This paper will restrict itself to matters of environment and socio-economic development of the littoral and island states of the Indian Ocean, leaving out the general security and geopolitical questions. The latter are important and timely but should be handled in a seperate paper.

It is within this context that this paper will provide a general and synoptic outline of the development interests of the coastal and island states; the existing recources of regional character, and the impact of various activities designed to enhance economic, social and technological development on the environment. The trend towards treating some of those issues on the pan-Indian Ocean basis is already suggested by the six instances outlined above.

Of necessity, the exercise requires the paper to be selective as to what should be included for one seminar discussion. Such a list needs only to be selective and indicative rather than exhaustive. Several other topics can be suggested in the course of the discussion of the few. And given the .

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breadth of the fields to be covered the paper cannot purport to be a detailed academic discussion of each topic. Rather, it will present only broad outlines of subjects each of which is susceptible to detailed academic teatment.

The first part of the paper will broadly introduce the concept of development as used in this paper. It will discuss the situation among the countries of the region and offer a small selection of some of the sectoral needs which would be of interest within a regional framework.

The second part will deal with the resources, with a major emphasis on [illegible] natural resources, with regional character, or those the utilization of which have obvious regional implications. The outline will include coastal and immediate terrestrial resources; marine resources, human resources, and selected basis infrastructure.

The third part will identify the concept of environmental problems and their regional character. It will suffice to focus on the marine environment only with a few of the problems originating within it and those generated elsewhere but finding expression in the marine environment.

Arising from the problems raised in the three sections, the fourth part will outline, with annotation, some of the crucial issues which should be amenable to research and possible policy action.

The extensive footnotes are intended as a basic reading for those who might be interested in Indian Ocean research.

II DEVELOPMENT OF STATES IN THE INDIAN OCEAN REGION

The concept of development became a vogue subject of study after World War II. But it is also evident that it meant different things to different authors, very often being confused with the concept of growth which denotes cummulation in the quantitative sense. For purposes of this paper we take it to mean two complimentary meanings: Firstly, development is the process by which a country provides for entire population all the basic needs of life, such as good public health, adequate nutrition, shelter and education, and provides everyone of its population with opportunities to contribute to that very process through employment as well as scientific and technological construction. Secondly, it is the process by which the national authorities initiate, construct and maintain productive mechanisms and infrastructure which diversify and perpetuate the productive base of the country such as in

agriculture and industries, so as to ensure that the society can overcome the pressures and necessities of their national and related economic systems for all future times.

Development is, therefore, perceived here as a dynamic process which can be manifested by clear qualitative as well as quantitative indicators. For instance, a country is said to be developing if it is seen to be establishing and enhancing indicators such as steadily improving public health and sanitary conditions; adequate nutrition; improved educational opportunities at all levels of its entire population; providing opportunities for its entire population to participate in gainful employment as well as direct participation in the productive aspects of the national economy, and providing adequate shelter for each person. One could submit, in fact, that nearly each of the foregoing points are indicators as well as prerequisites of development.

Another characteristic of development as a process is that once it is established, it should perpetuate itself and be sustainable to higher levels of productivity and sophistication. But it must, pari parsu, be systematic, resulting in positive gains to the society as a whole. This is the welfare notion essential to the definition which are not revealed by such aggregate measurements of economic growth such as "gross national product", gross domestic product" or "per capita income." These may, however, be used as general indicators of the national wealth or indicators of growth and therefore providing the resources essential for the enhencement, but not as conclusive evidence, of development.[7]

Except for Australia and South Africa, all the littoral and island states of the Indian Ocean are referred to as "developing" in the lexicon of contemporary diplomacy. The direct meaning is that nearly all of them score low on all or most of the indicators discussed above. The general wealth of the country, irrespective of the distributive or welfare aspect, is indicated by the gross national product (GNP); the general condition of public health may be indicated by life expectancy at birth; and the general educational condition may be suggested by the literacy rate. All these are shown in Table 1 below, for some of the states, primarily from Western Indian Ocean, but juxtaposed against Australia, for comparison.

The cut-off point for what is adequate or low is, of course, a problem which depends on ones sensitivity to the notion of welfare. As to the standard for national wealth, the World Bank classifies those with gross national product per person less than $410 at 1982 rates, as low-income economies while those with $410 or more as middle-income economies.[8].

The main feature of the socio-economic activities of these countries is that they are not significantly diversified. In most cases, upto 80 per cent of the population is engaged in the agricultural sector, even though agriculturally arable land is not always large. Table 2 illustrates the point, for the states of Western Indian Ocean.

Table 1: Basic country data

Country	Length of coastline (km)	Population (millions)	GNP (US $) 1982	Literacy Percent	Life expectancy at birth (yrs)
Reunion (France)		0.35	300	60	-
Tanzania	800	19.8	280	80	52
Somalia	3 000	4.5	290	70	39
Malagasy	4 000	9.2	320	50	48
Kenya	500	18.1	390	45	57
Mozambique	2 500	12.9	180	33	51
Comoros	350	0.35	300	60	-
Mauritius	200	0.95	1 050	75	-
Seychelles	600	0.06	1 775	65	
Australia		15.2	11 140	-	74

Source: World Bank, World Development, 1984 pp.218-219 and UNEP, Socio-Economic Activities that may have an Impact on the Marine and Coastal Environment of the East African Region. UNEP Regional Seas Reports and Studies No.41 (UNEP 1984) p.4. The figures for literacy seem rather suspect.

Table 2: Employment by sectors.

Country	Agricultural land (Km^2)	% of total land	Employment by sector and % of population		
Comoros	1 080	48.3	A. 89		
Reunion (France)	628	26.0	A. 14		
Kenya	68 280	12.0	A. 78	1.10	S.12
Malagasy	88 800	15.0	A. 87	1.4	S.9
Mauritius	1 026	55.0	A. 6	1.35	
Mozambique			A. 66	1.18	S.16
Seychelles			A. 21		
Somalia	82 000	12.3	A. 82	1.8	S.10
Tanzania			A. 82	1.6	S.11

Key: A - Agriculture (including fisheries)
1 - Industry
S - Service

Source: UNEP, Socio-Economic Activities that may have an Impact on the Marine and Coastal Environment of the East African Region. UNEP Regional Seas Reports and Studies No.41 (UNEP 1984)p.5

Clearly, the industrial and service sectors of these countries are very small. And this confirms one well-known fact, namely that the agricultural products are either consumed directly or exported as raw materials. If the production from this vital sector was flourishing then perhaps these countries should, at the very least, have adequate food for their populations. Yet we learn too that the food production has been on steady decline, as indicated by Table 3, which illustrates growth rates of food output, by region, in global terms.

Table 3: Growth rates of food output 1960-1980

Region	Total		Per capita	
	1960-70	1970-80	1960-70	1970-80
Africa	2.6	1.6	0.1	- 1.1
Middle-East	2.6	2.9	0.1	0.2
South Asia	2.6	2.2	0.1	0.0
The World	2.7	2.3	0.8	0.5

Source: World Bank, World Development, 1984 p.90

The suggestion from the data is that the vast majority of the population of the countries are actually engaged in a sector of decreasing productivity and that, in Africa, at least, some people are starving. As a corollary to that, it can be concluded that from the point of view of nutritional needs, the countries are not developing. And, moreover, malnourished people are bound to be unproductive in other sectors and this might trigger a vicious circle.

In general, poor performance in food production has been attributed to several factors, among them: allocation of the best land to cash rather than food crops; improper use of agricultural inputs such as fertilizers, insecticides and herbicides; inadequate incentives to farmers to increase production; improper pressure by aid donor agencies; drought which causes crop failure; inadequate agricultural infrastructure and soil erosion which impoverishes the agricultural land. The full treatment of these problems is beyond the scope of this paper.[9] However, we shall discuss some of them in the sections on resources and the environment.

Public health is another factor suggested to be both an index as well as a prerequisite of development. The averagely low life expectancy at birth shown in Table 1 underscores that it is a serious problem for development in the region since it would be expected that the majority of the population die during their would-be productive ages. A recent WHO/UNEP study found that the major health problems in the region arise from poor and inadequate water supply for human consumption; absence of sewerage and sanitation facilities; high incidence of parasitic and communicable diseases; and congestion in urban areas. And the study observed further that the magnitude of the problems seemed "clearly related to the level of economic development covered by the study.[10] A different study found that the ratio of the number of persons per doctor in some of the countries were as follows: Kenya 1/11,000; Malagasy 1/10,000; Mautitius 1/2,000; Mozambique 1/34,000; Seychelles 1/3,000 and Tanzania 1/17,500.[11]

Table 2 has eloquently illustrated how limited the industrial sector of these countries are. Most of that, at any rate, is engaged in production of consumer goods absorbed locally.

The net effect is that trade among the countries in the region is limited in scope since most of the countries produce nearly similar products: raw agricultural (cash) crops, such as tea, coffee, pyrethrum, cloves, sisal, wheat, jute, cotton and peanuts, which are largely exported to the industrialized

countries of Europe, Japan and North America. This trend is further strengthened by the fact that the developing countries of the region import their manufactured commodities from Europe, Japan and North America. Therefore, the exports of raw materials are geared to obtaining foreign exchange for payment of the manufactured goods from those sources. A state of dependency then tends to be assured.

Transportation infrastructure in the developing countries are also weak. The large bulk of commodities are carried by ships owned by European, Japanese and American liners, which dictate the charges, insurance rates and the time of delivery. Development of carriers in the developing countries of the region has constantly run into problems of cost and competition.[12]

The traditional owners of the shipping lines also provide the tankers which transport petroleum and oil to the developing countries. None of the states in the Western Indian Ocean region has established notable hydrocarbon reserves yet. Therefore, these countries have had to import oil despite the vagaries of its market, such as the escalated prices of early 1970s. And it is not quite clear if they have reaped any benefits from the decline in the market which started in 1983. This is basically because the oil companies which originate from North America and Europe, also largely rationalize the market price in the developing countries of the region.

Some of the countries in the region have placed very strong emphasis on the tourist industry as a source of national wealth. Kenya, for instance, makes a major issue of the fact that it gets up to 12 per cent of its annual foreign exchange earnings from tourism, and that after receiving about 350 000 tourists in 1980-81,[13] it should aim at one million annually by the end of the decade. Other states in the region which are ranked equally high as destinations for tourists are Seychelles, Tanzania and Mauritius.

But the development value of tourism is highly questionable, sometimes criticisms coming from very high levels of the governments. The Vice President of the country said that Kenyans believed that only 15 to 20 per cent of the total money earned from the industry accrued to Kenya.[14] And shortly after that comment the minister for Tourism and Wildlife appraised the figure upwards and submitted that Kenya get 50 per cent of the total proceeds, and in fact urged that the industry should be revamped.[15]

The arguments are that there are foreign exchange swindles by international operators. But beside that argument it is also maintained that the receiving government invests heavily in the creation of the basic infrastructure, for which the industry pays nothing. Furthermore, the tourists are said to have a number of negative social impacts on the society, very often contradicting national development goals.[16] In ultimate analysis, tourism may earn some revenue to the country but is not a development sector because it does not, by its passive and "museum" character, improve the quality of life in the society.

III REGIONAL RESOURCES

It is not practical to deal with all resources in the region of relevance to development in this paper. Therefore, it is proposed that this outline should be confined to a selection of resources with regional significance, or those the management of which have important regional implications, especially for development as discussed above.

For that purpose, the following four categories of resources have been selected for discussion:

1. Coastal and Terrestrial Resources
2. Marine Resources
3. Human Resources
4. Infrastructural Resources.

The purpose here is simply to outline the various components of these categories and thus suggest how they could be of interest for study or research in a regional network.

1. Coastal and Terrestrial Resources

Only two resource components, namely: agricultural land or soil and rivers and their loads shall be discussed under this category.

The significance of agricultural land and its soil is evidenced partly by the proportion of national population engaged in the agricultural sector for employment, and partly by the fact that the primary responsibility of any national entity is to be able to feed its population. Apart from the data in Table 2 above, it is also well-known that over 80 per cent of the population of the developing countries reside in the rural areas, and deriving

their livelihood from the agricultural sector. Yet it has also become a matter of general global alarm that some of these countries, particularly in Sub-Saharan Africa (where Western Indian Ocean falls), are unable to produce adequate food to feed their population.[12]

When the problem is attributed largely to drought and encroaching dessertification, other invidious causes are often overlooked or played down. One factor, not equally stressed, is the fact that the most pressing environmental problem in the Eastern-African region involves deforestation and massive soil erosion by which loads of fertile and productive soil is washed into the ocean.[18] It has been estimated, in aggregate, that the Indian Ocean receives about 3 400 million tonnes of suspended sediments per annum, about half of which is a direct result of river input.[19] The rivers draining that load include Shebelle, Sabaki, Tana, Ganges, Brahmaputra, Irrawaddy, Indus, Kelani, Ruvuma, Rufuji, Juba, Zambezi and Limpopo. A closer look at some of the rivers by the sections of the oceans gives the picture shown in Table 4.

Table 4: Relative Volumes of two Sedimentary Zones of the Indian Ocean.[20]

		Volume $10^4 m^3$	% of total
Submarine delta cones:	Indus	2.12	9.9
	Ganges	7.28	34.2
	TOTAL	9.40	44.1
Afro-Australian Bordering basins	Africa	4.81	22.6
	Australia	0.44	2.1
	TOTAL	5.25	24.7

It is generally known that the sedimentary accumulations are higher off the Asiatic subsontinent than those of the East Coast of Africa but in the latter case the information is not yet sufficient to help verification. Evidence is clear, though, by the damage caused by the deposits. For instance, along the Kenyan north coast the sedimentary loads of the Sabaki are heavily noticeable in Malindi area including the otherwise delectable coral reefs. In Malagasy "soil loss average 25-40 metric tons per hectare per year nationwide and reaches as much as 300 metric tons per hectare per year in the highlands."[21]

Whether there is drought, or not, the loss of the fertile top soil from agricultural land will hamper agricultural productivity. As a consequence it will be necessary that to enhance productivity, heavy doses of fertilizers must be injected into the land. But these countries do not produce their own fertilizers. Therefore, they have to import the volumes, which is a major foreign exchange burden. Besides, if fertilizers are necessary, then studies of the soil chemistry need to be done to ascertain the degree of acidity or alkalinity of the necessary fertilizers. And this is a further burden on the economy. In point of fact, this latter study is rarely done which means that the wrong fertilizers might be used, thus destroying the soil further.

But the problem is rather fundamental: the soil erosion must be stopped in the first place, otherwise the agricultural inputs such as the fertilizer and, perhaps, pesticides and herbicides added to the land will be washed to the sea, as was the soil. Obviously, one should assume that so long as there is soil erosion as pointed out above, the chemical agricultural inputs are also, ipso facto, drained into the ocean.

Recent general surveys by UNEP[22] report that in Kenya the use of pesticides in agriculture has increased 10 fold since 1966; fertilizers are probably in higher proportions. While some of that is drained to inland waters, a significant amount is carried from central highlands and emptied by Sabaki into the ocean. Similarly, in Tanzania, a country dependent on agricultural products such as coffee, sisal and cotton, fertilizers and pesticides are used in increasing degrees to boost production. In Mozambique, a significant amount of localized eutrophication in the adjoining bay exists as evidence of large quantities of phosphorus carried by Incomati, Maputo and Umbelezi rivers.

The island states of Mauritius and Malagasy also use large quantitites of pesticides and fertilizers for agriculture. And so long as soil erosion from agricultural fields is recognized as a problem, it is conclusive evidence that the fertilizers and pesticides do not stay in the place intended for them. As a consequence, the economies generally suffer serious leakage, and agricultural productivity, in particular, is bound to suffer. The economic waste is therefore evident in this region.

Somalia as a desert state has a unique problem of sand dunes movement, often carrying fertile sand over long distances, sometimes into the sea. An example is the Saraput area between Marca and Mogadishu where eventually a major dunes stabilization project was started, leading to limited agriculture on the stabilized dunes.

It is therefore understandable that in some of the countries, particularly Kenya, Tanzania and Mozambique, a high level afforestation campaign has been mounted at high levels of the government. Nevertheless, one problem remains: research needs to be done to determine the precise content of the river input into the ocean, even as efforts are mounted to prevent the soil erosion for agricultural and economic reasons.

2. Marine Resources

Marine resources which would be amenable to comparative study within a network include: fisheries, hydrocarbon, hard minerals, tidal wave for energy, and the so-called ocean thermal conversion for energy. For purposes of this paper, we shall limit the outline only to fisheries and hydrocarbon. In the end, two functional problems often associated with marine resources, namely, delimitation and settlement of disputes, will be raised as key issues worth keeping in mind as we discuss critical issues related to development in the Indian Ocean.

a) Fisheries - Fish is, by its very nature, a regional resource for the fact that they exist in the ocean environment which they roam without respect for the limits of national jurisdiction. There are the coastal species which will roam along the coastline, spawning within the coastal state area and spending the rest of their life in another area. On the other hand, there are the pelagic species which spawn within the coastal areas, then swim long distances across the oceans, as is the case with tuna. Other species, called anadromous, of which salmon is the best known, spawn up the rivers after which they spend their lives in the oceans. The converse of anadromous are called catadromous, which breed in the oceans and spend their life in the rivers. There exist several species with respective dictates of their biol gies. g

The importance of fish to national development may fall under three broad categories, namely: food protein for nutrition; employment of fishermen and related industries; and in trade, where surplus exists for export.

Significance of fish for nutrition is a paramount factor, especially given the nutritional needs of the developing countries. Some past statistics.[23] show that fish makes roughly 20 per cent of the world's total protein supply; accounts for 24 per cent of the animal protein intake in Africa; and 55 per cent of protein intake in populous South-East Asia. But the data also show the world catch to have varied over the years, being approximately 67 million tons in early 1970s; 74 million tons in 1976; and down to 72.4 million tons in 1978. Whatever is the case, however, fish is a main staple food in many developing countries, adding relish to the diet. Approximately 59 per cent of the population in these countries derive more than 30 per cent of their meat protein from fish. Only a few developed countries, such as Japan, Norway, Portugal and Spain would make comparable claim.

In most cases the fish is also cheap, being accessible through fairly simple traditional fishing techniques.

Apart from malnutrition, unemployment is another crucial development problem of the countries in this region. As noted in Table 2 above, an overwhelming share of the population is engaged in the agricultural sector, defined to include fisheries. It is also a point that most of the countries have an unproductive agricultural sector as evidenced by the rampant famine and malnutrition. In effect, there is a disguised unemployment in the sector.

Fisheries industry, if expanded has the potential of absorbing a significant labour force, as a labour intensive industry. People can be productively employed in fishing, processing, and marketing. Besides, there could be the boat-building and gear development industries, for an expanded sector, beginning with the traditional small scale fishing operations. But for expanded fishing activities certain development of skills and attitudes are necessary. There will also be requirement for ports and harbours suitable for the fishery activities.

3.2.07 Malnutrition is a broad international problem forcing some unpleasant sights in the world's press today. Therefore, the fish produced by the labours in this area should meet the local needs and prepare surplus for export for foreign exchange. This is partly why processing, mentioned in the preceding paragraph, is a significant consideration. Up to now Kenya has exported most of its surplus to Zaire in dried and smoked form. But as production is expanded, it would be important for countries of the region to develop effective links with international markets.[24]

The crucial question is the distribution and abundance of fishery resources within the region. Preliminary studies were commenced for the Indian Ocean Fishery Council from 1971 for stock assessment [25] and general survey of resources.[26] But one recent conclusion states that

> Comparing potential yield values estimated in 1973 with the actual catches in 1979, the Indian Ocean area still appears to be underfished.....The main part of the catch usually consists of Clupeidae (herring, sardine) and Engraulidae (anchovy) 36% followed by Serramidae (red fish basses) and Congridae (congers) 24%, Crustacea - mainly shrimp 15%, Scombridae (mackerel) and Istiopheridai (billfish) among others, making the remaining 11%.[27]

The preliminary studies suggest, however, that it is only believed that the East Coast of Asia is not particularly rich in fishery resources, the wealthiest part being off the coast of Somalia. Nevertheless, these are verifiable by more detailed research.

The most important recent development is the adoption of the United Nations Convention on the Law of Sea signed at Montego Bay, Jamaica on 10 December 1982.[28] Under Part 5, the Convention established a legal regime, sui generis, called the Exclusive Economic Zone, which according to Article 57, extends to a maximum of 200 nautical miles from the baseline from which the territorial sea is measured. The rights and duties of the coastal state within that zone are stipulated in Article 56:

> 1 In the exclusive economic zone the coastal state has:
>
> a) sovereign rights for the purposes of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the waters superjacent to the seabed and the seabed and its subsoil, and with regard to other activities for the purposes of economic exploitation and exploration of the zone, such as the production of energy from the water, current and wind;

No. 1 Cont:

b) jurisdiction as provided in the relevant provisions of this convention with regard to:

1) the establishment and use of artificial islands, installations and structures;

2) marine scientific research;

3) the protection and preservation of the marine environment.

c) other rights and duties provided for in this Convention.

As far as exploration, exploitation and conservation of the marine living and non-living resources in the zone, the rights of the coastal states are complete. But how much of the marine area now accrue to specific coastal states is determinable only by precise delimitation by the respective coastal state. To date, only broad global estimates have been made, as shown in Table 5.

The important point though, is that the actual acceptance of the concept of exclusive economic zone as a new legal regime was established by the beginning of the first substantive session of the third United Nations Conference on the Law of the Sea in July 1974. From the beginning of its evolution in 1971 some of the states in the Western Indian Ocean, particularly Kenya, had taken a leading role in its formulation and diplomacy.[29] Ordinarily, it should be expected that by that time they had determined the precise delimitation of their respective economic zones and the precise areas now gained under the new legal regime finally enshrined in the 1982 Convention. In actual fact, there is no known effort to that effect.

In view of the significance of fisheries for national development specifically as a source of nutrition, for employment creation and for foreign exchange earning, planning by the coastal states for exploitation of this new area of national jurisdiction is an imperative. Yet to plan, the coastal state must determine the precise scope of that area as well as the distribution and abundance of the resources within the area. For this reason, delimination of the area is a conditio sine qua non of national planning for marine resources management.

Wherever fisheries activities have been intensified, conflicts have often arisen as to the powers of the coastal state to prevent foreign fleets from fishing. The most notorius cases were in the Pacific, off the coast of Chile, Peru and Ecuador before the concept of the Exlusive Economic Zone was adopted. Perhaps the most virulent disputes have been known in North Eastern

Table 5: Areas of sea-bed acquired by States, beyond the 200 meter Isobath through the extension of National Jurisdiction limits to a distance 200 nautical miles from the coast.

No Gains (50)	0-5 000SNM* (10)	5-10 000SNM (4)	10-12 000SNM (6)		20-2000 000SNM (52)	Over 200 000SNM (24)
(Land-locked & Shelf-locked states)	(Albania	Bulgaria	Iran	Algeria	Kenya	Australia
	Bangladesh	Dahomey	Malta	Argentina	Korea(North)	Brazil
	Cameroon	Ethiopia	Thailand	Barbados	Korea(South)	Canada
	Congo	Guinea	Trinidad Tobago	Burma	Liberia	Chile
	Gambia		Tunisia	China,P.R.	Libya	Ecuador
	Israel		Uruguay	China,Rep.of	Malaysia	Fiji
	Lebanon			Colombia	Mauritania	Iceland
	Romania			Costa Rica	Morocco	India
	Syria			Cuba	Nauru	Indonesia
	Yugoslavia			Cyprus	Nicaragua	Japan
				Dominican Rep.- public	Nigeria	Madagascar
				Egypt	Oman	Maldives
				El Salvador	Pakistan	Mauritius
				Equatorial Guinea	Panama	Mexico
				France	Saudi Arabia	New Zealand
				Gabon	Senegal	Norway
				Ghana	Sierra Leone	Peru
				Greece	Sri Lanka	Philippines
				Guatemala	Sudan	Portugal
				Guyana	Tanzania	Somalia
				Haiti	Tonga	South Africa
				Honduras	Turkey	Spain
				Ireland	United Kingdom	Soviet Union
				Italy	Venezuela	United States
				Ivory Coast	Vietnam (South)	
				Jamaica	Western Samoa	
					Yemen (Aden)	
					Yemen (San'a)	

Source: Ocean Development and International Law Journal
Vol. 1, Spring 1973,p.40.

* Square Nautical Miles.

Atlantic since the Anglo Norwegian Fisheries dispute culminating in the case settled by the ICJ in 1951.[30] Later on, the so-called Cold War between Iceland and Britain which was finally resolved not by decision of the International Court of Justice to which the dispute and application had been taken but by a series of agreements with the contending long distance fishing countries.[31]

Within the western Indian Ocean region there had been one conflict between Tanzania and Kenya regarding the scope of fisheries jurisdiction within the Pemba Channel, as far back as 1970.[32] This dispute was resolved by bilateral negotiations conducted between 1971 and 1975 and the eventual agreement on the precise limits of national jurisdiction was signed in the end.

The question of delimination will be revised later; suffice it to emphasize that it is a tool of planning, especially since there are international resources available from the Food and Agriculture Organization of the U.N. to assist the process.[33] Initiative must however, come from the individual coastal states and their institutions.

a) Hydrocarbon - Since the so-called oil embargo which started in 1973, petroleum, oil and natural gas as sources of energy have become extremely valued. It is valued partly because it is a source of energy which is indispensable for national development and partly because those states which can export hydrocarbon in refined or crude form would earn valuable foreign exchange for development. Therefore, the countries which did not already have it have been frantically exploring and prospecting in perpetual hope.

Hydrocarbon deposits in marine enrionment are associated with certain fossil deposits of the continental shelf, even though some prospects exist for deposits in the deep sea-bed areas.[34] The wider and thicker the continental shelf off a coastal state, the higher are the hopes of hydrocarbon deposits in the sediments.

For these reasons the legal regime of the continental shelf has remained controversial since the well-known Proclamation by Harry Truman, President of the United States, on 28 September 1945.[35] Over the years controversies have surrounded the concept even after attempts to codify the definition in the 1958 Geneva Convention on the Continental Shelf.[36] But after rather protracted negotiations an acceptable formulation was adopted in Part 4

of the 1982 United Nations Convention on the Law of the Sea. Article 76 which defines the continental shelf is long and complicated, but paragraph 1 gives the formulation under simple circumstances as follows:-

> The continental shelf of a coastal state comprises the sea-bed and sub-soil of the submarine areas that extend beyond its territorial sea throughout the natural prolongation of its land territory to the outer edge of the continental margin, or to a distance of 200 nautical miles from the baseline from which the breadth of the territorial sea is measured where the outer edge of the continental margin does not extend up to that distance.

But paragraphs 4-6 deal with complex circumstances where the continental margin extends beyond 200 nautical miles. The point of note here is that with the standard limit of 200 nautical miles considerable area is brought under national jurisdiction as suggested in Table 5. It is known already, for instance, that some states would be better off with the depth criteria based on end of continental margin than with the straight 200 nautical miles criterion. That is the evidence clear from Table 6 showing the top ten given the two criteria. Clearly, the states ordinarily with narrow continental shelf are likely to base their delimitation on the 200 miles so that the legal continental shelf is coterminus with the exclusive economic zone. But all seem to depend on that national endownment under the assumption that the bigger the continental shelf, the greater the chances of finding hydrocarbon.

Table 7 presents indicative profile of the continental shelf of the coasts of Somalia, Kenya and Tanzania. This is only indicative because it tells us nothing of the extent of the entire continental margin. Nevertheless, it suggests the likely preference for a 200 miles criterion.

The Outer Edge of the Continental Margin (3 000 metres)	200 Nautical Miles from the Coast
1. Australia (783 800)	United States (1 676 600)
2. New Zealand (500 300)	Australia (1 381 700)
3. Norway (433 700)	New Zealand (1 338 700)
4. Indonesia (420 200)	Japan (985 900)
5. Canada (393 500)	Soviet Union (945 200)
6. Soviet Union (317 200)	Indonesia (767 700)
7. United States (317 200)	Mexico (702 600)
8. Japan (300 800)	Brazil (699 900)
9. Argentina (251 900)	Chile (659 300)
10. Mexico (214 100)	Norway (560 500)

Table 6

Ranking Order of states acquiring the largest of sea-bed beyond the 200 metre Isobath through the adoption of New National Jurisdiction limits.

Source: Ocean Development and International Law Journal, Vol. 1, No.1, Spring 1973,p.42

Table 7: Profile of the Continental Shelf on Eastern African Coast: Cape Guardafui to River Ruvuma (estimates in kilometres

Distance from Cape Guardafui	Width of the Shelf		Distance from Cape Guardafui	Width of the Shelf
At 0 distance	52		1 800	10
100	25		1 900	7
200	48		2 000	37
300	16		2 100	12
400	12	40°E is at	2 130	
500	20		2 200	2
600	25		2 300	18
700	16		2 400 (Pemba)	4 either side
800	20		2 500	10
5°N is at	840 km		2 600 [Zanzibar]	65 incl. island
900	19		2 700	40
1 000	20		2 750 [Mafia]	70
1 100	10		2 800	100
1 200	10		2 900	33
1 300	8		3 000	12
45°E is at	1 350		3 100	3
1 400	4		3 200	2
1 500	4		3 300	20
1 700	15			

(Data are estimates by Dr. K.O. Emery of Woods Hole Oceanographic Institution measured from a bathymetric map at the Institution at the request of this author. The profile is measured for every 100 km interval from Cape Guardafui to the mouth of River Ruvuma.
One km = $\frac{5}{8}$ mile. Measurement taken for continental shelf up to 200 metres isobath).

As seen in its definition above, the continental shelf is considered a natural prolongation of the territorial land and this has justified a special legal regime for its resources. The rights of the Coastal State over the shelf are expressed in Article 77 of the Convention, which deserves to be quoted in extenso here:

> 1. The Coastal State exercises over the continental shelf sovereign rights for purposes of exploring and exploiting its resources.
>
> 2. The rights referred to in paragraph 1 are exclusive in the sense that if the Coastal State does not explore the continental shelf or exploit its natural resources, no one may undertake these activities without the express consent of the Coastal State.
>
> 3. The rights of the Coastal State over the continental shelf do not depend on occupation, effective or notional, or any express proclamation.
>
> 4. The natural resources referred to in this Part consist of the mineral or other non-living resources of the sea-bed and sub-soil together with living resources belonging to sedentary species, that is to say, organisms which, at the harvestable stage , either are unable to move except in constant physical contact with the sea-bed and sub-soil.

The rules expressed in paragraphs 2 and 3 above, to the effect that the rights are exclusive and that such rights do not depend on occupation or any express proclamation are based on the fact that the continental shelf is a natural prolongation of the land territory. To that extent the legal regime of the resources of the shelf differ from that of the fisheries of the exclusive economic zone. In the latter case, the Convention under Article 62(1) requires the Coastal State to promote the objective of optimum utilization of the resources of the zone. Where the coastal state is unable to exhaust the total allowable catch it is required, under paragraph 2, to give other states access to the surplus, within the framework of an access agreement. Among other things, that requirement introduces an obligation to have a very intimate knowledge of the living resources of the zone. But it also distinguishes the scope of rights of the coastal state over the respective resources, and emphasizes why the precise limits of a continental shelf is likely to be a sensitive and controversial matter.

But once discovered, the hydrocarbon production, processing and marketing require complex organization at national level to ensure that the discovering state draws full benefit.[37]

(c) Delimitation of Maritime Boundaries - The short and general discussions on fisheries and hydrocarbon management will have, at once, suggested the significance of early delimitation of areas of national jurisdiction. Delimination is essentially a prerequisite to meaningful planning and management because it is the process by which what belongs to which state is determined.

This is true for fisheries which will, in any event, roam coastal waters irrespective of the delimited areas. The locations of spawning, breeding, feeding are factors important for unilateral as well as negotiation for bilateral and multilateral management. It is for such reasons that the negotiation and eventual delimitation agreement between Kenya and Tanzania on the Pemba Channel discussed above is important. It is further important for purposes of Article 62 of the Convention, discussed above, that each coastal state determines its precise area, the distribution and abundance of the resources and finally, total allowable catch.

Delimitation is particularly critical with respect to management of mineral resources, including petroleum, gas, oil, and other minerals such as hydrothermal brines. A number of issues arise in such management, and only a few examples will suffice.

First, it will be imperative that each country distinguish its area from the International area, subject to the jurisdiction of the International Authority within the framework of Part 11 of the Law of the Sea Convention. Certainlyno coastal state would entertain a confusion in boundaries which allows the International Authority to grant exploration licences in an area not clearly "International Area."And it is important that there is already established a Preparatory Commission which will allow "Pioneer Investors" to explore for resources immediately. That underscores the urgency of effecting precise delimitation.

Second, prospecting for mineral resources, especially hydrocarbon has been embarked upon by most coastal states. For instance, Malagasy was at it in early 1970s when it was actually reported that it had good prospects for oil reserves in the North Eastern coastal areas, adjoining Mozambique

Channel; Mozambique signed an agreement with a consortium of U.S. oil companies in Taxes on 5 June 1983 for hydrocarbon exploration and production. Tanzania has also signed exploration contracts. In Kenya exploration off-shore has been intense since 1980 and at one time members of parliament were keen to know if Kenya would soon join OPEC! The fact of exploration as such requires that such requires that each coastal state should be clear about the limits of its jurisdiction.

Third, where minerals are found to traverse the boundary of two states the problems are very complex. Recall, for instance, that when hydrothermal brines were discovered in the Red Sea, the kingdom of Saudi Arabia decreed that all resources in the area belonged to them.[38] Such issues might be easier to resolve if the delimitation was determined before the resources were discovered than afterwards. Already, the conceptual aspects of such problems are being considered specifically for resources which traverse areas of national jurisdiction.[39]

In actual fact, the contemplation of prospects for mineral deposits, especially hydrocarbon, has led to a number of intractable disputes, for instance: between Greece and Turkey,[40] Malta and Libya,[41] and libya and Tunisia.[42] Some of the disputes have ended up in the expensive process of the World Court adjudication only to be referred back for bilateral agreement, meaning agreement on the mutually acceptable rules and procedure for delimitation.[43] It might be cheaper that the countries determine their limits by themselves in the first place. This is why delimitation is cush a critical issue to be considered in management of natural resources of the region.

(d) Settlement of Disputes - The nature of disputes that may arise in the process of management of regional resources will have been obvious from the fore-going three items. In the Law of the Sea Convention the significance of the rules and procedure for settlement of disputes arising from interpretation and/or application of the Convention are highlighted in Annexes: 5 Conciliation; 6 providing the Statute of the International Tribunal for the Law of the Sea; 7 and 8 on Arbitration.[44]

Yet, it might be significant to formulate suitable regional framework for settlement of uniquely regional problems. After all, the instances of disputes arising from problems of delimitation tend to illustrate a tendency for the problems to be referred to bilateral negotiations and regional agreements.

3. Human Reourses

National development with available resources is planned and executed by human beings for human beings. That is why an outline of regional resources for development must at least mention the human resources. And certainly, there are a lot of human beings on the circumference of the Indian Ocean. Table 8 outlines the national area, population and birth rate of the states as an indication of the trend.

But the absolute area of the territory tells us very little unless the productive part of the territory is known. For instance, of the Kenyan area, it is estimated that approximately 60 per cent is classified as rengeland or arid and semi-arid land, thus agriculturally unproductive without major inputs. Somalia, for its part, is nearly entirely a desert and large areas of Coastal States in Western Indian Ocean would be arid in a good share of their territories. It has been argued too that a large population is actually a national burden, especially in those countries where agricultural productivity is low. The rate of population growth has not kept pace with food production. Therefore, it is argued, at a certain rate of growth of food production and population increase, the population may in fact be a liability in the development process.

But it is not automatic that if population growth is slowed down, food will necessarily be sufficient. The critical question is, therefore, to transform the absolute population into productive manpower in the management sense, and to ensure that they actually produce more than they consume. For instance, in the context of the recent drought, nomads would be a critical problem, especially as the visigoths of human rights advocate that no population should be displaced and resettled even when they are starving and food shortage together with logistical problems of food distribution militate against their interests. Somalia took a bold step under its Coastal Development Project to resettle 14 000 former nomads most severely affected by drought of 1973-1975 and trained them in fishing techniques.[45] That is an example of productive use of human resources, and Somalia currently has approximately

Table 8

Country	Area in thousands sq.km.	Population in millions mid-1983	Infant mortality rate	Rate of population increase (1983)
Bangladesh	144	95.5	132	2.4
Burma	677	35.5	93	2.0
Tanzania	945	20.8	97	3.3
Somalia	638	5.1	142	2.8
India	3 288	733.2	93	2.3
Malagasy	587	9.5	66	2.6
Sri Lanka	66	15.4	37	1.7
Kenya	583	18.9	81	4.0
Pakistan	804	89.7	119	3.0
Mozambique	802	13.1	109	2.6
Indonesia	1 919	155.7	101	2.3
Malaysia	330	14.9	29	3.3
Singapore	1	2.5	11	1.3

Source: World Bank, World Development Report, 1985.

3 000 full-time and 6 000 part-time fishermen, and the number could be increased to take care of both problems: unemployment and malnutrition.

The fisheries sector could develop manpower for boat-building, fishing, processing, and more. These are areas which are not sufficiently developed in the western Indian Ocean.

Similarly, in the hydrocarbon sector, it is important that local manpower be trained to handle the entire industry. Very often foreign companies will conduct the prospecting, drill for oil, largely utilizing the experienced labour force which has worked elsewhere, and to export the crudes for refinery elsewhere. The country of origin remains something of a warehouse for the raw materials which fuel industries elsewhere. In return for the proceeds from the crudes the country will receive consumer goods to be peddled by the national population. Very often agriculture is the victim and food imports will ensue. That has been the experience of Nigeria, for instance.[46]

The point is that there must be locally trained people, as manpower, to be involved in the exploration, prospecting, processing and marketing of the natural resources. There should also be local people well versed in the fiscal regime of the respective natural resources management. Otherwise, the resources, though local, would not be integrated into the fabric of national economy.[47]

Only carelessness can explain it if countries around the Indian Ocean should in future repeat some of the traditional mistakes in dealing with foreign enterprises engaged in exploitation of natural resources. Mozambique for its part is going through the experience with the Soviet Union on fisheries matters. Both Tanzania and Kenya have had experience on joint venture arrangements with Japanese companies: Ataka and Co Ltd and Taiyo Fishing Co Ltd in late 1960s and early 1970s. Folies of such ventures are well-understood and there should be locally trained persons capable of handling future arrangements.[48]

3.3.08 On mineral resources, Indonesia of all the states around the ocean, has perhaps had the most complete experience. Training for manpower in the entire industry is long and complex, but there are persons who can do it. They just have to commence early.

In summary, it is imperative that the states of the region commence training at all levels of agriculture, fisheries and mineral resources. That should cover training for exploration of alternative resources suitable for the area; techniques of harvesting, including prevention of post-harvest losses; processing and development of linkages between the specific sector and others; marketing; and possible reinvestment and diversification of the economy.

4. Physical Infrastructure

Development requires the support of physical infrastructure and there are some such infrastructures whose functional implications have regional character and, therefore, are amenable to study and action at regional level. In the present section a few such infrastructures will just be outlined without detailed presentation or analysis.

(a) Merchant ships are vehicles for international trade, and could enhance relatively inexpensive trade among the Indian Ocean States. Upto now countries of the Western Indian Ocean have found it difficult to establish

a.Cont: indigenous lines.[49] It is a rather weak proposition that the countries of this region should consider enhanced agricultural and industrial productivity as well as trade among themselves, but all, or most of it, to be handled by merchant ships cwned by the traditional shipping countries of Europe North America and Japan. It is imperative that the countries of the region should consider ways around the historical and current problems barring the ownership of the lines and in reasonable numbers to support trade within the region.

(a) Tanker Fleets which carry petroleum and oil to and from the Indian Ocean States hold a vital role in their development. The Indian Ocean is the heaviest oil tanker traffic route in the world. Approximately 550 million tones of oil per year are transported from the Middle East ports to Western Europe and America, but the East and South African countries import approximately 22 million tons of crude oil. On any one day there is an average of 224 tankers within the East African region, with actual importation estimates as follows:[50]

a)	Mogadishu	- Yearly average of	300 000 tonnes from Iraq
b)	Mombasa	- Yearly average	3 000 000 tonnes from Middle East
c)	Dar-es-Salaam	- Yearly average	1 600 000 tonnes from Middle East
d)	Maputo	- Yearly average	1 000 000 tonnes
e)	Tamatatave	- Yearly average	650 000 tonnes from Middle East
	TOTAL		6 550 000 tonnes

These studies indicate further that Comoros, Mauritius and Seychelles import refined oil from Middle East, with the following annual estimates: Mauritius 250 000 tonnes and Seychelles 60 000 tonnes.

Thus, there is considerable trade involving tankers and just within the region. But it should be of interest to determine precise ownership and numbers and the opportunity cost of not having tankers actually owned by the indigenous enterprises. This is a critical development issue in the region.

(c) Research ships are fundamental for the management of marine natural resources of the region. A prerequisite to the plan and management of living and non-living resources is survey and assessment of distribution and abundance of the resources, a task which cannot be undertaken in marine areas without research ships with different degrees of sophistication. Kenya once tried the use of a combined research and fishing vessel, the MV Kusi,[54] bought from the Netherlands and found out that the choice was inappropriate; because it was too expensive

for Kenya to manage. The question of choice of appropriate technology is linked to the knowledge, and is a matter of human resources. Both technology and manpower should therefore go together.

Even if there were no indigenously owned research ships at the start, the choice of the appropriate ones for lease or charter would be done carefully and inventoried.

(d) Research stations and equipment is an indispensable factor in the planning and management of the regional resour-ces for development. Previous studies have shown that even where there have been research facilities, the personnel and equipments have been largely in the fisheries sector, ignoring the mineral resources.[52] But the scientific basis for marine resources management can be developed only with local commitment from survey, data processing and application.

Because of their expensive nature, research stations should be amenable to regional utilization, or collaboration which leads to sharing of expertise, exchange of information, equipments and experience, as used to be the case within the East African Community. To do that one needs to have a full picture of what research stations are available, the personnel with their areas and level of specialization, and the equipments they have. These are critical issues for planning and management of regional resources.

IV IMPACT OF COASTAL AND MARINE ACTIVITIES ON THE ENVIRONMENT

1. Definition

Basically, this section is concerned with the causes of degradation in the marine and coastal environment of the Indian Ocean. Very often a reference to environmental degradation is construed to mean pollution, where pollution may be defined as:

> "Introduction in any manner whatsoever, of any substance or energy, into the marine environment, including estuaries, which may result in deleterious effects such as harm to living resources, hazard to human health, hindrance to activities, including fishing, impairment of quality for use of sea-water, and reduction of amenities."[53]

Pollution of the marine and coastal environment would, therefore include introduction of all wastes such as oil, urban and municipal sewage, industrial wastes and packaged or containerized loads. It would also include introduction of energy such as heat in any form, but it would not matter if the cause of introduction is deliberate or accidental, whether by human conduct or natural forces.

But degradation would be a little broader in that it would include also any activities such as removal of coastal vegetation, such as mangrove swamps, or removal of marine fauna, both of which would in their consequence, upset the ecological balance.

Upsetting the ecological balance of marine and coastal environment often leads to such concrete consequences as the disappearance of some fish species. The net impact of that might be realized in the decline in the distribution and abundance of fishery resources which, as emphasized in the preceding two sections, are important for critical development purposes such as nutrition, employment and foreign exchange. Therefore, allowing for degradation of the marine and coastal environment is to directly defeat concrete development goals. These consequences may be evident after a quick survey of the sources of degradation of marine environment.

2. Sources of Degradation of Marine Environment

Obvious and direct sources of degradation of marine environment may be classified under six broad categories as follows:

a) Land-based sources
b) Dumping of wastes
c) Ship-borne sources
d) Exploitation of marine resources
e) Engineering activities
f) Military activities

The subject of marine environment discussing these subject, has generated tremendous literature in the past two decades, most of that covering the biological, legal, institutional and engineering aspects.[54] But the present outline will be synoptic simply to draw attention to the problem and thereby suggest the impact of the various socio-economic, engineering and other technological activities on the marine environment of the Western Indian Ocean.

(a) Land-based Sources

Sources of degradation or pollution of the marine environment may be further classified to include run-off from agricultural lands, river loads and outfalls, and airborne pollution, or municipal sewage and industrial wastes.

The run-off from agricultural fields is composed partly of soil eroded or denuded from the fields and chemical compounds used as agricultural inputs. The latter aspect is akin to the airborne category since wind often carries agro-chemicals to the oceans. But some of the same soil load and agro-chemicals are also washed into the creeks and rivers which carry the full load into the ocean.

According to a recent joint study by FAO and UNEP,[55] the government officials in Kenya, Tanzania, Mozambique, Seychelles and Mauritius accept that they use heavy doses of pesticides such as DDT, dieldrin, lindane, aldrin, thiodan and toxphere; fungicides and herbicides; and fertilizers. And the ocean receives most of these chemicals as part of the load eroded and carried from agricultural lands. The impact has been considerable in some instances;[56] the Ministry of Agriculture in Mauritius attributes the decline of fisheries in the estuaries and lagoons to pesticides run-off; and in Mozambique, helicopter spraying of parathion against tsetse fly is reported to have killed fish in the Limpopo River which flows into the Indian Ocean.

The load of a river is relative to the catchment it drains and the volume of water it carries. Table 4 above, may be suggestive in that regard. But the general volume of water load of a given river may also be suggestive, unless the estimate of sediments transported by the river is given. Thus, Table 9 outlines some main rivers of the eight states of the Western Indian Ocean, the average flow in cubic metres per second, and in a few cases, the estimated amount of sediment transported by the river.

A task still remains to determine the precise quantity and quality of the loads from agricultural fields washed into the oceans either as run-offs or through the rivers. Upto now, however, this is the most serious marine environmental problem in the Weestern Indian Ocean region. It will be noted too that as much as it is a marine environmental problem, this is critical problem for agricultural productivity, with serious implications for socio-economic development.

Domestic and municipal waste originate from the urban centres and the volume should be expected to be directly proportional to the population of such centres. A great deal of research needs to be done to determine the precise quantities and quality of the loads discharged into the ocean because at the moment the magnitude may only be vaguely surmised from the population of the municipal centres.

For instance,[57] Somalia's two major towns are experiencing annual growth average of 7 per cent, which is now about 600 000 for Mogadishu. In Kenya, Malindi's population is currently 20 000; the town is known for its flourishing tourist industry which has recently created about 2 000 jobs and will probably attract more. Mombasa, Kenya's second largest town, a core of the tourist industry, the national entreport and route for trade now has a population of 340 000 people. According to a recent assessment, the 25 year old sewage system in Mombasa discharges 1 200 000 gallons per day of sewage into the Indian Ocean with 80 per cent primary and 20 per cent secondary treatment.[58]

Tanzanian's main coastal towns, Dar es Salaam, Tanga, Zanzibar, Kilwa, Lindi, Pemba, Mafia, Bagamoyo and Mtwara are all experiencing fairly fast growth but the wastes are all discharged directly into the seas and harbour without treatment.[59]

Table 9: Main rivers and ports (compiled from national reports).

Country	Name of river	Flow m^3/sec	Sediment transport tonnes per annum	Main points
Comoros				Moroni Fomboni Mutsamudu
France (La Reunion)	Du Mat	up to 1 700		Des Galets
	Des Galets	up to 950		
	De l'Est	up to 900		
Kenya	Tana (Athi(Galana)		55 000	Mombasa
Malagasy	Betsiboka	955	40-50 million	Antseranana
	Mangora	830		Mahajanga
	Tsiribihina	560		Toleara
	Sofia	550		Toamasina
	Mananara	460		
	Mangoky	400		
	Mahajambu	310		
Mauritius	Grand River South East	134		Port Louis
	Grand River North West	27		
Mozambique	Zambezi	15 000		Beira
	Lurio			Maputo
	Save			Nacala
	Limpopo			
	Rovuma/Ruvuma			
	Montepuez			
	Pungue			
	Maputo			
Seychelles	Le Niol			Victoria
	Cascade			
	Rochon			
Somalia	Juba	382		Kismayu Merca Mogadishu
Tanzania	Pangani			Dar es Salaam
	Rufiji	1 133		Mtwara
	Ruvuma/Rovuma			Tanga
	Wami			

Mozambique's main coastal towns are Maputo and Beira with Maputo hosting 800 000 inhabitants. Both towns have 10 untreated outlets into the sea. A sewage treatment plant is under plan at Metola Bay but it will have to compete with the fast growth of the towns. As pointed out earlier, eutrophication has been noticed in lagoons of the Metola Bay.

In Malagasy Republic, sewage treatment is practically non-existent. Wastes from the capital of Atananarivo are drained into the ocean untreated. The main coastal towns are Toamasina 76 505, Mahajanga 71 843, Toliary 65 560, and Antseranana 32 453.

The level of industrial wastes reaching the Western Indian Ocean is still known to be low, at least relative to the northern or eastern regions of the Indian Ocean. It is significant though, that the precise quantities and quality discharged is not known yet.

There are a number of industries located at the coast.[61] For instance, Somalia being largely a livestock-oriented economy has waste consisting largely of untreated effluents from slaughter houses and leather and affiliated industries. Such wastes are characterized by high BOD, suspended solids, and high level of nutrients.

In Kenya, the majority of the industries are located around Nairobi and Mombasa. Most of the Nairobi waste is carried by a river which flows through the city to the Athi River into the Indian Ocean. The character of the wastes is not precisely known, but they would include chrome salts and solids from tanneries, cyanide from mining and smelting operations, heavy metals and organic loads.

In Tanzania, the main coastal industries are soap manufacturing, sisal, plastics, super phosphate plants, wood processing, textiles and for fishnets. Most of them discharge wastes into the Indian Ocean directly.

Major industries in Mozambique are concentrated around Maputo and Beira. Industrial pollution was established in Maputo and Matola Bay by studies conducted in 1980 by the Mozambique Government, following a cholera outbreak. It is important to note that the bay was declared out of bounds for swimming and fishing because of the high level of pollution.

The situation in the island states is rather diverse. In Malagasy, the industrial wastes are dumped into the Pangalanes Canal, without treatment. In Mauritius most of the waste is from the sugar industry and a distillery all of which are dumped into the ocean raw.

Three points are important to consider in regard to these categories of wastes from land based sources. The first one is that the impact is not likely to be instantaneous. Impact of pollution from these sources depend on toxity, persistance and bioaccumulation. Some of the highly toxic wastes will have immediate or short-run negative effects as was the Maputo case detected in 1980. In most cases, however, it is the cumulative effect of persistent substances that could have devastating impacts. That is the experience gained from the tragic Minamata and Nagiita poisoning by methyl mercury from the Japanese industries in 1950s:[62] it took several years to identify the health problem and yet nearly a decade to link it to the methyl mercury drained into the Minamata Bay by the industrialists.

The second point is that in most of the countries in the region, there are plans for expansion of industrialization as a vehicle for enhancing development.[63] Therefore, even though the problem may not be critical now, it is important to do baseline assessment now to determine the trend of change as well as the appropriate remedial measures. This is one of the particular significances of the adoption of the conclusion of the Conference of Plenipotentiaries on the Protection, Management and Development of the Marine and Coastal Envrionment of the Eastern African Region done at Nairobi from 17 to 21 June 1985. The Convention adopted by the Conference has an Article 7 outlining the general provision on pollution from land-based sources.

The third point is that the pollutants, once in the ocean, will be transported by currents to other parts of the same ocean. In the setting of Western Indian Ocean the impact of the Somali Current, North East Monsoon, South Equatorial current and Mozambique current will be to wash the East Coast of Africa with pollution loads from the industrialized states of the Northern Indian Ocean.[64]

The level of industrialization and the proliferation of urbanization with their effluents in India, for instance, is quite well documented. But recent reports show that the Gulf States such as Saudi Arabia and Oman, in their effort to break from dependence on crude oil, have embarked on major

petrochemical industries. Saudi Arabia produces approximately 500 000 tons of hazardous wastes each year; Oman and United Arab Emirates are following suit, but they do not have adequate treatment and disposal procedures.[65]

Atmospheric transportation of pollutants is also relative to the amount of chemicals used in agriculture and emitted from industries. It has become a critical problem in North America and Europe where it is known as "acid rain", given that chemical fumes finally precipitate in moist forms with the rains. In the Indian Ocean area its intensity would correspond to the use of chemicals in agriculture and industrialization as already discussed. The dominance of the use of such chemicals was evidenced in early 1960s when Edward Wenk reported that DDT found in the Bay of Bengal had actually originated from East Africa.[66]

(b) Pollution by Dumping

Dumping actually refers to a mode by which the wastes reach marine environment, rather than a source in the strict sense. It arose with the increasing strictness of the regulations controlling disposal of toxic military industrial and municipal wastes in North America and Europe. Industrial and municipal authorities resorted to the use of special ships which were to be loaded with such dangerous wastes for disposal in the high seas. The best publicized incidents were the "Operation Chase", involving dumping of nerve gas by the US Army in August 1970, the Enskeri and the Stella Maris incidents of March 1975 and July 1971, respectively.[67]

It was the growth of the "dumping" industry which prompted the conclusion of the first treaty on the subject at Oslo, Norway on 15 February 1972. With the realization that wastes could be transported by ships or aircraft for dumping outside the North Eastern Atlantic, the area covered by the Oslo Convention, a global treaty as signed in London on 29 December, 1972.

The global convention, in its Article 3(1) (a) defines dumping as:

"(i) any deliberate disposal at sea of wastes or other matter from vessels, aircraft, platforms or other man-made structures at sea:

(ii) any deliberate disposal at sea of vessels, aircraft, platforms or other man-made structures at sea."

From the surveys of the trends in the magnitude of pollution from land-based sources it will be apparent that the countries of the region under review would not have reached the critical situation which necessitated invention of the dumping industry in Europe. However, two points must be borne in mind. The first point is that the trend to the generation of massive wastes already exists, especially to the north of the Indian Ocean. The examples of India, Saudi Arabia and Oman have been cited above. In fact, Oman is known to have problems with the disposal of polychlorinated biphenyts (PCB) which is known to have strong carcinogenic properties. Such might provide the first regional problems of dumping. The second point is that some industries in the highly industrialized countries have in the past negotiated with some African countries the chances of the latter receiving and dumping some of the highly toxic wastes for which industrialized states have prohibitive disposal standards.[68] It was not specified that such wastes would be destined for the marine environment once brought to the developing countries of Africa but the probabilities that they would end up in the ocean are rather prominent.

What one ought to consider is the content, toxicity and persistence of the dumpable wastes and their impact on natural resources of the region, especially fisheries and coastal amenities both of which are development resources.

(c) Ship-borne Sources

Of the various forms of possible pollution from ships, oil pollution is the most prominent. This is particularly so in the Indian Ocean. In the discussion of the tanker fleets, under infrastructure, we saw the data for the oil tankers plying the Western Indian Ocean carrying petroleum, and as pointed out, these make the Indian Ocean the busiest tanker traffic route in the world. Not that all the oil they carry is discharged into the ocean but the question is how oil carried by ships gets into the water in the first place.

Oil carried by ships may be discharged either accidentally or deliberately. And, understandably, it is the accidental episodes that are well-known, particularly since the Torrey Canyon incident of March 1967. That incident raised strong public awareness and indeed, several more catastrophic incidents followed.[69]

Fortunately, the Indian Ocean has not experienced much of the catastrophes. The closest have been two incidents: The first one was the grounding of the 237 700 ton Japanese supertanker, Showa Maru at the Strait of Malacca in Janury 1975. The second one was the reported collapse of the 250 000 ton Spanish supertanker Castillo de Belver, 25 kilometres off the Cape of Good Hope in August 1983. In both cases the entire loads of crude oil from the Middle East were lost. Other accidents could occur in the Indian Ocean, and the probabilities should perhaps be in direct proportion to the volume of the tanker traffic. The second mode of discharge is the deliberate type largely through tank washing and deballasting, especially as the tankers approach the sheltered areas approaching the home of crude oil in the Middle East. In some cases the tank washing is done close to the east coast of Africa.

That discharge adds up with the persistent practice and shows clear evidence in form of tar balls or oily deposits which are prevalent on the East Coast of Africa.[70]

But let it be clear that hydrocarbons are not the only substances transported by ships. In fact, the increasing number of such substances was so evident that Inter-governmental Maritime Organization had to expand the scope of the 1973 London Convention for the Prevention of Pollution from Ships - which applied to oil - to include substances other than oil, by adoption of a 1978 Protocol to that effect.

Some of the chemicals so transported are far more lethal than oil, and there is a relevant recent incident. In autumn 1984 a French ship, Mont Louis carrying packaged Uranium Xachloride, believed to be destined for enrichment in the USSR, somehow lost the entire cargo in the sea off the coast of Belgium.

That incident has raised a special question. Very often, in refrence to pollution from ships, reference is made to discharges or spillage. The question is, would loss of packaged or containerized substances, as was the case in Mont. Louis be considered as discharge or spillage? The Conference of Plenipotentiaries on the Protection, Management and Development of Marine and Coastal Environment of the East African Region in June 1985 accepted explicitly that such can be discharge or spillage within the meaning of "Marine pollution incident" defined in Article 1(d) of the Protocol concerning

Cooperation in Combating Marine Pollution in Cases of Emergency in the Eastern African Region.

(d) Exploitation of Marine Resources

Exploitation of the various categories of marine resources can have different degrees of environmental damage. For instance, throwing away of fish by catch may be blatant economic waste but the general environmental impact may not be significant in the short-run. On the other hand, use of explosives for fishing has a number of serious impacts such as indiscriminate killing of all species of flora and fauna in the area. Part of the drastic consequences may be destruction of valuable resources like coral reefs.

The more dramatic of exploitation of resources is an instance of a blow-out at an oil well. In such circumstance, the underground oil reserve, responding to the physical pressure underground, will flow out, into the water and the beaches. Such incidents have been a subject of considerable concern since the Santa Barbara oil well disaster in 1969, which killed thousands of marine birds and fish apart from the impact on the beaches. In the Indian Ocean area the damage at the Iranian oil wells which occurred in 1983 is the clearest example. At the beginning the discharge rate was between 4 000 and 5 000 barrels per day but the tempo seemed to have risen upto 16 000 barrels per day as the damage to installations increased. The total flow was reported to have covered an area the size of Belgium by the time Iran managed to cap the wells.

The point is that blow-outs occur as engineering problems of mining. As the countries of Kenya, Tanzania, Mozambique and Malagasy intensify their search for oil, they should also commence some degree of preparedness both for prevention as well as remedy of such incidents.

Problems associated with exploitation of resources will actually increase as the mining of ferromanganese nodules begin in the Indian Ocean. How soon that could be is uncertain.

(e) Degradation Resulting from Engineering Activities

A number of coastal, port and estuary engineering works can cause notable environmental damage to the marine and coastal environment. Examples of such activities include quarrying, dredging, reclamation and damming at the estuaries.

Quarrying may be done for sand, gravel or coral for building industry. Of the countries in Western Indian Ocean, Seychelles has a complete documentation of this problem which they say started during the 19th upto early 20th century.[71] According to the reports, this destroyed coral formation of the foreshore upto about ten kilometres.

Dredging is a popular port activity. In Seychelles, during 1971 and 1972, dredging was done of the sea-bed in order to build a reclaimed airport and a new port.[72] In Kenya, an American dredger was hired and engaged to expand and deepen the five mile channel into Kilindini Ports. Its impact was / evidenced by cracks in some buildings around Kizingo area, as well as the general tremor which prompted public dismay during February and March, 1982.[73]

Reclamation has also been well-known in the Seychelles, as noted above. Due to limited development land around Victoria, a major reclamation project was done from about 1976.[74] Large mangrove swamps were cleared; continuous small-scale reclamation is still proceeding, under permit, by sea front residential owners. The obvious consequence is the destruction of the coastal mangrove swamps which might be breeding ground for some marine fauna. But there may also be later problems arising from the chemical composition of the refill materials, as seepage begings, and their impact on marine environment.

Dam building to facilitate hydro-electric power generation and for irrigation is easily a popular engineering work and is indeed so in the Western Indian Ocean.[75] The consequence of such constructions is to increase siltation and erosion. Besides, because it modifies the flow regime into the sea, it does affect the impact of waves, tides and currents by erosion and transportation of silt of the coastal lands. While the east coast has seen some serious problems of siltation in the marine environment, it has not actually witnessed the tragedy / such as that wrought by Akasombo Dam on the Coast of Benin and Ghana. The dam, completed in 1965, has caused serious coastal erosion which destroyed the town of keta in Ghana, displacing 10 000 people; has twice displaced a road; destroyed 30 to 40 hectares of palm oil plantations; threatens the old town / cf Aneho with its 10 000 inhabitants, and more. Commentators think the final result might be to send Togo along the road to the fabled continent of Atlantis.[76] The point is that the problem is not confined to Togo and Ghana. It has become a problem for the entire Gulf of Guinea.

(f) Problems Arising from Military Activities

There are at least three broad categories of environmental problems arising from military activities, viz: arms tests; disposal of materials remnants of war; and installation of military structures and devices at sea.

Atmospheric tests of nuclear weapons is the most notorious instance of environmental problems related to military activities. The problem was given its strongest notoriety by the United States nuclear tests on Marchall Island during March and April 1954, an exercise which resulted in the release of radioactive debris which eventually injured Japanese fishermen and rendered their fish unsuitable for human consumption. As a result the United States Government agreed to make ex gratia payments to the Japanese residents of the Pacific Island of Rongelap.

More recently, the French government conducted several test in Murora atolls in the South Pacific Ocean area. Australia and New Zealand complained that measureable quantitites of radionuclides from the tests were deposited on their territories, approximately 6 000 kilometres away. Both countries brought the matter to the International Court of Justice.[77] During the Court proceedings and after several recorded protests by several Pacific States, the French government was understood to have given a public undertaking that they would not conduct further nuclear weapons tests.

Such tests are, no doubt, a nervous and sensitive affair which most states find objectionable. During their meeting at Raratonga, Cook Island, in August 1985 the thirteen members of the South Pacific Forum adopted the Treaty of Raratonga which sought to proscribe nuclear tests in the region.

It is clear that the French government could conduct similar military activities, with adverse environmental consequences in the Western Indian Ocean. The evidence for this is: The French delegation at the Conference of Plenipotentiaries on the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region proposed, but later withdrew, what they called "Interpretative Statement annexed to the Final Act of the Conference of Plenipotentiaries." The statement said inter alia that the implementation of the convention and its protocols might be suspended if the Government of France deemed them an obstacle to activities connected with national defence missions. This is not specific. But from the experience in the South Pacific, it is conceivable that nuclear weapons tests could be one possible defense mission.

The French government is not the only one that might conduct such tests but they offer an example, especially since they are not contracting parties to the 1963 Test Ban Treaty.[78] But it is important to note the research findings by Edward Wenk, Jr. who submits that testing of nuclear weapons is still the principal source of radio-nuclides in the ocean space and that harmful amounts are already detectable in any 50 gallons of water sample sample anywhere in the world's oceans.[79]

Materials that remain after military activities but which cannot or need not be stockpiled are considered as disposable wastes and can be a lethal burden to the state holding them. No doubt the oceans become an attractive disposal site. Such was the case with nerve gas coffins which were disposed of in "Operation Chase" conducted by the United States Army in August 1970.

A more classical instance of cause and effect occurred in the Baltic Sea. Danish fishermen operating off the Coast of Sweden in the Baltic were in August 1969 burned by fish contaminated with German mustard gas dumped by the Allies after World War II.[80] The point is that even if the materials were containerized and sealed as were the cannisters in the Operation Chase, the effect of ocean currents might make them difficult to locate for monitoring after a short while.

Emplacement or installation of artificial devices in the exclusive economic zone or in the seabed will probably increase with the sophistication of military activities. The jurisdiction over all installations in Exclusive Economic Zone is dealt with under Articles 56 and 60 of the 1982 Law of the Sea Convention; the seabed, on the other hand is to be utilized exclusively for peaceful purposes but that might not effectively exclude various forms of naval activities.[81] These could include weapons as well as detection and communication devices. Their presence would be incompatible with some uses of the sea such as trawling, mining or aquaculture.

In conclusion, it can be summarized here that the Indian Ocean still remains an important frontier in terms of the natural resources which can be utilized to enhance development in the Infian Ocean Region. However, various human and natural activities around the ocean are degrading the ocean environment. The impact is not just some nebulous and remote problem called pollution or degradation but actually putting development in jeopardy. For that reason the protection of marine environment in the Indian Ocean region is actually a development imperative which extends to agricultural lands and public health

AGENDA FOR RESEARCH

The following issues are extrapolated from the foregoing discussion, at random as possible subjects or issues susceptible to constructive studies for the promotion of development and protection of the environment in the region. They are only suggestions for discussion and should lead to other topics.

River Input into Oceans (RIOS)

This selection is based on the fact that the most important source of environmental degradation in the Western Indian Ocean (as is elsewhere) is land-based sources, most of it carried by rivers. The unique characteristic of the problem here is actually the actual degradation of agricultural lands and the loss of agricultural inputs such as fertilizers and pesticides. The concern with RIOS would be to assess exactly what is happening to agriculture and hence what is taken in by the oceans.

RIOS is not an original concept here.[82] A project precisely by that title was already initiated by UNEP and actually adopted by the Second Session of the Governing Council as a part of the Programme's activities. The particular project was to be concerned with quantity and physical process rather than quality. The activity was to be done with the collaboration of the Global Investigation of Pollution in Marine Environment (GIPME) which is conducted within the framework of the Inter-Governmental Oceanographic Commission, an affiliate of UNESCO, based in Paris.

At the same time, UNEP Executive Director had requested states to participate in the development of a register of clean rivers which was to be compiled in collaboration with UNESCO. That implies assessment of baseline data on the quality and precise chemical and physical content of the load carried by the rivers into the oceans.

At the very least, the relevant research could begin by getting the respective compilations under RIOS and register of clean rivers as a basis for future work. Such information would be valuable towards a protocol for en enforcement of Article 7 in the Eastern African Regional Seas Convention.

B. A Profile of Tankers and Merchant Ships Carrying Trade along Indian Ocean States

This is premised on the supposition that maritime trade is a significant aspect of development of the countries of the region. And that in order to make a meaningful suggestion for enhancement of efficient trade it is significant to have a complete basic information on the ships and tankers beginning with the liner conferences registered in the countries of the region. And that in order to make a meaningful suggestion for enhancement of efficient trade it is significant to have a complete basic information on the ships and tankers beginning with the liner conferences registered in the countries of the region.

Besides, ship-borne pollution will probably tend to increase in significance in the Indian Ocean; to enhance control will require a clear understanding of the ownership, charter trends, flags of convenience and frequency as well as ports of call. The completed study by Coasta Ricky Mahalu would be a useful beginning point for East Africa.

C. Strategies for Controlling Ship-born Pollution in the Indican Ocean

Various strategies exist at the levels of legislation, surveillance and enforcement. A regional consideration is useful because of the fluid nat e of the shipping operations, elusive task of surveillance and the limited capacity of any individual states to carry out the tasks of surveillance and enforcement. Therefore joint or coordinated action may have to be considered. The recent Memorandum of Understanding among fourteen Western European States agreeing to take measures through Port State Control, to enforce internationally accepted standards is a useful precedent.

That would require as a start, inventorying of the available capacity and legislation as well as examination of options such as port-state strategies. Such information will in any case be necessary for enforcement of Article 5 of the June 1985 Eastern African Regional Sea Convention (The Nairobi Convention).

D. Marine Scientific Research in the Indian Ocean States

The focus here would be on enhancement of capacity to conduct marine scientific research geared concretely towards resource assessment, and conservation measures.

It is important to know, as a start, the scope of infrastructure, equipment and experts that are available. The listing of experts should be based on scholarly publications produced because the ultimate interest would be in experts who would be useful in the creation of the strong, persuasive and credible information, not just bureaucrats. A further purpose would be facilitate exchange of information and, to the extent possible, to initiate research collaboration and sharing of resources among them.

The recent compilation published by UNEP in 1982[84] seems rather sketchy and hurried.

E. Prospects for Increased Oil and Gas Trade among Indian Ocean States

The primary focus here is on oil as part of energy requirements for the development of the Indian Ocean States, Most of the states input oil and, indeed, most of oil trade originate from the Gulf, transported through the region. Can it be made cheaper for the states in the region? What are the incentives to the increased trade within the region? What are the constraints? What is the exact pattern of proven reserve which exist in the region?

F. To what extent can Fisheries Management enhance development of the Indian Ocean States?

It has been generally held that fisheries management, properly planned, can be very labour intensive. Studies which establish the precise extent would persuade the coastal states to intensify fishing, and thus, increase supply of that source of food protein.

In such a study assessment would need to be made of conditions of access, fishermen's loan schemes, cooperatives and encouraging fish consumption.

G. How can Coastal States enhance their gains from Coastal Tourism?

"In the era of packaged tours most of the payments by tourists remain or find its way back to the country of origin." That proposition needs clear assessment and determination of ways of enhancing the gains from tourism. We saw several critical comments against tourism in the section on development; and more concrete facts should be published to guide policy.

H. Determining profitable Fisheries Access Arrangements for the Indian Ocean States.

Fishing in the Western Indian Ocean and in the high seas has been done largely by long distance fleets from Korea, Japan, China Spain and Societ Union. In view of the aoption of the legal regime of the Exclusive Economic Zone the arrangements for access to fisheries within that zone will have to be established and enforced.

The proposition here is for a network of scholarly and policy appraisal of past experience, as have been cases in Kenya and Tanzania, Seychelles as well as Mozambique, and to set out suitable options for access by foreign fleets which could be aopted by the coastal states in the region. Consideration would need to be given to the interests of the coastal as well as land-locked states on the one hand, and the longdistance fleets on the other.

I. To what extent can the Indian Ocean States benefit from LOME III as far as Marine Resources Management is concerned ?

Most reports have indicated that the ACP States have been very unhappy with the resources delivered by EEC under LOME I and II.LOME III was signed on 8 December, 1984.

Title 11 of the Convention (Articles 50-59), is on Development of Fisheries, which should be of interest to the ACP States within the region. Those provisions should be placed within the broader context of the general purpose of the agreement between African, Caribean and Pacific States on development cooperation. The appraisals and a recommendations emanating from such studies should guide subsequent research and policy.

Besides, it is expected that EEC will be a contracting party to the June 1985 Eastern African Regional Sea Convention (The Nairobi Convention) having been invited in accordance with Article 26 of the Convention. The precise scope of their input into the implementation of the Convention should interest scholarly research. The partinent question of what would be the rights and obligations of the EEC states within the agreement should be researched and discussed.

J. Implications of adherence to Treaties on Environmental Matters

The most critical issue in the Indian Ocean area is the management of natural resources for development. Yet it is clear that a lot of activities are having negative impact on the natural resources and,therefore,promising to frustrate development.

There are several agreements on environmental matters and,therefore, relating to rational management of such natural resources already concluded at global and regional level. But it is clear too that even after their involvement at the negotiation stages and accepting the formulations, a number of states in the region are reluctant to sign or otherwise the agr agreements. Very often, even after accepting the treaty, the states have an inadequate performance in implementation.

On the former aspect of signature to an agreement, there is a recent instance when Kenya was mildly rebuked by a local newspaper (Sunday Standard 7/7/85 Editorial), for failing to sign the East African Regional Seas Convention on June 21 1985.

It seems appropriate to do a series of studies on selected agreements to determine legal, economic and technical implications of the states adherence to them, and what, in the opinion of the relevant governments, discourages adherence to such agreements.

In some cases, the studies should remove the fears, in others they should encourage adherence. In yet other cases, the studies should suggest ways of overcoming the constraints against adherence.

K Development of Legislation related to the Management of Natural Resources and the Environment.

Law may be characterized as the ultimate articulation of national policy in a given subject area so as to prescribe the substantive rules as well as the procedures for implementation and the sanctions attached to performance and/or non-performance. Therefore, a study of the development of legislation in the above area is an assessment of the exact status of the standing national policies as well as to identify gaps that require legislative action. Of necessity, such studies would also seek to ascertain the extent to which the laws are actually implemented and any impediments to the effective implementation.

Since some of the natural resources and their necessary management have regional implications,it would be necessary that the researchers indulge in some comparative studies. But the very natural unity or inter-relatedness of the natural environment would require that regional approach.

In the end, effective management of natural resources and the environment would require harmonization of the laws to avoid trans-national injuries or disadvantages brought about by the disparity of the regulatory standards.

Specific subject areas may be selected for analysis and perhaps the quest for harmonization of legislation. Examples are: fisheries, legislation including access regulations and enforcement procedures; Marine pollution regulation; Air pollution; Discharge standards for industrial and municipal wastes; oil and gas exploration and exploiting; Wildlife.conservation and management; Public health legislation, Water resources conservation and management; Agriculture legislation; and Ports and harbours management.

L. Selected Issues on the Law of the Sea.

This is a broader theme which could include some of the specific instances mentioned in the outline above. But its necessity is mandated by the fact that participation in marine matters is bound to increase within the region after entry into force of the Convention signed in October 1982. In any event, even if the convention as a whole runs into problems of its implementation as a convention, most of the subjects raised in it a will be put to policy work by the states in the region as well as states from abroad.

Therefore, subjects should be selected and be subjected to legal as well as policy studies. Such subjects might include:

1: Delimitation problems in the Indian Ocean region, with historical, legal and policy analysis.

2: Options for settlement of disputes on marine affairs in the Indian Ocean region.

3: Terms for access by long distance fishing fleets in the Indian Ocean region.

4. Prospects for Sea-bed mining in the Indian Ocean area: Legal and policy aspects.

5: Transfer of Technology as a policy issue in the exploitation of mineral resources of the Indian Ocean.

6. National regulation of scientific research within the Exclusive Economic Zone.

FOOTNOTES:

* An earlier draft of this paper was presented at the Inaugural seminar of the Issue-Based Indian Ocean Network at the Mahatma Gandhi Institute in Mauritius in September, 1985.

1. See "Fisheries Case" /1951 / ICJ Reports 132 .

2. The text of the Convention is reprited in International Legal Materials Vol. 21 p. 1261 (1982)

3. The first United Nations Conference on the Law of the Sea met in Geneva from February to April 1958 and in the end, adopted four Conventions and one Optional Protocal. For commentaties, see Jessup, "The United Nations Conference on the Law of the Sea" 59 Columbi L. Rev. 236-268 (1959); Fitzmaurice "Some Results of the Geneva Convention on the Law of the Sea" 8 Int and Comp L.Q 72-121 (1959); Friedheim, "The Satisfied and Dissatisfied States Negotiate International Law: A Case Study" in Falk and Hanrieder (Eds) International Law and Organization (New York: J.P.Lippincott Co. 1968) p. 70. The second conference, which ended without any achievements was held at Geneva in 1968. Then the Third United Nations Conference on the Law of the Sea adopted the 1982 Convention after negotiations which commenced with a preparatory phase in 1969 and substantive sessions in 1974.

4. For some examples see Friedman and Williams, "The Group of 77 and the United Nations: An Emergent Force in the Law of the Sea", 16 San Diego Law Rev. 555 (1979); Rembe, Africa and the International Law of the Sea (Alphen aan den Rijn, The Netherlands: 1980 Sijthoff Publications on Ocean Development Volume 6); Coquia, "Development and Significance of the 200 Mile Exclusive Economic Zone", Philippines Law Journal Vol.LIV Dec.1979 pp. 440 et seq; and Okidi, "The Role of the OAU Member States in the Evolution of the Concept of the Exclusive Economic Zone in the Law of the Sea: The First Phase" 7 Dalhousie Law Journal 39 - 71 (1982)

5. UNEP, UNEP Regional Seas Programme: The Eastern African Experience (Nairobi: UNEP 1984. UNEP Regional Seas Reports and Studies No.53); Hulm, A Strategy for the Seas: The Regional Seas Programme Past and Future (Nairobi: UNEP 1983), UNEP, Achievements and Planned Development of UNEP'S Regional Seas Programme and Comparable Programmes Sponsored by Other Bodies (Nairobi, UNEP 1982 UNEP Regional Seas Reports and Studies No.1)

6. Indian Ocean Newsletter Vol VI No. 2 December 1985 pp.9 and 14. (Published by the International Centre for Indian Ocean Research, West Australia Institute of Technology, Bentley, Australia.)

7. See some elaboration on the concept of development by Dudley Seers "What are we trying to measure" in Journal of Development Studies,' Vol. 3 (1972) pp. 21-34 and C.O. Okidi, Management of Natural Resources and the Envrionment for Self-Reliance" in Journal of Eastern African Research and Development, Vol.14 (1984) pp. 92-110.

8. World Bank, World Development Report, 1984 (New York, Oxford University Press 1984) p.ix.

9. For some points of view see Adedeji, "Perspectives of Development and Economic Growth in Africa up to the year 2000" in What Kind of Africa by the Year 2000? (Addis Ababa: OAU Report of the Monrovia Symposium February 1979) pp.53-88; Barbara Dinham and Colin Hines, Agribusiness in Africa: A Study of the Impact of Big Business on Africa's Food and Agriculture Production (London: Earth Resources Research, 1983); Karl Borgin and Kathleen Corbett, The Destruction of A Continent: Africa and International Aid(New York: Harcourt Brace Javanovich 1982).

10. WHO/UNEP, Public Health Problems in the Coastal Zone of the East African Region. UNEP Regional Seas Reports and Studies No. 9 (UNEP 1982)p.27.

11. UNEP, Socio,Economic Activities that may have an Impact on the Marine and Coastal Environment of the East African Region. UNEP Regional Seas Reports and Studies No.41 (UNEP 1984) p. 10.

12. For instance, see discussions by C.R. Mahalu, "Development of the Shipping Industry: The East African Case" in Okidi and Westley (Eds.) Management of Coastal and Offshore Resources in Eastern Africa (University of Nairobi, IDS Occasional Paper No.28, 1978) pp.181-207

13. Afriaa Now. October 1981, pp.105,106.

14. In the instance of Kenya see demand that the public be told the truth about tourism, by Vice President Mwai Kibaki. See Daily Nation headlines on 27 April 1982. Code of Conduct was later urged for the tourist sector in Kenya Parliament, see Daily Nation 13 October 1982.

15. Daily Nation, 27 April 1982, p.3 and 1 May 1982, p.20

16. Migot-Adholla and Katama Mkangi, Study of Tourism in Kenya: With Emphasis on the Attitude of Residents of the Kenya Coast. (University of Nairobi, IDS Consultancy Reports No.7, 1982).

17. For comments and some policy prescriptions see World Bank, Toward Sustained Development in Sub-Saharan Africa: A Joint Program of Action (Washington DC: IBRD, 1984).

18. See for example, comments by Daniel Finn, "Land Use and Abuse in the East African Region," in Ambio: A Journal of the Human Environment, Vol.12 No.6 (1983) pp.296-301; Okidi.

19. UNEP, Pollution and Marine Environment in the Indian Ocean. UNEP Regional Seas Reports and Studies No. 13 (UNEP 1982) p.133.

20. Data from A.R.T. Hove, "Some Aspects of Current Sedimentation, Depositional Environments and Submarine Geomorphology of Kenya's Submerged Continental Margins" in Okidi and Westley (Eds), supra note.

21. See Finn, op.cit.p. 296

22. UNEP Regional Seas Reports and Studies No.13, op. cit. pp.123-130

23. World Food Council, The Role of Fisheries in Improving Nutrition, WFC/1980/10 of 18 April 1980,p.2

24. Preliminary studies done under the aegis of the Indian Ocean Fishery Commission include: FAO, International Trade: Tuna. IOFC/DEV/71/18; International Trade: Shrimp, IOFC/DEV/71/15; International Trade; Groundfish, IOFC/DEV/71/18: International Trade Crab, IOFC/DEV/71/16; International Trade: Fish Meal, IOFC/DEV/71/17, all available from IOFC, FAO Rome.

25. H. Hayasi, Stock Assessment, IOFC/DEV/71/3 (Rome: IOFC, FAO March 1971).

26. D.H. Cushing, Survey of Resources in the Indian Ocean and Indonesia, IOFC/DEV/71/2 (Rome: FOA/IOFC March 1971).

27. UNEP Regional Seas Reports and Studies No.13, op. cit. p. 36

28. Text of the Final Act and the Convention are reprinted in International Legal Materials Vol. 21 (November 1982) pp. 1245 and 1261 et seq.

29. For a historical analysis see Okidi, "The Role of the OAU Member States in the Evolution of the Concept of the Exclusive Economic Zone in the Law of the Sea: The First Phase" Dalhousie Law Journal Vol.7 No.1, March 1982, pp.39-71.

30. See Supra note 1

31. Treaty signed between Iceland and Belgium on 28 November 1975 in International Legal Materials Vol.15 (1976) p.1; between West Germany and Iceland p.43. Between Iceland and Norway signed on 10 March 1976 and between Iceland and UK in June 1976 are both in International Legal Materials Vol. 15(1976) pp. 875 and 877 respectively. For the Fisheries Case" (United Kingdom vs. Norway) see ICJ Reports 1951 p.116.

32. Reports of arrest of Kenyan fishermen by Tanzanian authorities were published in The East African Standard on 19th, 23rd and 24th September and 6th October 1970.

33. A dossier on the EEZ: Comprehensive Programme of Assistance in the Development of Fisheries in Economic Zones was released by the FAO in 1981. Among other things it contains two pamplets: Fisheries Development in the 1980's and World Fisheries and the Law of the Sea, (Rome:FAO, 1981).

    See also a pamplet prepared by William T. Burke, Fisheries Regulation Under Extended Jurisdiction and International Law(Rome: FAO, 1982, FAO Fisheries Technical Paper No. 223).

34. See the views of an eminent authority, K.O. Emery, "The Potential for Deep Ocean Petroleum" Ambio Special Report No.6 (1979) pp.87-92.

35. The Proclamation, considered the first enunciation of positive law on continental shelf is reprinted in Lay, Churchill and Nordquist (Eds) New Direction in the Law of the Sea. Vol. 1 (Dobbs Ferry, New York: Oceana Publications 1973) pp. 106-109.

36. For the text of the 1958 Convention, see United Nations Treaty Series, Vol. 499,p.311 (1964).
    Scholarly publications on the subject are actually legion but they do not concern us here; just for interest see Jennings "The Limits of Continental Shelf Jurisdiction" International and Comparative Law Quarterly Vol.18(1969) p.819 et seq. and Oda, "Proposals for Revising the Convention on the Continental Shelf" in Columbia Journal of Transnational Law Vol.7(1968) pp. 1-31.

37. This is an important matter but beyond the scope of this paper. For a general outline see Okidi, Management Profile and Training Needs for Marine Resources Development (University of Nairobi, IDS Working Paper No. 415, October 1984).

    For a history of awkward experiences arising from bad management, see Nwankwo, After Oil, What Next? Oil and Multinationals in Nigeria Enugu, Nigeria: Fourth Dimension Publishing Co. Ltd, 1982).

38. On the hot brines see Ross, "Red Sea Hot Brines Area: Revisited" in Science, Vol. 175 (March 1972).

    For Decree No. M-27 dated 7 September 1388 Hegira, (September 7, 1968) see International Legal Materials, Vol.8 (1969)p.606.

39. See, for instance, Lagoni, "Oil and Gas Deposits Across National Frontiers" in American Journal of International Law, Vol.73 (1979) pp. 215-243.

40. See Agreement on Procedure for Negotiation of Aegean Continental Shelf in International Legal Materials, Vol. 16 (January 1977) p. 13 and Gross, "The Dispute Between Greece and Turkey Concerning the Continental Shelf in Aegean Sea" in American Journal of International Law, Vol. 71 (January 1977) pp. 31-59.

41. For a point of view, see Official Documents About the Malta/Libya Dispute on the Dividing Line of the Continental Shelf (Government of Malta, 8th September 1980).

42. For commentary on the dispute see Feldman, "The Tunisian/Libya Continental Shelf Case: Geographic Justice or Judicial Compromise?" in American Journal of International Law, Vol. 77 (April 1983) pp. 219-38.

43. See a general review by Rainer Lagoni, "Interim Measures Pending Maritime Delimitation Agreements" in American Journal of International Law Vol. 78 (April 1984) pp. 345-368. There are several other bilateral agreements on the maritime interests.

44. For some comments see Adede, "Law of the Sea--The Integration of the Settlement of Disputes Under the Draft Convention as a Whole" in American Journal of International Law, Vol. 72 (January 1978)pp.84-95 and Rosene, "Settlement of Fisheries Disputes in the Exclusive Economic Zone," American Journal of International Law,Vol. 73 (January 1978)pp.89-104.

45. See Somali Democratic Republic, Five Year Development Plan 1982-1986 (Mogadishu: Ministry of National Planning 1982) p. 168.

46. See Nwankwo, After Oil, What Next? op. cit.

47. See Okidi, "Management Profile and Training Needs for Marine Reources in Developing Countries" in United Nations, Institutional Arrangements for Marine Resources Development, Report of the Expert Group Meeting on Institutional Arrangements for Marine Resources Development held at UN Headquarters 10-14 January 1983 (New York, 1984) pp. 97-118. There are seven other articles in the report which are of interest on the theme.

48. The United Nations Centre on Transnational Corporations has done research and compiled considerable information on the topic. See for instance one of the publications authored by Robert Hamlisch, Transnational Corporations in International Fisheries (New York, January 1980).

49. For some commentaries, see Mahalu, "Development of the Shipping Industry" op. cit.

50. For these data see IMO/UNEP, Oil Pollution Control in the East African Region. UNEP Regional Seas Reports and Studies No. 10 (UNEP, 1982) p.22-23.

51. See Okidi, Kenya's Marine Fisheries: An Outline of Policy and Activities. (University of Nairobi, IDS Occasional Paper No. 30, January 1979).

52. UNESCO/ECA, Marine Science and Technology in Africa: Present State and Future Development. (Paris: UNESCO Reports in Marine Science No.14, 1981.

53. This is the reasoned definition adopted by C.O. Okidi in Regional Control of Ocean Pollution: Legal and Institutional Problems and Prospects (Alphen aan den Rijn, The Netherlands: Sijthoff & Noordhoff, 1978) p.12. It differs in some respects from the 1971 GESAMP definition which was adopted in Article 1 (4) of the 1982 Law of the Sea in a slightly modified form.

54. See for instance, United Nations, The Sea: Prevention and Control of Marine Pollution, UN Doc. E/5003, (Report of the Secretary-General,1971); Study of Critical Environmental Problems, Man's Impact on the Global Environment: Assessment and Recommendations (Cambridge, Mass: MIT Press, 1970); Johnston, D.M. (Ed) The Environmental Law of the Sea (Gland, Switzerland: International Union for the Conservation of Nature and Natural Resources, 1981) and Okidi, Regional Control of Ocean Pollution, op. cit. All the above have extensive references.

55. FAO/UNEP, Marine Pollution in the East African Region. UNEP Regional Seas Reports and Studies No. 8 (UNEP, 1982) p.28.

56. Ibid.

57. For the ensuing data see UNEP Regional Seas Reports and Studies No. 41, op. cit. pp. 8-9.

58. UNEP Regional Seas Reports and Studies No. 13, op. cit. p. 110

59. ibid. p. 111.

60. ibid. and UNEP Regional Seas Reports and Studies No. 41, p.9.

61. UNIDO/UNEP, Industrial Sources of Marine and Coastal Pollution in the East African Region. UNEP Regional Seas Reports and Studies No. 7 (UNEP, 1982) summarizes the scope of the problem and the sources as outlined hereafter.

62. For this phenomenon see Goldberg, "Marine Pollution: Action and Reaction Times" in Oceanus, Vol. 18 (Fall 1974) pp. 13 et seq.

63. Some projections of industrial development in the region are discussed in UNEP Regional Seas Reports and Studies No. 7 op. cit. pp.8-11

64. See Okidi, Regional Control of Ocean Pollution op. cit. pp. 165 - 171 UNEP Regional Seas Reports and Studies No. 13 op. cit.pp.1-4 and No. 17 op.cit. pp. 4-9

65. That the reports have actually reached the popular press is important See The Sunday Times (Nairobi) July 28, 1985, p.5

66. See Wenk, "The Physical Resources of the Oceans" in Scientific American, Vol. 221 (September 1969) pp. 167, 168-9. But for general discussion on problems and prospects see Okidi, "The Prospects for Cooperation Among Developing Countries in Legal Aspects of Control of Transboundary Air Pollution" in Flintern, Kwiatkowska and Lammers (Eds) Transboundary Air Pollution: International Legal Aspects of Cooperation of States (Nijthoff, forthcoming).

67. For details, see Okidi, Regional Control of Ocean Pollution, op. cit. pp. 17-25.

68. See discussion on this in Okidi, "Management of Natural Resources and the Environment for Self-Reliance" Journal of East African Research and Development, Vol. 14 (1984) pp. 92, 98.

69. For an account, see Wardley Smith, "Occurrence, Causes and Avoidance of Spilling Oil by Tankers" in Proceeding of the Joint Conference on Prevention and Control of Oil Spills, March 13-15, 1973 (Washington DC: American Petroleum Institute, 1973).

70. UNEP Regional Reports and Studies No. 10 op cit. and FAO, Pollution: An International Problem for Fisheries (Rome FAO World Food Problems No. 14, 1971) especially pp. 15-20, 52-55.

71. FAO/UNEP, Legal Aspects of Protecting and Managing Marine and Coastal Environment of the East African Region: National Reports. UNEP Regional Seas Reports and Studies No. 49 (UNEP, 1984) pp. 81, 83.

72. ibid

73. Reports were covered in local newspapers such as the Daily Nation (Nairobi) 27th March 1982, p.9.

74. UN/UNESCO/UNEP, Marine and Coastal Area Development in the East Africa Region. UNEP Regional Seas Reports and Studies No.6 (UNEP, 1982))pp.29-30

75. UNEP Regional Seas Reports and Studies No. 41 op cit. pp. 22-24

76. For the foregoing see a synotic writeup in New Africa, August 1985,p. 27

77. For details see "Nuclear Test Case" Australia vs. France ICJ Reports 1974, pp. 253-455 and New Zealand vs. France ICJ Reports 1974,pp.457-538

78. The question of legality of atmospheric nuclear tests remains controversial expecially since the ICJ disposed of the cases by Australia and New Zealand without addressing that question. The position in general international law would be that such tests are illegal, and that provides the legal basis for the protests by the States of the South Pacific. For some discussions see Luke Lee's "The Legality of Nuclear Weapons Tests" in Oesterreichische Zeitschrift fuer Oeffentiches Recht, Vol. 18 (1968) pp. 307 et seq., Thomas M. Frank, "Word Made Law: The Decision of the ICJ in the Nuclear Test Cases" American Journal of International Law, Vol. 69 (1975) pp. 612-620.

79. Wenk, "The Physical Resources of the Oceans" Scientific American, Vol.221 (September 1969) pp. 168-169.

80. Schachter and Serwer, "Marine Pollution Problems and Remedies" American Journal of International Law, Vol.65 (1971) pp.84,107.

81. Detailed discussion will probably be presented on the political aspects of IBION, but for a broad discussion see Tullio Treves' "Military Installations, Structures and Devices on the Seabed" in American Journal of International Law, Vol. 74 (1980) pp. 808-857.

82. For some background and detailed documentation see Okidi, Regional Control of Ocean Pollution, op. cit. pp. 74-77.

83. Dr. Mahalu, of the Faculty of Law, University of Dar es Salaam is the wellknown researcher in Eastern Africa working on the subject. See his Public International Law in Shipping Practice: East African Aspirations (Batten Baden, West Germany: Nomos, Verlagsgesellsschaft, April 1984).

84. United Nations Environmental Programme Regional Sea Programme Activity Centre/UN ECA/UNESCO Directories and Bibliographies, 1982. Marine Research Centres: Africa(Rome: FAO for United Nations Environment Programme Regional Seas Programme Activity Centre, Geneva).