

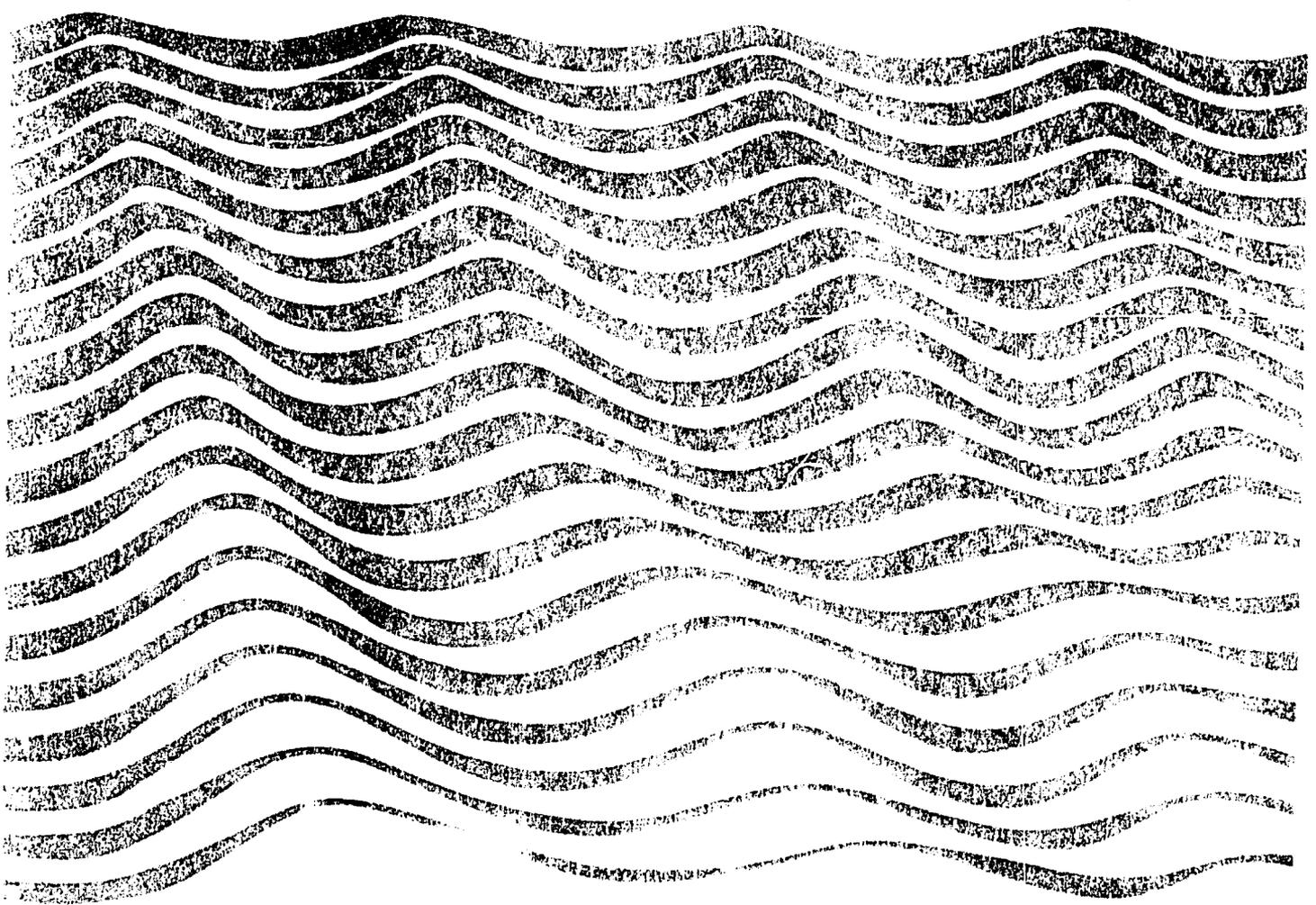
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Unesco reports  
in marine science

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# Marine science and technology in Africa: present state and future development

Synthesis of Unesco/ECA survey  
missions to African coastal  
states, 1980  
Project RAF/78/024



## I. SUMMARY OF RECOMMENDATIONS

1.

### 1. Action at the National Level

1.1 African coastal states should establish sound economic development policies or review their existing national policies, concerning the development and exploitation of their marine resources, taking into consideration the full implications of the Third United Nations Conference on the Law of the Sea. These policies should reflect an appreciation of the potential importance of the resources of the sea in economic development.

1.2 African coastal states should establish or strengthen the necessary administrative machinery to ensure the efficient implementation of government policies relating to the development and rational exploitation of their marine resources.

1.3 African coastal states should strive to establish or strengthen the necessary infrastructural facilities for the development of marine science and technology as a basis for the full and rational exploitation of their marine resources. This should be reflected in the establishment or strengthening of training and research institutions in marine science and technology, and in the provision of the necessary services to ensure the efficient and rational use of their marine resources.

### 2. Action at the Regional Level

2.1 African coastal states should pool their resources and form regional or subregional cooperative groupings in order to bring about a quicker and more substantial development of marine science and technology as a basis for the full and rational exploitation of their marine resources, e.g. through cooperative training and research programmes.

2.2 African coastal states should cooperate on a regional or subregional scale in carrying out such undertakings as deep-sea oceanographic research, surveillance of their Exclusive Economic Zones, development of marine transport systems, e.g. shipping lines and provision of ship-building and repair facilities.

### 3. Action at the International Level

3.1 Through international cooperation, individual African coastal states should be assisted to establish the necessary infrastructures for the development of marine science and technology through appropriate training and research programmes.

3.2 Through international cooperation, African coastal states should be assisted to form regional or subregional cooperative groupings in order to bring about a quicker and more substantial development of marine science and technology and thus enable these countries to be self-reliant in the development and rational exploitation of their marine resources and in making full use of the sea as a transport and communication medium.

## 1.1 Eastern Africa

### COMOROS

#### Background information

The Federal Islamic Republic of Comoros comprises an archipelago of 4 islands - Grande Comoro, Anjuan, Maheli and Mayotte.

Area: 2160 km<sup>2</sup>

Coastline: 560 km.

\*Population: 0.37

#### Training in marine sciences

There are at present no training institutions in marine sciences and there is a great shortage of middle and high level manpower. Training of a few professionals of these cadres takes place abroad.

#### Research in marine sciences

At present there is practically no research activity going on in the field of marine science. The Department of Oceanography and Marine Fisheries (Département Oceanographie et Peches Maritimes) at Moroni is understaffed, has poor accommodation and no research equipment of any kind. There are however some routine meteorological observations carried out daily and it is intended to establish a marine meteorological station in the future.

### DJIBOUTI

#### Background information

The Republic of Djibouti is a small country with a semi desert climate and poor terrestrial resources. It obtained its independence from France in 1977.

Area: 23,000 km<sup>2</sup>

Coastline: 300 km.

Population: 0.11

\*The population figures are given in millions and are based on the Midyear Estimated Population in the U.N. Demographic Year Book 1977. .../...

### Training in marine sciences

There are no training institutions for middle and high level manpower in marine sciences and there is therefore a great shortage of such manpower. Furthermore, because of the poor standard of primary and secondary education, there are few suitable candidates for scientific training.

### Research in marine sciences

The Government is making great efforts in developing a capability in marine science and technology, and has established three institutions to be responsible for marine science activities :

- Institut Supérieur d'Etudes et de Recherches Scientifiques et Techniques (I.S.E.R.S.I.) - (Institute of Higher Technical Education and Scientific Research).

This institute was established in 1979 to replace the former Le Centre d'Etudes Géologiques et de Développement (C.E.G.D.), (Centre for Geological and Development Studies) of the French colonial government. It is staffed by one research scientist and two assistants and at present, carries out some work on the farming of the brown alga (sea weed Eucheuma spinosum). The Institute owns a boat and a barge.

- Service de L'Elevage et des Pêches Maritimes (S.E.P.M.) (Farming and Sea Fisheries Department).

This Department is responsible for all activities concerning fisheries development and livestock breeding. It is understaffed and does not carry out any research at present.

- Aquarium Tropical de Djibouti (A.T.D.) (Djibouti Tropical Aquarium)

The aquarium which is intended for public entertainment and research is manned by a curator and an assistant and at present conducts no research.

## KENYA

### Background information

The Republic of Kenya has rich agricultural and freshwater resources. Its marine resources are also said to be considerable but are not yet being fully exploited.

Area: 582,646 km<sup>2</sup>

Coastline: 500 km.

Population: 14.34

### Training in marine sciences

Marine science activities are a recent development at the University of Nairobi and there are as yet no special training programmes in the subject at the undergraduate or postgraduate level. It has been reported however, that the University intends to introduce both undergraduate and postgraduate programmes in marine biology in the near future, and some departments in the Faculty of Science have recently introduced some marine-oriented topics in their undergraduate programmes.

### Research in marine sciences

The principle institution engaged in marine science research at present is the Kenya Fisheries and Marine Research Institute which is very well located on the coast at Mombasa, with a modern marine research laboratory. The laboratory is however not fully equipped and most of the seven national marine scientists are still without postgraduate qualifications. The research programmes of the Institute at present include fishery biology, environmental studies, reef ecology and chemical oceanography. There are plans to train more scientific staff for the Institute and to acquire two research boats.

The Faculty of Science of the University of Nairobi has a research station on the coast of Diani near Mombasa, but it is not well equipped and the buildings are not in a good condition. A few members of the academic staff in the biological sciences carry out some marine science-oriented research, e.g. in coral reef ecology, marine algae and microbiology. A closer cooperation between the University and the Institute would facilitate a more economic use of scientific manpower and facilities.

Area: 308 km<sup>2</sup>  
Coastline: difficult to estimate  
Population: 0.06

#### Training in marine sciences

As there are no institutions of higher learning the few high level professionals required by the government, including those concerned with marine activities, are trained abroad.

#### Research in marine sciences

The Seychelles government established a Department of Fisheries under the Ministry of Agriculture in 1972 which created a Research Section in 1976. The research activities of the Department have been and are still mainly fishery-oriented, aimed at providing data for the development of the fishery industry. These activities are centred on fishery surveys, stock assessment and post-harvest handling (fish technology).

The Royal Society Research Station on Aldabra atoll: The government of Seychelles recently established a foundation to operate the island of Aldabra and the Research Station of the British Royal Society on the atoll after the termination of the Society's lease. It is intended to use the multi-disciplinary research facilities for externally-funded visiting research scientists.

### SOMALIA

#### Background information

The Somali Democratic Republic is a hot and largely arid country with a population over 60% of which is made up of nomadic pastoralists. The country has few natural terrestrial resources and its economy is at present based mainly on livestock and bananas. However, its coastline is one of the longest in Africa and being within the Somali upwelling area the fishery resources of its "exclusive economic zone" are said to be some of the richest in the continent; these resources however remain far from being fully exploited. The present economic policy of the government places much emphasis on the development of the country's marine fisheries to facilitate a settled existence for the nomadic population.

Area: 637,657 km<sup>2</sup>

Coastline: 3,200 km.

Population: 3.35

#### Training in marine sciences

There is at present no important activity concerning the training of marine scientists in the country but the Somali National University has had a long-standing plan to establish a Faculty of Marine Sciences and Fisheries. It is still hoped that this project which was worked out with the assistance of UNESCO (G. Hempej, 1979) will be implemented in due course when the state of the economy of the country becomes more favourable or through bilateral or multilateral cooperation. It has been reported that a few marine scientists are undergoing training abroad.

#### Research in marine sciences

There are at present no important research activities going on in the country but the Ministry of Fisheries has worked out a project aimed at the establishment of a marine biology and fishery research institute. It was originally expected that this project, which remains unimplemented, would be executed through multilateral cooperation between the governments of Somalia and Japan and the Arab League Educational, Cultural and Scientific Organisation (ALECSO).

### SUDAN

#### Background information

The Democratic Republic of the Sudan comprises a vast territory with a varied climate ranging from desert in the north to equatorial in the south. The economy of the country is mainly based on irrigation agriculture of which there are plans for enormous expansion, with assistance from Arab states. In recent years the government has shown much interest and enthusiasm in the development of marine sciences with a view to enabling

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the country to make full and rational use of its living and non-living resources in the Red Sea.

Area: 2,505,825 km<sup>2</sup>  
Coastline: 700 km.  
Population: 16.13 (1976)

#### Training in marine sciences

The training of marine scientists in the country is centred at the Institute of Oceanography at Port Sudan, which was established in 1977 under National Council for Research and which received various forms of assistance from UNESCO (Morcos, 1974, Schroeder, 1977) during its formative years. In its training programmes the Institute works in close collaboration with the University of Khartoum. The Institute is at present headed by an expatriate Director and there are two qualified national scientists on the staff, with more undergoing training abroad.

#### Research in marine sciences

There are three institutions in the country responsible for marine science research activities :

The Institute of Oceanography, Port Sudan: Apart from training (see above) the Institute is empowered to carry out all relevant types of oceanographic research. However, owing to limitations of staff and facilities present research programmes are confined to the ecology and conservation of coral reefs, ecology and geology of coastal lagoons, hydrography of the Red Sea and coastal sedimentology. Future programmes would include general fishery biology, mariculture, heavy metal deposits, reef conservation, pollution and basic oceanography.

The Department of Zoology of the University of Khartoum has a Marine Biology Station at Suakin on the Red Sea coast, which was established in 1973, but due to lack of staff there has not been much research activity at the Station. It is expected, however that with a recent

improvement in the staffing situation the Station will functioning soon.

The Fishery Research Centre which was established in 1975 under the Agricultural Research Corporation has a Red Sea Fisheries Research Section at Port Sudan with two field laboratories situated at Port Sudan and at Dongonab respectively. Present research activities are limited to the biology and culture of oysters and future programmes would include fishery surveys and mariculture. The present scientific staff consists of two nationals and five more are on training.

## TANZANIA

### Background information

The United Republic of Tanzania is a large country comprising the former territory of Tanganika and the Indian Ocean islands of Zanzibar and Pemba. The country has a varied climate and is endowed with rich terrestrial, freshwater and marine resources, all of which remain underexploited at present. In its economic development policy, the government has given much emphasis to the development of the country's marine resources, especially fisheries.

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<u>Area:</u>	945,087 km <sup>2</sup>
<u>Coastline:</u>	800 km. (excluding islands)
<u>Population:</u>	16.09

### Training in marine sciences

The University of Dar es Salaam started to develop an interest in marine sciences in 1968 when it established a Marine Biological Station under the Department of Zoology : Through various forms of assistance from UNESCO, mainly for equipment and teaching experts, the Station has become an important training and research centre.

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In 1978 the University took over the former East African Marine Fisheries Research Organisation (EAMFRO) at Zanzibar and established an Institute of Marine Sciences, incorporating the former Marine Biological Station at Kunduchi in Dar es Salaam, as a field Station. The Institute's mission includes the development of research and teaching programmes in all aspects of marine sciences.

The University now offers a B.Sc. course in Marine Biology and an M.Sc. course in Fisheries and Aquatic Science and, with the assistance of UNESCO, will be offering the Open University Post-graduate Course in Oceanography with effect from the 1981/1982 academic year. There are also facilities for Ph.D. studies in marine sciences by research. The teaching of marine sciences at the University is a cooperative exercise between the Institute of Marine Sciences and several other sections of the University including the Departments of Zoology, Botany, Chemistry, Geology, Mathematics, Sociology and the Faculty of Law.

The Fisheries Research and Training Centre under the Ministry of Natural Resources and Tourism runs a three year Diploma course for fishery extension officers.

#### Research in marine sciences

The principal institution responsible for research in marine sciences in the country is the Institute of Marine Science of the University of Dar es Salaam, at Zanzibar. The scientific staff of the Institute and its Marine Biological Station includes seven Tanzanians and two expatriates; another four Tanzanians are doing their postgraduate training. The current research programmes of the Institute include fishery biology, fish taxonomy, benthic ecology, phytoplankton, population dynamics, fishery statistics, aquaculture and marine pollution. Among the important research and training facilities is a well equipped modern research vessel. It is intended to relocate the Institute at a new more spacious site where there will be enough room for future expansion.

The Fisheries Research and Training Centre, of the Ministry of Natural Resources and Tourism, also carries out research oriented towards the development of the Fishery Industry.

BENINBackground information

The Republic of Benin is a small densely populated country with rich agricultural resources. It was a former French colony (Dahomey) which gained its independence in 1960 and changed its name to Benin in 1975. Due to its very short coastline marine resources are not very important in the country's economy.

Area: 112,622 km<sup>2</sup>

Coastline: 100 km.

Population: 3.29

Training and Research in marine sciences

There is a great shortage of scientific manpower and there are no activities on training and research in marine sciences at present. However, with adequate staffing and equipment there are several institutions potentially capable of performing this role, including:

The University of Benin;

The Ministry of Higher Education and Scientific Research;

The Ministry of Cattle Breeding, State Farms and Fisheries;

The Directorate of Fisheries.

CAMEROONBackground information

The United Republic of Cameroon is a country rich in agricultural, forestry, freshwater and marine resources, non of which are being fully exploited at present. There is a serious shortage of high level manpower in all sectors of the economy.

Area : 476,000 km<sup>2</sup>

Coastline: 350 km

Population: 6.67

Training and Research in marine sciences

There are at present no activities concerned with high level training or research in marine sciences. However, the Faculty of Science of the University of Cameroon with the cooperation of the University of Bordeaux I and a few other French institutions, is planning to establish an institute of marine sciences.

CAPE VERDEBackground information

The Republic of Cape Verde is composed of an archipelago comprising ten islands - St. Antao, St. Vicente, St. Lucia, St. Nicolau, Sal, Boa Vista, Maio, St. Tiago, Fogo and Biava. Fisheries form the mainstay of the economy, accounting for 60-62% of its export earnings.

Area: 4033 km<sup>2</sup>

Coastline: 2000 km

Population: 0.31

Training and Research in marine sciences

There is a great shortage of trained manpower and there are no training or research institutions in marine sciences. However, some oceanographic studies are being carried out by scientists from the German Democratic Republic.

GAMBIABackground information

The Republic of Gambia is a small country with a relatively small population, whose economy depends mainly on tourism.

Area: 11,300 km<sup>2</sup>

Coastline: 80 km.

Population: 0.55

Training and Research in marine sciences

There are no institutions of higher learning or professional training in marine sciences and the country depends for most of its middle and high level manpower training on overseas institutions or those of neighbouring countries. The very limited research activities in aquatic sciences are centred in the Department of Fisheries of the Ministry of Agriculture and Natural Resources and these are mainly oriented towards the development of freshwater and brackish water fisheries in the Gambia river.

GHANABackground information

The Republic of Ghana is one of the most progressive countries in tropical Africa, and concerning the availability of basic infrastructural facilities and professional scientific and technological manpower the country is better placed than many other African coastal states. There are good training institutions in marine sciences in the country and many professional scientists especially in the field of aquatic biology. However, the state of the economy of the country, which has been steadily deteriorating in the past several years has been a great constraint and is tending to lead to stagnation in the development of marine science and technology. This has been caused by such factors as lack of

foreign exchange for the importation of spare parts and new equipment, and the decline of interest and enthusiasm among national scientists, many of whom have left the country in search of better conditions of work elsewhere. This kind of brain drain is one of the most serious problems facing Ghana and many other African countries today, and it is a problem for which a quick solution is difficult to find.

Area: 235,500 km<sup>2</sup>  
Coastline: 600 km.  
Population: 10.48

#### Training in marine sciences

The training of marine scientists in Ghana takes place at the Universities of Ghana and Cape Coast. Although the plans to establish an institute of marine science and oceanography at the University of Ghana have not materialized, the University has been offering postgraduate studies in Aquatic Biology since 1974, and scientists with this kind of background can easily orientate towards marine biological research. However, there are no university programmes as yet in the areas of physical oceanography, chemical oceanography or marine geology and consequently, there is a shortage of scientists with these specializations in the country. This would not seem to be a big problem, however, as appropriate postgraduate programmes in these subjects could easily be introduced in one or other of the country universities. The question is simply one of giving priority to these areas of marine science by the Government and University authorities.

#### Research in marine sciences

The principal institution engaged in marine science research in Ghana today is the Research and Utilization Branch (RUB) of the Fishery Department, Ministry of Agriculture. The research is therefore

mostly fishery-oriented, although there have also been some observations in the past in physical and chemical oceanography and marine geology. RUB has good laboratory facilities at the port of Tema and owns a modern, well-equipped research vessel - R.V. Kakadiama (180 tons, 29.2m) and two smaller vessels. The research section of RUB has a staff of 32 including six scientists and four senior technical officers. Current research programmes are in the areas of biological oceanography, hydrography, planktonology, stock assessment, fishery statistics and population dynamics.

The Institute of the Aquatic Biology under the Council for Scientific and Industrial Research is mainly concerned with research in limnology but also carries out some marine science-oriented research.

There has also been some studies, sponsored by UNEP on marine pollution and coastal erosion.

## GUINEA

### Background information

The Republic of Guinea is a country rich in agricultural and mineral resources. After severing its close relationship with France as an "overseas territory" in 1958, the country went through a difficult period of reconstruction and it was only during the past few years that the country began to take an active interest in the development of science and technology as a basis for the development of its marine resources, which are still little understood.

Area: 245,857 km<sup>2</sup>

Coastline: 300 km

Population: 4.65

Area: 36,125 km<sup>2</sup>  
Coastline: 250 km  
Population: 0.54

#### Training in marine sciences

There are as yet no institutions for advanced training or research in marine sciences and professional scientists and technologists are at present being trained abroad (Brazil, Portugal, USA, Cape Verde). The country is planning to establish some training and research institutions of its own.

#### Research in marine sciences

Some oceanographic observations and fishery surveys and stock assessment have been made by foreign research vessels and by the "Centre de Recherches Océanographiques de Dakar Tiaroye" in Senegal. These studies have revealed the existence of very rich fishery resources in the inshore and the extensive continental shelf, which are due to a combination of several favourable physical characteristics of the oceanic waters of the country, including upwelling and convergence of ocean currents with different physical properties.

### IVORY COAST

#### Background information

The economy of the Republic of Ivory Coast is based on agriculture, timber and recently on offshore oil. There has not in the past been much emphasis on the development of the living marine resources of the country. Because of the close relationship existing between the Ivory Coast and France there is close collaboration between the two countries in matters concerning scientific research and training.

Area: 322,463 km<sup>2</sup>  
Coastline: 550 km  
Population: 5.15

#### Training in marine sciences

There are no specialized courses in marine sciences offered at the National University of the Ivory Coast and students wanting to specialize in marine science subjects are sent to foreign universities and other institutions, mostly in France. However, the Faculty of Science offers a course in Hydrobiology as part of the programme in Tropical Ecology whose main emphasis is Freshwater Biology.

#### Research in marine sciences

The Government of Ivory Coast attaches high priority to the development of science and technology as a basis for economic advancement and has set up an elaborate administrative machinery for the direction, execution and coordination of scientific research. There is a Ministry of Scientific Research with several research institutions under it:

The most important institution concerned with marine science research is the "Centre de Recherches Océanographiques (CRO)" which was founded in 1959. The Centre is administered and managed through a cooperative arrangement with the French organization - "Office de la Recherche Scientifique d'Outre Mer (ORSTOM)" which specializes in the development of scientific and technological research in developing countries. The French Government contributes in the financing of the research activities of the Centre and most of the senior scientists at present are French nationals. However, there is a concerted effort to train Ivory Coast scientists and the present scientific staff includes seven qualified or training indigenous scientists. The present research programmes of the Centre are biased towards fisheries development, but there is also some work being carried out in physical

and biological oceanography. Besides carrying out research, CRO also participates in the training of local marine scientists by taking on postgraduate students from the national or overseas universities for the field work part of their research projects.

The "Institut d'Ecologie Tropicale" (Institute of Tropical Ecology) in collaboration with the Faculty of Science of the University, carries out some limnological research.

There is also an Institute of Maritime Documentation, Research and Studies under the Ministry of Marine Affairs.

## LIBERIA

### Background information

The economy of the Republic of Liberia is at present dependent on minerals (mainly iron ore), rubber and timber. The marine resources of the country are not well developed and not being fully exploited.

Area: 113,370 km<sup>2</sup>

Coastline: 550 km

Population: 1.80

### Training and Research in marine sciences

There is practically no activity going on at present concerning research and training in marine sciences. The Biology Department of the Falkner College of Science and Technology, University of Liberia, carried out some observations in the past on marine plankton and fishery biology, but owing to staff problems, even this modest effort has stopped. It would appear that there is a great need for cooperation between the University and government ministries and of a coordinating mechanism to ensure that university activities were in harmony with and relevant to the country's economic problems and in particular to its manpower needs.

In a recent reorganization of the Division of Fisheries, Ministry of Agriculture, a Research Institute which will be responsible for all research related to fisheries development, was to be created.

assessment of pelagic and demersal fisheries and marine pollution. It is hoped that future research programmes will include mariculture.

The Centre is facing several problems arising from the lack of a clear fishery policy, lack of equipment and shortage of suitably qualified local counterpart scientists.

## MOROCCO

### Background information

Morocco is bordered by the Mediterranean in the north and the Atlantic in the west. The country has rich fishery resources in its Atlantic Ocean waters, which are not being fully exploited at present. There has been an interest in marine science research for several decades and several research institutions were established and staffed by French scientists during the French colonial government. However, in recent years, with the departure of most of the French scientists, the country has been experiencing an acute shortage of trained scientific manpower which has resulted in a serious decline in scientific activities in all areas.

Area: 567,600 km<sup>2</sup>

Coastline: 1,800 km

Population: 18.24

### Training in marine sciences

At present training in marine sciences is limited and takes place at the Mohamed V (formerly Rabat) University. The Department of Earth Sciences of the University, in collaboration with the University of Bordeaux I in France, offers courses in sedimentology, geochemistry and physical oceanography. However, there are no courses being offered by the University in marine or fishery biology, which would seem to explain the great shortage of qualified scientists in these areas.

## Research in marine sciences

Research in marine sciences is centred at the Mohamed V University and in a few government ministries :

The Department of Earth Sciences of the University and the Department of Geology of the Ministry of Energy and Mines carry out research on the geology and geochemistry of the continental shelf; an inventory of the results of this research including detailed bathymetric charts are being prepared. The Department of Earth Sciences of the University, in collaboration with the University of Bordeaux I, is also carrying out studies in the geochemistry and sedimentology of the coastal estuarine zone.

The Sherifien Scientific Institute of the University carries out some research in marine biology and ecology.

The "Institut de Peches Maritimes" (Institute of Marine Fisheries) of the Department of Merchant Marine, Ministry of Commerce and Industry, in Casablanca, has good facilities for marine research in biochemistry, pollution and fish processing.

There is also a well planned UNDP/FAO project on stock assessment and resource management which is provided with seven experts, a well equipped research vessel and a computer.

## NIGERIA

### Background information

Many African countries are in a dilemma, created by the vicious circle of poverty, leading to limited ability to develop and exploit their natural resources, leading to stagnation of their economies, leading to poverty. Nigeria is fortunate to have come out of this vicious circle, and, in recent years, the country has been making a great effort in the promotion of science and technology for its economic development. The new-found wealth in oil has provided both the stimulus and the material support for this effort. However, the energy and enthusiasm have come so suddenly,

- The African Regional Centre for Aquaculture at Calabar has an intake capacity of 40, was opened in June 1980 and offers a one-year Diploma course in Aquaculture to marine scientists who would, after qualifying, go back to their countries and organize teaching and research projects in aquaculture. The Centre also carries out research and field work to support its training programmes.

Several universities in Nigeria have also, during the last few years, established research and teaching programmes in marine sciences:

- The University of Lagos offers a course in marine biology and fisheries as a component of the B.Sc. Biology programme.

The University (Department of Biological Sciences) has also established a Marine Research Unit, which is well equipped, but whose facilities are not being fully utilized due to a shortage of qualified staff. There are facilities for M.Sc. and Ph.D. studies by research.

- The University of Calabar offers a course in fishery biology as a component of the B.Sc. Zoology programme. It was also intended to introduce a full B.Sc. programme in Marine Biology and to create a Department of Marine Sciences in 1981. There is a plan to establish an Institute of Marine Sciences eventually.

- The University of Port Harcourt runs an M.Sc. programme in Hydrobiology and Fisheries.

It has also been reported that the universities of Ibadan and Ife offer M.Sc. programmes in marine biology. In addition, the University of Ife conducts and coordinates research on pollution problems in the country.

## SENEGAL

### Background information

The economy of the Republic of Senegal is based on agriculture (mainly groundnuts), industry and fisheries. The country derives much of its protein requirement and a considerable portion of its export earnings from its fish

resources and in its economic development policy, considerable emphasis has been given to the development and exploitation of the country's marine resources.

Area: 196,192 km<sup>2</sup>

Coastline: 500 km

Population: 5.09 (1976)

#### Training in marine sciences

The University of Dakar does not at present offer full-scale degree studies in marine sciences, but a few marine-oriented courses are offered as parts of major programmes in some departments, e.g. courses in coastal geomorphology and hydrology are offered to geography students and in marine ecology and marine invertebrate and vertebrate systematics to zoology students. Graduate students wanting to specialize in marine sciences have to go abroad.

#### Research in marine sciences

The principal institution responsible for marine science research is the "Centre de Recherches Océanographiques de Dakar-Tiaroye" (CRODT). The Centre is under the Secretariat of Scientific and Technological Research and its research programmes are mostly oriented towards the development and exploitation of marine fisheries. The scientific staff of the Centre consists of 14 expatriate scientists (mostly French) and 11 qualified or training Senegalese scientists. The Centre has fairly well equipped laboratories and two small boats; there is also an FAO research vessel on loan to the Centre. Most of the staff scientists are marine biologists and the main research programmes at present are stock assessment and management and fishery biology. Future research programmes would include pollution studies of the coastal environment.

The Departments of Geography and Zoology of the University of Dakar also carry out research in coastal geomorphology and remote sensing, and pollution respectively. There does not seem to be much cooperation or coordination of activities between the University and CRODT.

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The Department of Marine Biology of the "Institute Fondamental d'Afrique Noire (IFAN)" has in the past conducted some marine biological research, but the shortage of qualified scientists has seriously affected its research activities.

## SIERRA LEONE

### Background information

The Republic of Sierra Leone is a country rich in agricultural, mineral and fishery resources. It has a larger tradition of marine science and technology development than most of the other West African coastal states. The British colonial government established the West African Fisheries Research Institute (WAFRI) in 1952 to serve the fishery interests of its former colonies of Sierra Leone, Gambia, the Gold Coast (Ghana) and Nigeria. Through a series of transformations WAFRI eventually gave rise to the Institute of Marine Biology and Oceanography (IMBO) of the Fourah Bay College, University of Sierra Leone in 1967. Since then, the country has maintained its lead among the West African coastal states in having well conceived training and research programmes in marine science and technology. With the recent development of the University of Sierra Leone, these programmes have been diversified in scope and strengthened in depth.

<u>Area:</u>	71,740 km <sup>2</sup>
<u>Coastline:</u>	400 km
<u>Population:</u>	3.47

### Training and Research in marine sciences

Practically all activities concerned with research and training in marine sciences in the country are centred at the University of Sierra Leone with IMBO as the focal point. Apart from research in marine sciences, IMBO also conducts freshwater (limnological) research, a diversification which deserves commendation as it is a good example of economical use of manpower. The main research programmes being carried out by the Institute at present are in fishery biology and ecology, fishery resources survey, algology and limnology. Future research programmes include biological and chemical

oceanography, stock assessment and population dynamics of economic species, marine pollution, egg and larval ecology, aquaculture and biology and ecology of mangroves.

In its training activities, the Institute contributes the oceanography component of the B.Sc. programme in Zoology and Oceanography in the Faculty of Science of the University and offers a diploma course in Aquatic Biology and Fisheries. As a result of good working arrangements between IMBO and the Faculties of Science and Engineering of the University, many students in these faculties now graduate having taken appropriate courses in marine sciences which would make them more versatile, and sometimes more competent, in their future work, e.g. in matters concerning coastal area development and construction. Some members of the Faculty of Engineering and the Department of Geology also carry out some research projects in such marine science-related problems as coastal erosion, siltation and sediment transport.

The Institute (IMBO) at present has a staff of 11 including five scientists and six technical and administrative staff. The main constraints being experienced by the Institute are shortage of staff and of working space. The Institute could also do with a good research boat, but it has access to the boats of the Fishery Division of the Ministry of Natural Resources.

## SAO TOME AND PRINCIPE

### Background information

The Democratic Republic of Sao Tome and Principe comprises the two islands of Sao Tome and Principe. It is located about 300 km from the coast of Gabon and the two islands are separated by a distance of 150 km.

Area: 854 km<sup>2</sup>  
Coastline: 260 km.  
Population: 0.08

### Training and Research in marine sciences

There are at present no activities in marine science training or research in the country.

### TOGO

#### Background information

The Republic of Togo is a small country with a relatively large population. Its economy is at present based on agriculture and mineral (mainly phosphates) resources.

Area: 56,000 km<sup>2</sup>  
Coastline: 50 km  
Population: 2.35

### Training and Research in marine sciences

There are at present no institutions concerned with research or training in marine sciences in the country, but an oceanographic laboratory is under construction at Agbodrafo.

### ZAIRE

#### Background information

The Republic of Zaire is a large country with a great variety of resources including mineral, agricultural and forestry. The country has a very short coastline, and except for offshore oil, not much importance is attached to other marine resources.

Area: 2,345,000 km<sup>2</sup>  
Coastline: 50 km.  
Population: 26.38

## DJIBOUTI

### Main activities of interest

Fisheries development: There is a Department of Farming and Sea Fisheries (Ministry of Agriculture). The artisanal fishery is being developed by motorising the simple fishing crafts. A \$500,000 USAID funded project for the establishment of an industrial fishery is under consideration. It will involve construction of fibreglass boats, supply of fishing vessels and outboard motors, provision of maintenance service and canning, refrigeration and drying facilities, together with vehicles for fish distribution. There are no institutions for research or training in fisheries and there is a great shortage of manpower at all levels.

### Harbour facilities

There is a harbour at Djibouti which also serves Ethiopia.

## ETHIOPIA

### Main activities of interest

Marine resources development and exploitation: There is a Ministry of State Farms which is responsible for industrial fishery development and a Department of Fisheries (Ministry of Agriculture) which is responsible for the development of the artisanal fishery. Both these fisheries are in a state of re-organisation. At present there are no fishery training schools and qualified personnel is in short supply. Other marine resources being exploited are sea salt, shells and corals.

Conservation: There are plans to establish a marine national park at the Dalakh Archipelago.

Pollution: Ethiopia participates in the ALECSO/UNEP Programme for Environmental Studies of the Red Sea and Gulf of Aden.

.../...

Marine Transport and Harbour Development: There is a national Maritime Transport and Harbour Authority (Ministry of Transport and Communications) and a National Shipping Corporation responsible for regulating maritime transport and for running and managing the national merchant marine fleet respectively. It is intended to establish a marine training institute. There are plans to modernise and expand the two harbours of Assab and Massawa.

Boat Building and Servicing: There is a small shipyard at Massawa which is to be expanded.

## KENYA

### Main activities of interest

Fisheries development and exploitation: There was not much emphasis on marine fisheries in the past but steps are being taken to develop both the artisanal and industrial fisheries. An Institute of Wildlife and Fisheries Training is under construction. There is an FAO aquaculture project at Malindi.

Conservation and Tourism: There is a Department of Wildlife Conservation and Management under the Ministry of Environment and Natural Resources. Three marine national parks and three marine reserves have been established near Malindi. Tourism is well developed both inland and on the coast.

Boat building and repair services: There is a large shipyard at Mombasa with good dry dock facilities, capable of building large inboard engine boats and of repairing large ocean-going vessels. It is one of the best dry dock facilities in Eastern Africa.

Harbour development: Mombasa is one of the best natural harbours in Eastern Africa. There are plans to build another harbour at Lamu in the north and to expand the Mombasa harbour. It is also intended to establish several small harbours for fish landing.

Pollution: There is an Anti Marine Pollution Committee one of whose functions is to monitor pollution around the Mombasa harbour.

## MOZAMBIQUE

### Main activities of interest

Marine resources development and exploitation: The artisanal fishery is not well developed but the industrial fishery is moderately developed with several fishing companies. The only other marine resource being exploited at present is salt.

Maritime training: There is a maritime training school at Majunga for commercial and fishing deck officers and marine engineers.

Boat building and repair facilities: There is a large shipyard at Diego Suarez with good dry dock facilities. It has the capacity to build large inboard engine boats and to repair large ocean-going vessels. It is one of the largest dry dock shipyards in Eastern Africa.

Harbour development: The two important harbours in the country are Tamatave (the largest) and Majunga, both of which are experiencing severe congestion. There are plans to enlarge the harbour at Tamatave and to resite the one at Majunga due to serious siltation problems.

Cartography and hydrography: There is a National Institute of Geodesy and Cartography one of whose functions is to deal with the questions of cartography and hydrography of the inshore area of the country.

## MAURITIUS

### Main areas of interest

Marine resources development and exploitation: Both artisanal and industrial fisheries are moderately developed and there is a mariculture project. There are plans to exploit the marine algae resources of the country.

## SEYCHELLES

### Main activities of interest

Fisheries development and exploitation: The artisanal fishery is not well developed, and the tuna industrial fishery is being reorganised.

Training of technicians: There is a Fishery Training School which is being reorganised to train fishermen, sailors and motor mechanics.

Harbour development and coastal area management: The main port of Victoria is being expanded by land reclamation and there are also plans to expand and improve the Mahe harbour.

Marine parks, conservation and tourism: There are five marine national parks around and including five islands, established for the purpose of tourism and conservation. The sea turtle is one of the animals being protected.

## SOMALIA

### Main activities of interest

Marine resources development and exploitation: The artisanal and industrial fisheries are not very well developed. There is some exploitation of sea salt.

Training of marine technicians: Training of marine technicians takes place abroad, mainly in the USSR.

Harbour development: The three main ports of the country are Mogdisho and Kismayu, on the Indian Ocean coast, and Berbera, on the Red Sea coast.

Boat building: There is a fibre glass boat construction project being run with technical assistance from Sweden.

Conservation: The Dugong is protected by law.

## SUDAN

### Main activities of interest

Marine resources development and exploitation: The marine fishery resources are not well developed but there are projects aimed at an improvement. There is a joint project with Saudi Arabia on the exploitation of heavy mineral deposits at the bottom of the Red Sea.

Marine parks: There are plans to establish national marine parks.

Boat building: There is a small boat yard at Port Sudan for building small and medium-size boats.

Marine pollution: There is a multidepartmental marine pollution monitoring programme.

Harbour development: Port Sudan is the country's only sea port at present but a new port scheduled for completion in 1985 is being built at Suakin, south of Port Sudan.

## TANZANIA

### Main activities of interest

Marine resources development and exploitation: Both the artisanal and industrial fisheries are moderately developed. There is some small scale exploitation of sea salt and sea weeds (algae).

Training of technicians: The Division of Fisheries, Ministry of Natural Resources and Tourism, runs two training institutes, one for a general diploma in fisheries and the other for specialised technical training.

Harbour development: Dar es Salaam is the main harbour of the country but there are medium harbours at Mtwara, Tanga and Zanzibar and small harbours at Pangani, Bagamayo, Kilwa, Lindi, Mafya and Pemba. There are plans to enlarge the Dar es Salaam harbour and to improve the other harbours.

Boat building and repair facilities: The Mbegani Fisheries Development Centre has facilities for the construction of medium-sized wooden boats with inboard engines. There are also boat yards at Pangani, Lindi, Mtwara and Mwanza on Lake Victoria. There are plans to construct a large dry dock shipyard at Dar es Salaam.

Marine pollution and coastal area degradation: A law prohibiting marine pollution was enacted in 1970 and there are plans to establish an oil disaster centre to cope with oil spills outside the Dar es Salaam harbour. There is a serious coastal erosion problem along the coast of Dar es Salaam.

Conservation and tourism: Three marine conservation areas have been established to protect the coral reefs around the near-shore islands off Dar es Salaam, the sea turtles around Maziwi Island off Pangani and the dugong in the Rufiji Delta and Mafya Channel. Tourism is a well developed and important industry both on the coast and inland.

Harbour development: A Hydrographic Commission has been created to coordinate all activities concerned with the extension of the Cotonou port.

## CAMEROON

There is a great shortage of manpower and the marine resources of the country are not well developed. The fishery resources are making an insignificant contribution to the economy of the country.

## CAPE VERDE

### Main activities of interest

Fisheries development and exploitation: Both artisanal and industrial fisheries are well developed and fishery resources contribute 60-62% of the country's export earnings. There are freezing facilities at Mindelo and an old canning factory at Paria. Further development of the fishery industry is hampered by the lack of qualified personnel.

Training of technicians: There is a Nautical School at Mindelo for training mechanics and electricians, which also caters for Guinea-Bissau.

Harbour facilities: Mindelo is a major fishing port.

## CONGO

### Main activities of interest

Marine resources development and exploitation: The exploitation of marine fisheries is carried out by foreign fishing companies under

## GABON

### Main activities of interest

Marine resources development and exploitation: The artisanal fishery is mostly being run by outsiders with little participation of the local people. There is an industrial fishery with modern fishing vessels exploiting the rich fishery resources of the country but there is much room for improvement. There is off-shore exploitation of oil and marine pollution is a serious problem.

## GAMBIA

### Main activities of interest

Marine resources development and exploitation: The artisanal and industrial fisheries are fairly well developed and there is an elaborate administrative machinery for their running and their further development, but they are mostly run by foreigners. There seems to be a conflict between foreign and national interests in the exploitation of the resources. There is a shortage of qualified manpower compounded by the fact that fishing as an occupation is not popular among Gambians. There are plans to exploit several mineral resources from the continental shelf.

Training of technical personnel: This takes place overseas or in neighbouring countries e.g. at the Ghana Nautical College; occasionally, it is done on the job.

Boat building: There is a small dockyard under the Gambia Port Authority equipped to service small ocean-going vessels and to build small trawlers, river barges and ferries.

Harbour development: There are plans to build a second port at Banjul.

Coastal area management: The Public Works Department of the Ministry of Works and Communication is responsible for the control of coastal area erosion.

Tourism: Tourism is well developed along the Atlantic coast of the country and up the Gambia river in the way of good hotel facilities, water sports and river transport.

Marine Pollution: There is regular monitoring of oil pollution in the port area.

Meteorology, hydrography, topography and cartography: These activities are carried out by the Water Resources Department of the Ministry of Agriculture and Natural Resources.

## GHANA

### Main activities of interest

Marine resources development and exploitation: Both the artisanal and industrial fisheries are well developed. There is an all round infrastructure for the efficient exploitation of the marine fishery resources of the country in the way of efficient and experienced fishermen, good fishing boats including factory ships and gear, large and efficient local fishing companies, a good fishing port (Tema), off-shore facilities for fish-handling and processing; practically all these activities are run by Ghanaians themselves and almost all the infrastructures are owned and managed by Ghanaians.

Training of high level technical personnel: The Ghana Nautical College provides practically all the training required at this level.

Training of middle level technical personnel: There are no formal fishery or maritime schools for middle level personnel, but the Fisheries Department (Ministry of Agriculture) organizes vocational courses for all the personnel required in this cadre.

Boat building: There are several boat building companies with boat yards of all grades. There is a large well equipped dry dock at Tema, capable of handling large ocean-going vessels and claimed to be the best in West Africa.

Harbour development: The main harbour of Tema can handle and service large ocean-going vessels. A deep-sea fishing harbour is to be constructed at Elmina and a smaller fishing port for the artisanal fishery at Mumford.

Pollution and environmental protection: There is an Environmental Protection Council which is responsible for environmental protection including pollution and coastal area erosion control.

## GUINEA

### Main activities of interest

Marine resources development and exploitation: Both the artisanal and industrial fisheries are being reorganised to improve their efficiency and to co-ordinate their activities, and there are plans to build several fish-landing harbours along the coast. The Guinea Hydrocarbon Society is carrying out off-shore exploration of oil.

Harbour development: Conakry is the main harbour of the country and there are plans to expand it. Port Kamsar is a small harbour for the mining industry.

Boat building: There are small boat yards capable of repairing small boats and two floating docks in the Conakry harbour are at present carrying out dredging work.

Pollution: There is an Agency responsible for the monitoring and control of pollution arising mainly from sewage and the aluminium industry.

Training of technical personnel: The Secondary Marine Polytechnic and the Centre for Oceanographic and Fisheries Research are responsible for the training of technical staff at this level.

## GUINEA BISSAU

### Main activities of interest

Marine resources development and exploitation: The rich marine resources of the country are not being fully exploited at present, but their development is one of Government's priorities in its economic reconstruction effort. For the industrial fisheries, there are three companies operating in fish processing and a modern freezing plant is under construction. There is a Secretariat of Fisheries under the Prime Minister's Office which is reorganizing the fishery industry with assistance from Brazil.

Training of technical personnel: The School of Navigation in Cape Verde offers training places to trainees from Guinea Bissau and there are annual fellowships from Portugal for middle level training. A mechanical engineering school is to be established in the country.

Harbour development: The harbour in Bissau is small and can handle only one ship at a time.

## IVORY COAST

### Main activities of interest

Marine resources development and exploitation: The fishery resources of the country are not fully exploited and both the artisanal and industrial fisheries are underdeveloped. However, the Government has now set up an elaborate administrative machinery for the development of both fisheries. There is a Directory of Marine and Lagoon Fisheries which is responsible for fishery statistics, fish handling, fishing technology, improvement of fishing boats and fishing gear, aquaculture and fishermen cooperatives. There are agreements for fishery exploitation with Senegal, Guinea, Spain, France, Korea and Japan. There is off-shore exploration and exploitation of oil.

Training of technical staff: There are at present no training institutions for higher level technicians and technologists, but there are proposals for the establishment of a Regional Academy of Marine Sciences and Technology in Abidjan to serve all the French-speaking West African countries.

Marine pollution: The Directorate of Hydrocarbons is responsible for the protection of the off-shore oil fields and of the environment generally. A National Commission for the Environment was formed recently to take over some of the functions of the Directory of Hydrocarbons, including oil pollution.

Harbour development and marine transport: The port of Abidjan is one of the busiest and most efficient in West Africa and there are plans for its further modernisation and expansion. The country has two modern and competent shipping companies - The state-owned

"Société Ivoirienne de Transports Maritimes"(SITRAM) and the privately owned "Société Ivoirienne de Navigation Maritime" (SIIM). These two companies handle about 40% of the country's shipping business, in accordance with the code of conduct stipulated by the United Nations Conference on Trade and Development (UNCTAD), to the effect that 40% of shipping should be carried by the country of origin.

## LIBERIA

### Main activities of interest

Marine fisheries development and exploitation: The artisanal fishery is not well developed and the industrial fishery is only moderately developed. However, steps have been taken to improve the situation, including the establishment of a Division of Marine Fisheries of the Central Agricultural Research Institute (CARI). There are plans for joint fishing ventures with the USSR and for an acoustic fisheries survey of the EEZ area through assistance from the French Government.

Training of technical personnel: There is no organized training of this cadre at present, but the proposed "Manu River Union Marine Training Institute" to be established in 1981 as a cooperative venture between Liberia and Sierra Leone, is expected to fill this gap.

Harbour development: Monrovia is the main port of the country and there are plans to modernize and expand it. The other ports - Greenville, Harper and Buchanan are also to be improved.

Boatyard facilities: The Masurado Fishing Company owns a small boatyard for servicing small boats.

Maritime Transport: There is a Maritime Affairs Commission which is responsible for regulating all maritime affairs including maritime transport. Many shipping lines in the world use the Liberian "flag of convenience" by special agreement with the Liberian Government.

Pollution and coastal area degradation: There is some pollution arising from the iron ore industry and coastal erosion is a serious problem.

## MAURITANIA

### Main activities of interest

Marine resources development and exploitation: The fishery resources of the country are very much underdeveloped at present. An on-going FAO project aimed at improving the artisanal fishery has run into several difficulties and after six years of operation has not met with much success. A Japanese-assisted project has also not been very successful. There is off-shore exploration of oil.

Training of technical personnel: The Mamadou Toure Centre at Nouadhibou runs vocational training courses in several technical subjects including diesel mechanics, fishing, refrigeration, electrical work etc. But this is not enough, and there is a great shortage of manpower at all levels.

## MOROCCO

### Main activities of interest

Marine resources development and exploitation: The fishery resources of the country are only moderately developed, but the Government is making a great effort to improve the situation through manpower training and research. There is an Institute of Marine

Fisheries which is responsible for stock assessment and management. There is a seaweed industry based on the collection and processing of seaweeds into agar-agar.

Training of technicians: This training is carried out by the Institute of Marine Fisheries and the Ministry of Agriculture.

Boat building: There are small boat yards at Casablanca, Agadir and Saefi.

Harbour development: There is an on-going project of constructing ports at every 200 km of coastline.

## NIGERIA

### Main activities of interest

Marine resources development and exploitation: The Government is making great efforts to develop and modernize the fishing industry. The artisanal fishery is to be greatly expanded through the training of higher and middle level technical personnel, the strengthening of fishery research, the development of fishery cooperatives and the provision of on-shore facilities for fish landing, fish handling and fish processing. Nigerian participation in industrial fisheries exploitation (at present largely in the hands of foreign companies) is to be increased through the encouragement of local private fishing companies and formation of state fishing enterprises. The establishment of aquaculture in the lagoon zone is also being given prominence. Oil exploration and exploitation already form a big thriving industry.

Training of technical personnel: The training programmes of the Federal Marine Training School, the existing state fishery schools and the Nigerian Nautical college are to be expanded and their trainee

potential. The artisanal fishery uses mostly primitive fishing methods and the industrial fishery consists of three boats, using hook and line. There was a plan for an FAO-assisted project in 1975, aimed at an overall improvement of the artisanal and industrial fisheries, including the establishment of a tuna fishing fleet and a tuna harbour.

## SENEGAL

### Main activities of interest

Marine resources development and exploitation: Both artisanal and industrial fisheries are well developed and the rich fishery resources are making a considerable contribution to the economy of the country. There is good fishing capability among the local fishermen and the artisanal fishery which is entirely in the hands of the Senegalese, is very efficient and productive. The industrial fishery is also largely operated by Senegalese whose fishing fleets go as far north as Mauritania and as far south as Angola.

Training of technical personnel: The Nautical Maritime School (E.N.F.M.) and the Technical School for Oceanography and Marine Fisheries (E.A.T.O.P.M.) train all the middle level technicians required for the fisheries and other maritime activities of the nation, but high level technologists have to be trained overseas or in neighbouring countries. It is hoped that the latter category of personnel will in future be trained at the proposed Regional Marine Science and Technology Academy to be established in Abidjan, Ivory Coast.

Harbour development: Dakar is the main harbour of the country. A fishing port is to be established at St. Louis on the mouth of the river Senegal, and two new ports are to be constructed at Saloum and Casamance, south of Dakar.

Boat building and repair facilities: A major super-tanker dockyard is being built in Dakar.

Conservation and tourism: Senegal has established three marine parks at "Lagune de Barbarie", "Ile de la Madeleine" and "Parc du Delta de Saloumi". These marine parks are an additional attraction for the long established tourist industry.

Pollution: There is a Department of the Environment whose functions are purely legislative.

SIERRA LEONE

Main activities of interest

Marine resources development and exploitation: The artisanal fishery is well developed, well organized and well staffed, with qualified national manpower. There are plans to further develop the artisanal fishery through the improved training of fishermen and other marine technical staff at all levels, the provision of more modern fish-landing harbours, development and provision of modern fishing boats and fishing gear and better organization of fishing cooperatives. The industrial fishery which is also well developed is to be further improved through the training of local manpower at all levels, and through the provision of on-shore facilities such as fishing harbours, cold storage and fish handling and processing facilities. Off-shore oil exploration is to start soon.

Training of technical personnel: Until recently, there were no specialized institutions for the training of such cadres, but there were ad hoc vocational courses given by the Division of Fisheries, Ministry of Natural Resources, the University of Sierra Leone and

the Sierra Leone Ports Authority and through on-the-job training by the fishing companies. Recently (September 1980), the Sierra Fishing Company, with technical assistance from the USSR, established the Siaka Stevens Marine Training School in Freetown for the training of low-middle level marine technicians. It is hoped that this school, together with the proposed Manu River Union Nautical School in Monrovia and the proposed regionalization of the Ghana Nautical College, will provide all the technical manpower required at all levels.

Harbours development: The main harbour in Freetown is capable of handling large ocean-going vessels including container ships, and there are plans to construct several modern fishing harbours.

Boat building and servicing facilities: Existing boat yards are to be improved so as to have the capability of building medium-sized boats and two dockyards are to be constructed with slipways capable of handling small ocean-going vessels. There are long-term plans for further improvement and modernization of harbours and other on-shore facilities.

Tourism: The tourist industry is well established with several first class modern hotels along the fine beaches in Freetown.

Coastal area degradation: Coastal area erosion is becoming a serious problem in many places along the coast and there are also problems caused by siltation and by sediment transport and deposition.

## TOGO

### Main activities of interest

Marine resources development and exploitation: The fishery industry is underdeveloped and there is a great shortage of manpower at all levels. There are no training institutions for technical personnel. There is a

Department of Planning and Fisheries Protection under the Ministry of Rural Planning, and a Division of Marine Fisheries under the Ministry of Rural Development, both of which are responsible for the development and administration of the country's fishery resources.

Environmental protection and marine pollution: Coastal area erosion is a serious problem and there is some pollution in the Lome harbour arising from domestic sewage, oil spills and the phosphate industry.

### ZAIRE

Owing to its very short coastline and the abundance of its other resources - minerals and agricultural products, Zaire does not have much interest in marine resources, with the exception of off-shore oil exploration and exploitation. There is, however, a Belgian-owned fishing fleet whose operations are centered mainly on the rich fisheries of Angola.

### 3. SUMMARY

Generally speaking, it would be true to say that the present level of marine science and technology development in practically all African coastal states is low, and far from being adequate in providing a sound and sustainable base for the rational exploitation of the marine resources of these countries. This statement is particularly true when consideration is taken of the full implication of the Third UN Conference on the Law of the Sea, especially as it relates to the sizes of the "exclusive economic zones" of coastal states, and the rights and obligations of these states in the management and exploitation of their marine resources and in safeguarding international interests in the sea areas under their national jurisdiction. The situation, however, differs from country to country, some of these states being in a better position than others, both in regard to the actual state of marine science and technology development and to the awareness of the governments of these countries as to the crucial importance of marine science and technology in economic development generally, and in the development of marine resources in particular. In attempting to make some comparison between the different African coastal states as regards their present levels of marine science and technology development, these countries could be divided into three broad categories:

3.1

Countries in which there are already good infrastructures for marine science and technology development, in the way of appropriate training and research institutions and other facilities, where the governments are well aware of the importance and crucial role of marine science and technology in the development of their marine resources and where there are reasonable numbers of qualified and/or training national personnel:

✓  
✓  
✓  
Ghana, Kenya, Madagascar, Morocco, Nigeria,  
Sierra Leone, Sudan, Tanzania. ✓

- 3.2 Countries in which there are moderate infrastructures for marine science and technology development, in the way of appropriate training and research institutions and other facilities, where the governments are fully aware of the importance and crucial role of marine science and technology in the development of their marine resources; and where there are some qualified and/or training national personnel :

✓  
✓  
Angola, Ethiopia, Guinea, Ivory Coast, Mauritius,  
Mozambique, Senegal, Seychelles, Somalia. ✓

- 3.3 Countries which for various reasons are at a low stage of marine science and technology development, where there are not as yet any substantial infrastructures for marine science and technology development, in the way of training and research institutions and other facilities, and where there are great shortages of trained manpower:

○  
Benin, Cameroon, Cape Verde, Comoro, Congo,  
Djibouti, Equatorial Guinea, Gabon, Gambia,  
Guinea-Bissau, Liberia, Sao Tome and Principe,  
Togo, Zaire. ✓

ANNEX I\*

## 3. GENERAL ACTIVITIES RELATED TO MARINE SCIENCE AND TECHNOLOGY DEVELOPMENT CARRIED OUT UNDER THE AUSPICES OF UNITED NATIONS ORGANIZATIONS AND OTHER AGENCIES

In the past, there have been several activities related to marine science and technology in most African coastal states and today there is hardly any such state without some form of that kind of activity going on. These activities have been and are being carried out under the auspices of the governments of the countries concerned and/or that of UN or other agencies. All these activities have contributed in one way or another to the development of marine science and technology in these countries and the achievements and experience gained are useful and must be taken into consideration in the working-out of this project, in order to obtain a realistic base and a proper perspective of the situation. Perhaps the most important short-coming of these activities is that most of them were conceived, planned and executed as separate projects with narrow and sometimes short-term objectives and with little or no co-ordination. Hardly any of them was conceived as an all-embracing comprehensive programme looking at the problem in its totality both as regards regional coverage and the inclusion of all aspects of marine sciences and technology. This was most probably due to the fact that most of these activities were planned and executed by single UN or other agencies acting on their own or at best in collaboration with a few bodies with similar interest in a comparatively narrow field.

This project has been planned with a view to overcoming these earlier shortcomings. Firstly, it is being executed by two UN agencies, both with very wide interdisciplinary interests, which have enlisted and invited the co-operation of other interested organizations; and, secondly, the project covers the whole of the African region (except the Mediterranean African countries) and is to consider all aspects of marine science and technology and their applications including fisheries, biological oceanography, chemical and physical oceanography, marine geology, food processing and preservation, economics and marketing, marine engineering, pollution, mariculture, coastal area development, training and research in marine science and technology, etc.

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\* This annex is a reproduction of Chapter 3 of a working document discussed at a Working Group Meeting convened by FAO and UNESCO in Addis Ababa, Ethiopia, 1971.

Another point which might be of advantage is that most of the key personnel involved in the execution of this project are people of experience who are indigenous to the region and therefore with a good understanding of the region and its needs.

In the following pages, the main past and present activities related to marine science and technology in African coastal states are summarized first on a regional basis and then in individual countries. This information was collected from reports of various UN organizations and agencies such as ECA, FAO, IMCO, IOC, UNDP, UNEP, Unesco, WMO and other organizations and from relevant correspondence in Unesco and ECA files. No claim is being made about the completeness of this information. In a quick search of this kind, some omissions and oversights are almost inevitable, but as this report is only aimed to serve as a general introduction and guide, this discrepancy is not a serious one. Moreover, some of the information will undoubtedly be found to be out-of-date, especially in relation to ongoing activities. It is hoped and expected that this information will be greatly improved upon and updated by the field missions.

### 3.1 United Nations Educational, Scientific and Cultural Organization (Unesco)

Unesco's marine science activities can be divided into two main categories: those of the Division of Marine Sciences (OCE) and those of the Intergovernmental Oceanographic Commission (IOC). During the sixties, Unesco's marine science programme continued to increase in scope, until it was decided in 1972 to divide the functions of the Office of Oceanography into the 'Secretariat of the IOC' and the 'Division of Marine Sciences'. The roles of the two units are complementary. The separation has been salutary in that each Secretariat has concentrated on its own mission, giving enhanced effectiveness to its programme actions. Simplistically, the separation of function is that the Division of Marine Sciences helps Member States to attain high quality marine science programmes and infrastructure so that they can participate in IOC-organized and co-ordinated scientific programmes, while meeting their other marine science needs as well. The Division of Marine Sciences

is an integral part of Unesco, and the Intergovernmental Oceanographic Commission (IOC) is an autonomous body 'established within Unesco', the membership of which (more than 100 Member States) differs somewhat from Unesco. The scientific programme of IOC is determined by its members through the IOC Assembly.

The programme of Unesco's Division of Marine Sciences is designed to respond to marine science needs of all Unesco Member States and especially to those of the developing countries. Unesco develops co-operation between scientists (and their governments) at three levels - globally, regionally and nationally - with the object of strengthening marine science at all three levels, which is done closely with the Intergovernmental Oceanographic Commission and other components of the UN system. Many of the activities are executed directly in association with IOC or in response to specific IOC recommendations. Similarly, Unesco works closely with the Scientific Committee on Oceanic Research (SCOR) of the International Council of Scientific Unions (ICSU). Finally, the Division works with certain other United Nations bodies (such as ECA, FAO, IAEA, IMCO, UN, UNEP and WMO).

The programme of the Division of Marine Sciences includes the following major components:

- (i) Dissemination of knowledge in the marine sciences, including publications and information services;
- (ii) Development of the scientific basis for the understanding and management of the marine environment and resources, especially coastal;
- (iii) Development of national and regional infrastructures in the marine sciences;
- (iv) Training and education of specialists in the marine sciences.

Those are the activities of immediate concern to the development of marine science in African member states through Unesco's regular programme or through large development projects carried out by extrabudgetary funds.

During the last decade, and particularly during the last few years, the marine sciences in Unesco have undergone a major evolutionary step in their development, which can be seen in two aspects of Unesco activities: (i) the extrabudgetary marine science development programme has grown rapidly to significant size, and (ii) research guidelines concerning a suite of relevant marine ecosystems have been developed to provide substance to national infrastructure development.

Unesco is working with Member States and SCOR to develop scientific programmes that are sound scientifically and are also relevant to a nation's development needs. Such programmes will allow a scientist both to contribute responsibly to his country's development and also to contribute to the advancement of science at the same time. An example is the mangrove programme being developed in Asia in order to provide a scientific basis for the more applied aspects, such as fisheries investigations and management of the mangrove environment. This mangrove programme already serves as the nucleus for regional co-operation and related projects are being established by nations on other continents. The national efforts are buttressed by international workshops, working groups and research projects, partly within the context of Unesco's Man and Biosphere Programme.

The increasing interest of the Member States in the coastal zones led to an evolution in the policies and programmes of the Division of Marine Sciences of Unesco, where emphasis on coastal research is gradually building up to the establishment of a major regional project on integrated management research of coastal marine ecosystems (COMAR). The inter-regional interdisciplinary research and training programme for the management of the coastal ecosystem will consist of a network of activities and pilot projects in different regions, including all sub-tropical sub-regions concerned in Africa, Asia and Oceania, the Mediterranean, Red Sea and adjacent Gulfs of the Indian Ocean and in Latin America and the Caribbean. Most of the work done in Unesco within the framework of this project was on coastal lagoons, mangroves and coral reef study. Among the activities carried out in Africa were two meetings, one on coastal lagoons on the north coast of Africa, 'Coastal ecosystems of the southern Mediterranean: lagoons, deltas and salt marshes', which took place in Tunis, 25-27 September 1978, and the other on 'Coastal ecosystems, with special reference to the coastal lagoons and estuaries on the West coast of Africa', which was convened in Dakar, 11-15 June 1979.

As a step towards the preparation of the Dakar Workshop, two Unesco consultants visited the coastal states of West Africa in 1978 in order to assess the needs of the region in coastal research. The findings of the Workshop were taken into consideration when formulating the UNEP Action Plan for West Africa (Libreville, Gabon, 5-9 November 1979). A project on coastal lagoons of West Africa is under preparation by Unesco and UNEP.

## References

Workshop on Coastal Ecosystems with Special Reference to Coastal Lagoons and Estuaries on the West Coast of Africa, Dakar, 11-15 June 1979, Unesco, MARINF/28.

Coastal ecosystems of the Southern Mediterranean: lagoons, deltas and salt marshes. Report of a meeting of experts, Tunis, 25-27 September 1978, Unesco reports in marine science 7, 25 pp.

### 3.2 Intergovernmental Oceanographic Commission (IOC)

According to its Statutes (revised 1970), the Intergovernmental Oceanographic Commission is "to promote scientific investigations with a view to learning more about the nature and resources of the oceans through concerted actions of its members". Of the presently 103 State Members of the Commission, 11 are from the West African region (Cameroon, Congo, Gabon, Ghana, Ivory Coast, Mauritania, Morocco, Nigeria, Senegal, Sierra Leone and Togo) and 6 from the East African region (Kenya, Madagascar, Mauritius, Seychelles, Somalia and Tanzania).

At the eleventh session of its Assembly (Paris, October/November 1979), the IOC established a Programme Group for Scientific Investigations in the North and Central Western Indian Ocean (IOC resolution XI-9). At the same session, the IOC Assembly decided in resolution XI-18 to arrange, in collaboration with the Division of Marine Sciences of Unesco, a Workshop on Marine Science Co-operation in order to provide the basis for a Marine Science Association for countries of the Atlantic coast of Africa. The proposed Workshop is scheduled for 1981.

The Commission's operational activities may be said to fall into the following categories: (i) Ocean Science, i.e., marine scientific research, (ii) Ocean Services, including transfer of knowledge and technology, and (iii) Training Education and Mutual Assistance in the marine sciences (TEMA).

Of particular interest for African countries are the Commission's activities in the field of ocean services, which include the promotion of exchange and archiving of oceanographic data from both national oceanographic efforts and from all marine programmes sponsored or supported by UN Specialized Agencies, and also the co-operation, with other UN bodies, in the development of information service related to marine science, including promotion and provision of guidelines for the development of regional co-operative networks for exchange of information.

### 3.3 Food and Agriculture Organization (FAO) of the United Nations

The Food and Agriculture Organization (FAO) of the United Nations has carried out and is carrying out several activities in many African coastal states. These activities have been mainly aimed at increasing and improving the capability of these countries in making fuller and more rational use of their fishery resources. These activities can be said in general terms to have been concerned with the development and improvement of various aspects of fishery technology - training of fishermen and fishery extension officers, fishing gear technology, fishing methods, fish surveys, boat building and repairs, navigation, marine engineering, fish processing and preservation, fish marketing, aquaculture (including mariculture), etc. FAO has also carried out, in co-operation with other UN organizations or agencies, activities related to the improvement of fisheries in African coastal states, e.g. the monitoring and control of marine pollution.

Actual on-going activities are too many to elaborate on here and it is hoped that the details of these activities in the regions and in individual countries will be obtained during the visits of the country missions through the co-operation of FAO country representatives and the relevant government authorities.

#### Some specific FAO activities in African coastal states

The United Nations Food and Agricultural Organization (FAO) has carried out and is carrying out several activities in many African coastal states whose main aim is the overall development and improvement of the fishery industry. These activities have taken various forms :

1. Training : The training of fishery personnel at all levels and in all aspects of the fishery industry has been and is one of the most important activities of FAO in African coastal states. The areas covered in these activities include : fishery biology and ecology, fishery statistics and stock assessment, exploratory fishing surveys, fishery management, navigation, marine engineering, pollution assessment and monitoring etc. Some of this training is carried out on a regular basis in established institutions, e.g. universities, and some takes the form of seminars, workshops or ad-hoc training courses.

2. Boat building : FAO has assisted several African coastal states to establish or improve their boat building technology in relation to the development of their fishery industry using the most appropriate and most easily available boat building materials, including timber, fibre glass, ferrocement, aluminium and steel. There is a great need for the establishment of technical schools for modern boat building in many African countries.
3. Fish technology : The development of appropriate fishing technology, including the right fishing gear and fishing vessels is still very much underdeveloped in many African countries. This shortcoming is realised and many of these countries have included the development of fishing technology as a priority among their regular FAO-assisted programmes.
4. Fish processing and marketing : One of the problems in the development of the fishery industry in African coastal states is the lack of efficient fish processing and marketing systems. FAO is assisting several of these countries in finding an appropriate solution to this problem through research, seminars and cooperative programmes. FAO is also, in collaboration with WHO, working out more efficient, hygienically-sound and safe methods of processing and preserving fish.

Some of the FAO-assisted activities related to fishery resources development in African coastal states are summarized in the following table :

<u>Country</u>	<u>FAO-assisted activity</u>
Madagascar	On the job training of fishermen, survey for sardines, reactivation of the CNRO at Nosy Be, training of marine biologists and oceanographers.
Mozambique	Training of fishermen in navigation, stock assessment, age reading and survey techniques, provision of consultants.
United Republic of Tanzania (mainland)	Advisory service to the Tanzania Fishing Corporation (TAFICO).
United Republic of Tanzania (Zanzibar)	Training of fishermen, fish processing.
Somalia	Training of fishermen, fish processing.
Kenya	Training of fishermen, fishing surveys, mariculture.

<u>Country</u>	<u>FAO-assisted activity</u>
Seychelles	Advice on management of fishery stocks and fishery development.
Sierra Leone	Marine engineering, fish technology.
Ghana	Fish technology.
Nigeria	Shallow water fisheries development.
Senegal	Improvement of artisanal fishery, fish marketing and processing.
Togo	Fish technology.
Morocco	Improved method of handling small pelagic fish.

5. Legal Advisory Service : FAO provides legal advisory service to African coastal states on :

- (a) revision of national legislation in relation to the 200 mile limit "exclusive economic zone",
- (b) control of foreign fishing within the 200 mile "exclusive economic zone",
- (c) legislation on fishery resources management and exploitation,
- (d) assessment and enforcement of control measures,
- (e) joint measures and licensing agreements,
- (f) bilateral agreements,
- (g) new forms of institutional structures, e.g., fishing corporations,
- (h) technical assistance, etc.

### 3.4 World Meteorological Organization (WMO)

Important activities of the WMO which are related to marine science and technology development in African coastal states include:

#### 1. Global weather experiments

These are experiments using floating buoys placed in different parts of the world oceans to collect scientific data (e.g., temperature and currents) and transmit it to satellites from which it is in turn

transmitted to land-based data collecting stations. This has been one of WMO's most successful activities. Although the main experiment is now over, about 133 buoys at different parts of the world oceans are still transmitting information.

## 2. Marine meteorology experiments over the sea

Experiments are being designed to observe the upper mixed layers of the atmosphere over the oceans.

## 3. Long-term world climate programmes

Experiments designed to enable long-term forecasting of the climate of the world.

### 3.5 World Health Organization (WHO)

The WHO is interested in problems of marine pollution as they relate to: sea food, tourism, fishing and environmental health.

The Organization has been participating in activities in several African coastal states related to:

- sanitary engineering works
- disposal of waste (e.g., sewage) into the sea
- provision of clean and safe water supply
- assessment and prevention of pollution
- water pollution monitoring
- food pollution monitoring
- health criteria, etc.

#### 4. REGIONAL ACTIVITIES RELATED TO MARINE SCIENCE AND TECHNOLOGY IN AFRICA

##### 4.1 The East African Region

In the context of this Project, the East African region coastal states are: Sudan, Djibouti, Ethiopia, Somalia, Kenya, Tanzania, Mozambique, and the Indian Ocean islands - Madagascar, the Seychelles, the Comoro Islands, Mauritius and La Réunion (France).

Important activities related to marine science and technology which were organized on a regional basis include:

##### 4.1.1 International Indian Ocean Expedition (IIOE), 1959-65

When the IOC was established, the IIOE was already under preparation by the International Council of Scientific Unions (ICSU) and the Scientific Committee on Oceanic Research (SCOR). It was conceived as an exploratory programme to allow individual scientists to carry out their own specialized research programme of interest. When the IOC was formed in 1960, it assumed the role of co-ordinating agency, but SCOR continued to play the scientific advisory role. Under the co-ordination of IOC, the following organizational measures were instituted in the programme:

(i) Establishment of an International Co-ordination Group for the IIOE composed of national co-ordinators for the programme and dealing with data exchange, preparation of atlases and processing analysis and publication of results.

(ii) Arrangement of special customs facilities and courtesies for ship and personnel of the expedition.

(iii) Publication of an IIOE Information Paper Series.

(iv) Establishment of International Centres, e.g., the Indian Ocean Biological Centre (responsible for sorting zooplankton samples) at Ernakulam, South India, supported by Unesco and India; and the International Meteorological Centre at Bombay, supported by UNDP and WMO.

(v) Designation of a Fisheries Subject Leader for co-ordination and evaluation of the fisheries aspect of the programme.

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\* This annex is a reproduction of Chapter 4 of a working document discussed at a Working Group Meeting, convened by ECA and Unesco, in Addis Ababa, from 5 to 9 May, 1980.

(vi) Arrangement for international standardization and inter-calibration tests.

(vii) Agreement upon reference stations at 15 locations throughout the Indian Ocean for intercomparison of methods and for information on seasonal changes.

The IIOE programme provided a stimulus in marine science education to developing countries as a substantial number of such countries participated in the expedition, became interested in marine science, obtained technical assistance and developed national organizations to deal with international oceanographic co-operation.

The two World Data Centres for Oceanography in Washington, D.C. and Moscow were charged with the responsibility of collecting the data obtained during this international co-operative programme and Unesco accepted the responsibility for the publication of the Collected Reprints of the IIOE, which were issued in eight volumes, together with an index.

The observational results of this co-operative investigation have been summarized and published in the form of five comprehensive atlases:

- IIOE Meteorological Atlas, Vol. 1, Surface Climate of 1963 and 1964, edited by C.S. Ramage, F.R. Miller and Chairman Jeffries, Washington D.C. (1972).
- Vol. 2, Upper Air, edited by C.S. Ramage and C.V.R. Raman, Washington D.C. (1972).
- IIOE Oceanographic Atlas edited by C. Wyrski, Washington D.C. (1971).
- IIOE Phytoplankton Production Atlas, edited by J. Krey and B. Babenerd, Kiel (1976).
- IIOE Geological-Geophysical Atlas, edited by G.B. Udintsev, Moscow (1975).

The more important findings of this expedition include:

(a) The surface current regime in the Northern Indian Ocean is influenced by the seasonally changing monsoon winds, which blow strongly from the south-west in summer and gently from the north-east in winter.

The ocean does not react on the summer monsoon from the south-west by establishing a simple current gyre covering the main part of the northern Indian Ocean, but by establishing a gyre which appears to contain many

relatively strong cyclonic and anticyclonic eddies, with dimensions ranging from 100-1000 km, capable of changing dramatically within two months or less. Numerical models were a great help in the understanding of these current features which certainly affect chemical and biological processes in the ocean.

(b) The biological results indicated that not even 0.1% of the primary production of the Indian Ocean was harvested by man's fishing at that time and that up to a tenfold increase in the fishing yield might be reached with present conventional means, which could be further augmented by new technology. IIOE provided the oceanographic basis for planning a rational exploitation of living resources. From oceanographic considerations the most promising areas for development appeared to be Somalia, South Arabia, Malabar, Madagascar and Java.

(c) In the geological-geophysical field the atlas mentioned above gives ample information including relief maps of the ocean floor; charts showing the depth of the sedimentary layer and of bedrock outcrops, the deep structure of the earth's crust and the upper mantle, as revealed by seismic investigation; magnetic and gravitational anomalies and many other relevant observations which are of paramount significance for current knowledge and further development of the concepts of plate tectonics and sea-floor spreading, all of which add to our understanding of the history of the oceans. Among the discoveries was that of a 'hot spot' of anomalously hot, highly saline water trapped in a deep basin in the Red Sea. It was suggested that it would be worth exploiting the locally rich metaliferous sediments found with this hot brine spring. The Saudi-Sudanese Red Sea Joint Commission for the development of the Red Sea non-living resources was created in 1975. The Commission carried out the first systematic research work for the evaluation and exploitation of the Red Sea deposits in 1976-77.

#### 4.1.2 Co-operative Investigations in the North Central Western Indian Ocean (CINCWIO)

These activities consisted of a Workshop (Nairobi, Kenya, March-April 1976), a Joint Mission by IOC/FAO/SIDA/SAREC to Somalia, Kenya and

The Institute was established by the University of Dar-es-Salaam in 1974 as an integral part of the University and is located on the island of Zanzibar. Its mission includes training and research in all aspects of marine sciences. Recently, the Institute was allocated enough land on a suitable site on the island for any future expansion and development.

#### 4.2 The West African Region

In the context of this Project, the countries considered to belong to the West African Regional Coastal States are: Angola, Benin, Cape Verde, Cameroon, Congo, Equatorial Guinea, Gabon, the Gambia, Ghana, Guinea, Guinea Bissau, Ivory Coast, Liberia, Mauritania, Morocco, Namibia, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo and Zaire.

Among the most important activities related to marine science and technology organized on a regional basis in West Africa are:

##### 4.2.1 International Co-operative Investigations of the Tropical Atlantic (ICITA), 1963-64

This was a development and an internationalization of an earlier locally conceived programme - the Guinean Year - which was drawn up on the request of the Commission for Technical Co-operation in Africa (CCTA) and the Scientific Council for Africa (CSA) and approved by them in 1961. The project had the following priorities:

- (a) A trawling survey of the demersal resources from Mauritania to Angola;
- (b) A campaign to study the meteorology and physical, chemical and biological oceanography of the Gulf of Guinea;
- (c) An experimental fishing campaign for sardine-like fishes, and
- (d) An experimental fishing campaign for tunas.

Later, the demersal fishery survey was financed by the US Agency for International Development and the US itself undertook the tuna survey and the oceanographic investigation survey of the Gulf of Guinea. In 1962, the IOC adopted the latter project as an official IOC programme and established an International Co-ordination Group for ICITA. The programme then comprised a multi-ship survey of the tropical Atlantic Ocean between latitudes 18°N and 18°S from the West Coast of Africa to South America. The field phase was subdivided into three periods during 1963/64, called Equalant I, II and III, in which up to fourteen research vessels from Argentina, Brazil, Rep. of Congo, German Dem. Rep., Rep. of

Tanzania (3-24 September 1977) and an ad hoc Intergovernmental Meeting of the Countries of the CINCWIO Region " (Nairobi, Kenya, 5-9 March 1979).

All these activities were aimed at finding out the state of marine science development (including research and training, fishery development, human and material resources, infrastructure facilities, etc.) in the Eastern African countries, the need for assistance in improving the situation and the scope for regional and international co-operation. These activities culminated in the Intergovernmental Meeting, which approved the recommendations that were made in all these areas.

### References

Report of the Scientific Workshop to initiate planning for a Co-operative Investigation in the North and Central Western Indian Ocean (CINCWIO), Nairobi, Kenya, 25 March - 2 April 1976. IOC Workshop Report No. 7, Unesco, Paris: Meeting of the Countries of the CINCWIO Region, Unesco Regional Office for Science and Technology for Africa, Nairobi, 5-9 March 1979. Ref. IOC/CINCWIO ad hoc 3.

#### 4.1.3 International Conference on Marine Resources Development in Eastern Africa (University of Dar-es-Salaam, Tanzania, April 1974)

This Conference was organized by the University of Dar-es-Salaam in collaboration with the University of Rhode Island. The main objective of the conference was to explore ways and means whereby the Eastern African countries could develop their marine science research capability through the training of local scientists in all aspects of marine science with a view to enabling these countries to exploit their marine resources more effectively and more rationally. The most important recommendation that was made was that an Institute of Marine Sciences should be established at the University of Dar-es-Salaam which would have a regional and an international outlook in research and training.

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\* The boundaries of the 'CINCWIO Region' were originally defined by the CINCWIO Steering Committee (meeting in Zanzibar, October 1975) as the area encompassed by the East African coastline out to 50°E, and from latitude 13°N to latitude 15°S.

The ad hoc Intergovernmental Meeting of the countries of the CINCWIO region (Nairobi, March 1979), at the suggestion of the delegate from the Democratic Republic of Madagascar, decided to recommend an extension of the boundary southward to the latitude of the southern border of Mozambique and thus to include Madagascar, Mozambique, Mauritius and La Réunion.

results were presented at a symposium on the oceanography and fisheries resources of the tropical Atlantic, organized at Abidjan, Ivory Coast, October 1966, through the joint efforts of Unesco, FAO and CAU. The oceanographic data was published in a two-volume atlas. Later, during the International Decade of Ocean Exploration (1971-80), an exploration of the eastern Atlantic continental margin was carried out and revealed the presence of large basins with a sediment thickness of more than 4 km in a belt associated with the Congo and the Niger rivers. These sediments contain many structural features suitable for gas and oil.

#### References

- K.O. Emery: Review of the results from the Eastern Atlantic Continental Margin Programme of the International Decade of Ocean Exploration. In: IOC Technical Series No. 11 (Unesco, Paris, 1975), pp. 52-62.
- ICITA Oceanographic Atlas: Vol. I Physical Oceanography, (Unesco, Paris, 1973), 289 pp; Vol. II Chemical and Biological Oceanography (Unesco, Paris, 1976), 358 pp.
- Proceedings of the symposium on the oceanography and fisheries resources of the tropical Atlantic. Results of ICITA and of the GTS. Held at Abidjan, Ivory Coast, 20-28 October 1966. (Unesco, Paris, 1969), 430 pp.
- H.U. Roll: International Co-operative Investigations of the Tropical Atlantic (ICITA), 1963-64. In: IOC Technical Series No. 20 (Unesco, Paris, 1979), pp. 18-19.
- F. Williams: Fishery Resources of the Tropical Eastern-Central Atlantic Ocean: Exploration, Utilization and Management since 1960. In: IOC Technical Series No. 11 (Unesco, Paris, 1975), pp. 33-49.

#### 4.2.2 Co-operative Investigations of the Northern Part of the Eastern Central Atlantic (CINEMA), 1967-74 - ICES/FAO/IOC

In the 1960s, the International Council for the Exploration of the Sea (ICES) has been approached for affiliation of West African countries and the Council was interested in strengthening its activities in the southern part of its area through co-operative studies. The rich living resources of the up-welling region brought about an old tradition of Moroccan, Senegalese, Spanish, Portuguese and French fisheries in the Canary Current region, which in the past decades had been fished by many nations from outside the region. It was FAO which pointed out the need

The proposal for a Co-operative Investigation of the Northern Part of the Eastern Central Atlantic (CINECA) envisaged a multi-ship survey of the whole area between 10°N and the Straits of Gibraltar, extending up to 25°W into the Atlantic. If possible, aircraft and satellite observations should complement the data base of traditional oceanographic section studies in order to achieve a thorough description of the hydrography and of the biological productivity of the area during two different seasons.

However, the transfer of physical oceanographic results and primary production data into prediction of fish catches proved more difficult than expected.

A terminal symposium on CINECA results was held at Las Palmas, Canary Islands, Spain (April 1978), the report of which recommended future scientific activities to improve the understanding of the complicated mechanisms of inter-actions in oceanic upwelling ecosystems.

#### References

ICES 1978: Report of the CINECA Symposium on the Canary Current: Upwelling and Living Resources, Las Palmas, Gran Canaria, 11-14 April 1978 (Copenhagen, ICES, 1978), 12 pages, 4 Annexes.

#### 4.2.3 West African Action Plan (WAAP) and related activities

Although UNEP's activities are concerned with problems connected with the human environment generally, its Governing Council has designated the 'Oceans' as a priority area in which UNEP will focus efforts to fulfil its catalytic role. For the convenience of carrying out its major functions in a systematic and integrated way, it has adopted a regional approach - UNEP Regional Seas Programme - in dealing with the main problem areas of the world oceans. By adopting this approach, UNEP feels that it will be able to focus effort on specific problems of high priority to the States of a given region thereby more readily responding to the needs of the governments and helping to mobilize more fully their own national resources. It is hoped that undertaking activities of common interest to coastal states on a regional basis would, in due course, provide the basis for dealing effectively with the environmental problems of the ocean as a whole.

A UNEP regional programme in this concept consists of a carefully worked out 'Action Plan' which is formally adopted by the governments before the programme is carried out.

At present, there are eight regional sea areas in which action plans are operating or are under development. Among these are: the Mediterranean (adopted in 1975), the Red Sea (adopted in 1975), and the West African region (under development, adoption expected in 1981), which are of interest to African countries.

UNEP has, in the past few years, sponsored or co-sponsored several activities aimed at studying existing or potential marine pollution<sup>1/</sup> problems in the West African coast, especially the Gulf of Guinea, and at finding or suggesting solutions to such problems.

Because of these studies, there is much more information and much more awareness and concern about the problems of marine pollution in the West African region than in Eastern Africa, where hardly any comprehensive studies on the situation have so far been carried out. Among the activities carried out in the region are:

- (i) UNEP Exploratory Mission on Marine Pollution Problems of the West African Coastal Countries of the Gulf of Guinea (25 April - 2 July 1976);<sup>2/</sup>
- (ii) IMCO/UNEP Workshop on Prevention, Abatement and Combating of Pollution from Ships in the Gulf of Guinea and Adjacent Coastal Areas (Douala, 12-17 December 1977);
- (iii) IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas (Abidjan, 2-9 May 1978);
- (iv) Unesco Workshop on Coastal Ecosystems with Special Reference to Coastal Lagoons and Estuaries on the West Coast of Africa (Dakar, Senegal, June 1979);
- (v) UNEP Meeting of Experts to Review the Draft Action Plan for the West African Region (Libreville, Gabon, November 1979).

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<sup>1/</sup> Marine pollution is defined as:

"Introduction by man, directly or indirectly, of substances or energy into the marine environment (including estuaries), resulting in such deleterious effects as harm to living resources, hazard to human health, hindrance to marine activities, including fishing, impairing the quality for use of sea water and reduction of amenities".

(Joint Group of Experts on the Scientific Aspects of Marine Pollution [GESAMP], 1972).

<sup>2/</sup> M.P. Angot and P. Kaniaru. Report of Exploratory Mission on Marine Pollution Problems of the West African Coastal Countries of the Gulf

The West African Regional Plan was discussed and approved by experts from member countries of the West African Region and from UNDP, FAO, Unesco, IOC, WHO and IMCO at a meeting organized by UNEP and hosted by the Gabonese Republic, held in Libreville, Gabon, 5-9 November 1979. It is hoped that the 'Action Plan' will be adopted by an intergovernmental meeting in January 1981.

For the purposes of the Action Plan, the region is defined as including the marine environment and coastal area of the following States: Angola, Benin, Cameroon, Congo, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Namibia, Sao Tome and Principe, Senegal, Sierra Leone, Togo, Zaire.

It is important to note that there is, at present, no action plan contemplated for the Eastern African region.

References

Report of the Meeting of Experts to review the draft Action Plan for the West African Region, Libreville, 5-9 November 1979. (UNEP/WG.27/4), 6 pages and 5 annexes.

4.2.4 Other regional activities

(i) GARP Atlantic Tropical Experiment (GATE), 1974

Sponsored by WMO and ICSU, GATE aimed at studying the convection in cloud clusters and its interaction with large-scale atmospheric circulation over the tropical Atlantic. The oceanographic part of the programme was aimed at investigating the response of the tropical Atlantic to atmospheric forcing on various scales and at determining heat, water and momentum fluxes through the air-sea interface. About forty research vessels participated; in addition, a great number of buoys and aircraft were deployed in summer and autumn 1974.

But the oceanographic part of the programme does not seem to have allowed for active participation by the West African countries. Several workshops and a terminal symposium (Kiel, FRG, 1978) were held, and an oceanographic atlas entitled 'Physical Oceanography of the Tropical Atlantic during GATE' will be published later in 1980.

References

Final Report of the SCOR Working Group 43 on Oceanography related to the GARP Atlantic Tropical Experiment (GATE). (WMO/ICSU GARP Activities Office, Geneva, 1979). 49 pp.

(ii) Global Weather Experiment (FGGE)

FGGE, culminating during the two Special Observing Periods, January/February and May/June 1979, included two sub-programmes which were of special significance to Africa and Asia: the West African Monsoon Experiment (WAMEX), and the Asian Summer Monsoon Experiment (MONEX). They aimed at observing, describing, understanding and predicting the two monsoons' circulations in the respective areas.

Nearly all West African countries participated actively in WAMEX, but only Kenya and Somalia, and probably the Seychelles, participated in the oceanographic programme of MONEX (IBDEX).

(iii) Proposed Joint Study of an Oceanographic Area designated 'The Atlantic-Iberian-African (AIA) Region'

The proposal (submitted by the delegation of Portugal) has been considered by the IOC Assembly, but the programme has yet to be developed. Countries of the region likely to participate include: Portugal, Spain, Senegal, Mauritania, Cape Verde Islands, and Morocco.

(iv) Proposed Pilot Ocean Monitoring Study (POMS) in the North Atlantic during the 1980s.

New observing techniques and new theoretical approaches renewed interest in the large-scale circulation of the ocean, as opposed to the nearly exclusive concentration on process studies which marked oceanography in recent years.

Co-sponsored by the Intergovernmental Oceanographic Commission, the Joint Organizing Committee for GARP and the ICSU Scientific Committee on Oceanographic Research organized a Pilot Ocean Monitoring Study Planning Meeting (Miami, U.S.A., 1-5 October 1979) to discuss the oceanographic aspects of the World Climate Research Programme in general and the prospectus for ocean monitoring in particular.

A number of oceanographic institutes in Canada, France, Federal Republic of Germany, United Kingdom, USA and the USSR are planning major experimental programmes relevant to POMS in the North Atlantic Ocean between 20° and 50°N during the early 1980s. This project is sponsored by ICES, IOC, IMO and ICSU, in conjunction with the development of the World Climate Research Programme (WCRP).

The research programmes are quite varied but most relate to the North Atlantic gyre and its associated currents to the north and South. Some of the programmes are to address the problem of studying the meridional heat transport associated with the North Atlantic circulation and related air-sea interaction processes.

#### References

Report of the Pilot Ocean Monitoring Study Planning Meeting, Miami, USA, 1-5 October 1979 (WMO/ICSU GARP Activities Office, Geneva, 1979), 43 pp., 8 Appendices.