Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

IOC-FAO Group of Experts on Ocean Science in Relation to Living Resources for the IOCINCWIO Region

First Session

Mombasa, Kenya
13-17 September 1994

Supported by SAREC

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In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
3. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' *(Also printed in Spanish)*
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping *(Also printed in French and Spanish)*
12. Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ships-of Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica *(Spanish only)*
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources *(Also printed in French and Spanish)*
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities *(Also printed in Spanish)*
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CCPS Working Group on the Investigations of 'El Niño' *(Also printed in Spanish)*
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
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51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
52. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean
53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic *(Also printed in French)*
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico *(Also printed in Spanish)*
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping
59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans *(Also printed in French)*
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' *(Spanish only)*
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico *(Also printed in Spanish)*
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
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1. OPENING

The Director of the Kenya Marine and Fisheries Institute (KMFRI), and Vice-Chairman IOCINCWIO, Dr. E. Okemwa, called the meeting to order at 9.00 on 13 September 1994, in the Lounge of the Reef Hotel, Mombasa, Kenya.

On behalf of the Chairman IOCINCWIO, and the Board of Management of KMFRI, Dr. Okemwa welcomed all participants. He recalled the strong regional need for focus on marine living resources, e.g. fish stock assessment and recruitment, identification of critical marine habitats, harmful algae, and marine mammals. He reported on how Kenya already has several ongoing activities with national, bi-lateral and multi-lateral support within these areas. His speech is given as Annex III.A.

Dr. Okemwa introduced the IOC Technical Secretary for the IOCINCWIO OSLR Expert Group, Mr. H. Enevoldsen, who welcomed the participants on behalf of the Secretary IOC, Dr. G. Kullenberg, and expressed the great appreciation of IOC to KMFRI and Dr. Okemwa for hosting the Meeting, and to SAREC for funding it. Mr. Enevoldsen pointed out that the OSLR is a joint programme of IOC and FAO, that the IOC is the only body within the United Nations charged with basic oceanographic research, and underlined its role to act as a joint specialized mechanism of the UN system for discharging responsibilities in the fields of marine sciences and ocean services. It was emphasized that it is not the primary role of IOC to act as a funding agency, but that the IOC jointly with Member States can facilitate funding of research and capacity-building activities. He therefore stressed the vital importance of a strong involvement by Member States and their research institutions in programme development and implementation. The relevant decisions of UNCED, the IOC Assembly, and IOCINCWIO-III were recalled as the background for the establishment of the Group. The Technical Secretary expressed his hope that the Group would succeed in initiating a focused and feasible OSLR Programme for the Region.

Dr. Okemwa then introduced Dr. J. Largier who, speaking initially on behalf of the Food and Agriculture Organization (FAO), welcomed the participants and pointed out how the FAO focus on resources is an appropriate complement to the IOC focus on the scientific basis for Ocean Science in relation to Living Resources. Dr. Largier referred to the political, social, and economic welfare of the people of the Region as the underlying objective of the Meeting. The need to set a realistic and effective research agenda for the Region was stressed. He expressed his belief that such research could make the difference between sustaining, enhancing, or depleting the marine resources of the region. Dr. Largier then went on to address the meeting in his individual capacity as a research scientist.

Finally, Dr. Okemwa introduced Prof. K. Mutahi, Permanent Secretary, who gave a speech on behalf of The Honorable Dr. Z. T. Onyonka, Minister for Research, Technical Training and Technology of Kenya. Prof. Mutahi addressed the participants and reiterated that it was a pleasure for Kenya to host the Meeting. He stressed the need for an improved knowledge base in order to ensure sustainable utilization of marine living resources in the region, and called for assistance in getting access to research vessels. He also stressed the importance of pollution-control mechanisms in relation to the conservation and utilization of marine living resources, and the need to continuously monitor the marine ecosystem. He then declared the Meeting open. His speech is given in Annex III.B. The List of Participants is given in Annex II. Dr. A. Semesi had conveyed her apologies the IOC Secretariat for not being able to attend the meeting due to other commitments.

2. ADMINISTRATIVE ARRANGEMENTS

The Technical Secretary introduced the draft Terms of Reference for the Group, recalling the decisions of the Third Session of the IOCINCWIO concerning Ocean Science and Living Resources.

Following some clarifying amendments, the Draft Terms of Reference, as shown in Annex III, were adopted.

2.1 ADOPTION OF THE AGENDA

The Provisional Agenda was introduced by the Technical Secretary. The Group of Experts adopted the Agenda as given in Annex I.

2.2 ELECTION OF CHAIRPERSON AND DESIGNATION OF RAPPORTEUR

Following the proposal of Prof. I. Fagoonee, the Group elected Dr. E. Okemwa as Chair for the Group and the Meeting. Dr. M. Ngoile was elected as Vice-Chair upon a proposal of Prof. I. Fagoonee.

The Group elected Prof. I. Fagoonee as Rapporteur. The Technical Secretary informed the Participants that the draft report of the Meeting would be prepared in English only.

3. CONSIDERATION OF IOCINCWIO-III AND RELEVANT ASPECTS OF UNCED

To provide a common information base for more detailed discussions on subject matters, Dr. M. Ngoile, speaking as Chairman of the Western Indian Ocean Marine Science Association (WIOMSA), summarized the Recommendations and Implementation Plan of IOCINCWIO-III, and the IOC-SAREC Action Plan with respect to OSLR. Referring to the IOCINCWIO Implementation Plan for 1993-95, Dr. E. Okemwa and other participants completed the brief by reporting on the implementation status of the various OSLR activities and new regional developments, viz:

(i) **Establishment of a Regional Group of Experts on Recruitment** - The IOC Secretariat has addressed this through the establishment of the Regional Group of Experts on OSLR.

(ii) **Approach to NORAD (Norway) FRITJOF NANSEN Project to obtain support for assessment/recruitment studies** - The RV FRITJOF NANSEN will not be available for a regional study in the foreseeable future due to other commitments. Nevertheless, Dr. A. Hoguane observed that there might be a possibility of having the RV FRITJOF NANSEN for a cruise in the Region during breaks in its programme when in the Western African coastal region.

(iii) **LME Symposium** - The International Symposium and Workshop on Status and Future of Large Marine Ecosystems of the Indian Ocean was successfully implemented at KMFRI, Mombasa, 28 March to 2 April 1993. The Proceedings are in press.

(iv) **Training Course on Phytoplankton Identification and Taxonomy**- A survey on the need for such training has been carried out by the University of Mauritius; it will be evaluated by the Group with the view to organizing a training activity in 1995.

(v) **Inventory of Marine Critical Habitats** - The activity will be discussed and planned by the Regional Group of Experts on OSLR.

A brief summary of elements of UNCED relevant to a regional OSLR programme was given by the IOC Secretariat.

4. SUMMARY DESCRIPTION OF THE GLOBAL IOC-FAO OSLR PROGRAMME

4.1 REVISED STRUCTURE AND GOALS OF OSLR AS ENDORSED BY THE SEVENTEENTH SESSION OF THE IOC ASSEMBLY

The Technical Secretary presented a summary of the revised structure and goals of the OSLR Programme as endorsed by the Seventeenth Session of the IOC Assembly.

Since its start in 1982, the OSLR Programme has traditionally been composed of recruitment programmes such as the Sardine Anchovy Recruitment Programme (SARP) and the Tropical Demersal Project (TRODERP), including a Peaneid Prawn Recruitment Programme (PREP), sub-programmes which have been implemented to a varying degree. The Regional OSLR Programmes have shown more viability, not the least in e.g. the WESTPAC and IOCEA Regions.

Based on the above experience, the Seventeenth Session of the IOC Assembly endorsed a re-focusing of OSLR to render it more relevant to the post-Rio UNCED period insofar as emphasis on sustainable use of resources, biodiversity, and related capacity building are concerned. This entails OSLR taking active part in the decision making regarding research priorities and distribution of resources.

The refocused Programme includes : Ecosystem Dynamics in Relation to Living Resources, **EDLR**; Harmful Algal Blooms, **HAB**; and the living resources module of the Global Ocean Observing System, **GOOS**.

An example of a sub-programme whose ecosystem approach has a central role in a refocused OSLR (EDLR) is GLOBEC International - the IOC-SCOR-ICES-PICES Global Ocean Ecosystem Dynamics Programme. GLOBEC includes e.g. aspects related to a coupled multi-disciplinary numerical modelling/sampling and observational system, which are thus also relevant to the development of the Global Ocean Observing System GOOS. Because of GLOBEC's focus on physical-biological processes, its development is very stimulating and could fulfil the role originally envisaged for OSLR.

Also contributing to the EDLR OSLR component is the increased number of LME activities which include the GEF Projects for LME Gulf of Guinea, and the Yellow Sea, and the NOAA (USA), IUCN, IOC, and KMFRI LME Symposium held in Mombasa, 1993. Another LME Symposium will take place from 8-11 October 1994, in Qingdao, P.R. China.

In developing new OSLR elements fresh and renewed partnerships are essential. This would also include a revitalized involvement of FAO. At the Seventeenth Session of the IOC Assembly in 1993 and the IOC Executive Council 1994, UNEP expressed its strong interest in a more active involvement in, and support to, the OSLR Programme. This was naturally welcomed with enthusiasm by the IOC Governing Bodies. IOC is also very pleased about the developing interaction with IUCN in marine mammal and biodiversity matters.

In the subsequent discussion, keen interest was expressed among the Group in the new focus of OSLR. In particular the Group requested the IOC Secretariat to make available more information about GLOBEC. The Science Plan for GLOBEC, presently in press, may give guidance and inspiration for joining GLOBEC or complement its activities via comparative interregional studies, collaborative research and exchange of information and scientists.

4.2 THE OSLR PROGRAMME IN OTHER IOC REGIONS

As inspiration in further developing an IOCINCWIO component of OSLR, examples amd experiences were presented of how this had been, and continues to be done in other IOC Sub-Committees and Commissions.

In particular, the Technical Secretary referred to the development of a regional OSLR/HAB Programme in the WESTPAC Region as an example of how a focused planning process and a strong national involvement in the development and implementation of the Programme had resulted in funding from both Member States in and outside the Region.

As Representative of the IOC Regional Committee for the Central Eastern Atlantic (IOCEA), Dr. B. Samb, summarized the development and activities of the IOCEA Group of Experts on OSLR. The IOCEA GE-OSLR was initiated by the Third Session of the Regional Committee for the Eastern Central Atlantic (IOCEA-III) (Dakar, Senegal, 18-22 January 1993) and met for the first time in Casablanca from 28-30 June 1993. Co-operative research activities which have been initiated or planned, include stock assessment, squid studies, and the effect of currents on fish larvae survival. Each project has been elaborated and finalized by resource persons in the Region, and has subsequently been evaluated by the GE-OSLR before being submitted to potential donors through IOC.

Furthermore, so as to develop an evaluation format for projects, it is envisaged to organize a training workshop for the IOCEA region, in which representatives from IOCINCWIO will also participate, on the utilization of acoustics in stock assessment work, including theoretical as well as practical aspects. It is also planned to establish a working group which should assess the results of various trawl assessment surveys carried out in the IOCEA Region. Both the sub-regions under influence of the Canary Current and those in the Gulf of Guinea are considered.

The Group requested the Secretary IOC to ensure the participation of one or two scientists from IOCINCWIO in the IOCEA Training Workshop on Acoustics not only so as to obtain the training itself but also as experience for the planning of similar training in IOCINCWIO.

5. PRESENTATIONS BY MEMBERS OF THE GROUP OF EXPERTS OF ONGOING PROGRAMMES AND PRIORITIES

As background for the identification of IOCINCWIO OSLR priorities, Group Members and Observers were invited to inform on ongoing and potential future activities in the Region relevant to the Terms of Reference of the GE-OSLR. Presentations are included as Annex V.

It was evident that the number of activities related to research on, and management of, marine living resources in the Region is high. Prof. I. Fagoonee expressed concern for the many and potentially overlapping activities, particularly those carried out by the various UN Agencies and the NGO's in the region. There was a general agreement that the GE-OSLR could be an important mechanism for coordination and development of joint action. In this respect, the continued participation of observers from relevant governmental and non-governmental organizations was stressed.

For the GE-OSLR to be efficient as a co-ordinating mechanism, and for IOCINCWIO scientists to be fully active in regional and global research communities, good and improved communication and exchange of information were recognized as crucial. The IOC initiative for establishing an E-mail network between marine science institutions in the Region was referred to as essential for effective communication, and IOC was urged to accelerate its development. The IOC e-mail system should be harmonized with the existing system which has been installed by ORSTOM in Madagascar, Seychelles, and La Reunion.

The question of how best to coordinate research activities between marine institutions in the Region was raised. The Group recognized that the only mechanism available are the IOC National Committees. This puts emphasis on the need for such Committees, which have already been established in some countries, including Mauritius.

6. IDENTIFICATION OF PRIORITIES AND ACTION REQUIRED FOR A REGIONAL OSLR COMPONENT WITH REFERENCE TO IOCINCWIO-III

With reference to IOCINCWIO-III, the Group considered priorities to be initiated in the period up to its next meeting, as well as those of a more long term nature. Some priorities had already been identified by Member States during IOCINCWIO-III and subsequent regional meetings and workshops.

The overall criteria for the selection of priorities under the various subject matters were those defined by the Seventeenth Session of the IOC Assembly for the refocused OSLR Programme. These are impact of climate change on marine living resources, biodiversity, and sustainable resources in tropical and sub-tropical zones.

6.1 FOLLOW-UP TO UNCED: INVENTORY OF CRITICAL MARINE HABITATS IN THE IOCINCWIO REGION

The Item was introduced by S. Aricò, IOC Secretariat. He referred to the 1993-95 IOCINCWIO Action Plan for the implementation of UNCED Agenda 21, which includes, *inter alia*, the preparation of an inventory of marine critical habitats. This activity would also constitute a step towards the implementation of the Convention on Biological Diversity.

On a global level, the loss of habitats appears to be occurring faster than the loss of species. Therefore, the first step to be undertaken in assessing the present situation in the IOCINCWIO region with respect to critical habitats would be to map them. According to Chapter 17 of Agenda 21 (Para 17.85), priority should be accorded, as appropriate to: i) coral reef ecosystems; ii) estuaries; iii) temperate and tropical wetlands, including mangroves; iv) seagrass beds; v) other spawning and nursery areas.

Information on both the location and the state of health of those ecosystems would help decision-makers develop rational policies at the national level aimed at the preservation of natural habitats as well as their sustainable use, and would inform the decision-making community on priorities in research activities to be undertaken by scientists in order to address scientific uncertainties related to the concerned critical habitats.

From a scientific viewpoint, information collected will also represent a basis for further investigation of topics such as the dynamics of those ecosystems and the impact of human activities on them, as well as their degree of resistance and resilience; their ecological role; their importance as habitats which maintain marine biodiversity; etc. The scientific information will provide the basis for the formulation of policies and management strategies for the protection and conservation of these ecosystems.

A number of activities related to OSLR in the Region could contribute to the inventorying of critical marine habitats. Examples are the Eastern African Coastal and Marine Environment Resource Database and Atlas Project (1993-98), co-ordinated and funded by UNEP with the support of the Belgian Government and leading institutions in the region. The project should be seen as management-oriented, since it was designed to enhance achievement of the main objectives of the UNEP Eastern African Action Plan.

A second example are activities carried out by ORSTOM (France) remote sensing station in La Reunion, which can contribute to the collection of satellite imagery for mapping critical habitats in the region.

The Group noted that aspects of the IOC-UNEP-FAO-IUCN Project on the Assessment and Control of Pollution in the Coastal and Marine Environment of the Eastern African Region (EAF/6) and (EAF/5), provide useful information for the inventorying. Other activities to be taken into consideration are carried out under SAREC, Belgian, and IUCN programmes.

Based on the background information provided and the discussion that followed, there was agreement on the order of priorities outlined in Agenda 21 as appropriate for the Region. The Group noted that in addition to the Agenda 21 list of marine critical habitats, lagoon, sandy beach, and rocky shore ecosystems should also be considered as critical. With respect to identifying areas to be inventoried, it was pointed out that the UNEP Atlas Project represents a significant source of existing information on natural resources summarized in the form of country map sheets.

The Group felt that this information should act as a guide for in-depth research activities in the habitats identified as critical. It was stressed that those activities should focus on filling gaps in the existing scientific knowledge, in particular as concerns coral reefs and mangrove ecosystems. It was also stressed that the available satellite images from the Atlas project would need to be verified through field observations. This would provide habitat assessments with a higher resolution.

The Group noted that the techniques for resolving seagrass beds from satellite imagery was at a formative stage, and that there were few programmes which address detailed studies on seagrass beds.

The Group emphasized the need for standardized methodologies in coral reef research. The Representatives of IUCN and UNEP informed that this is being addressed through a workshop to be held in 1994. Several Members of the Group expressed their strong interest in the workshop.

Several members reported that activities aimed at mapping critical habitats have already been carried out at the national level, and that results from these activities provide a basis of already available data. The data should be made available and compared through e.g. a workshop. Activities include:

(i) Aerial surveys with ground truthing of all the mangroves stands on the coast of Tanzania and the adopted Management Plan for them;

(ii) Same as above for Kenya, with the management plan in preparation;

(iii) The ongoing Mangrove Programme in Madagascar with the assistance from ORSTOM (France).

The Group stressed the importance of mapping mangroves in Mozambique.

The Group expressed its wish to UNEP that mechanisms be found for the implementation of phase two of the Atlas project, with a view to providing the Atlas for all the countries of the Region. The Group encouraged UNEP to coordinate the activities within the Atlas Project with the relevant activities carried out by ORSTOM (France) and SAREC.

The Group recommended that efforts should be made to prepare a project proposal for ground truthing of already registered seagrass beds. A first step would be to coordinate with UNEP in order to ensure availability of data (satellite images and a related data base) on seagrass bed distribution.

6.2 RECRUITMENT AND STOCK ASSESSMENT

A document prepared by Dr. P. Cayré on recruitment (see Annex VI) was discussed by the Group. It was pointed out that mechanisms controlling and determining recruitment are complex and involve:

(i) biology, physiology and reproductive strategy of exploited species;
(ii) the environment and its impact on different pre-recruitment and early life stages;
(iii) the adult population biomass (critical low level) and density-dependant regulation process.

The Group stressed that management of fish resources should remain a priority and, in this respect, carrying out of scientific research on fisheries is crucial. Thus research must target stock assessment as well as socio-economic concerns in order to predict and manage fisheries. Too much emphasis should not be placed on the recruitment mechanism itself when there is no evidence of recruitment over-exploitation. This statement needs to be qualified as far as the following three types of stocks or fisheries are concerned:

i) Coral reef and lagoons based fisheries which are the backbone of artisanal activity.
ii) The offshore and deep-water stocks which are basically tuna and other large pelagic fishes which support industrial and artisanal fisheries.
iii) The coastal fisheries including estuaries, mangrove area and shellfish, prawns and small pelagic stocks. These areas and resources are exploited by both artisanal and industrial fisheries.

For these three categories, **the Group recommended** a careful routine follow up of oceanographic parameters (temperature, salinity, turbidity, currents, etc.) in order to investigate any particular major change which could be observed through current statistics of existing fisheries. Special attention should also be given to economic statistics in relation to fisheries. For each of the previously mentioned fisheries or stocks types, **the Group recommended:**

i) <u>Coral reef and lagoon fisheries</u> Emphasis should be put on sampling at the landing sites and collecting length frequencies for further time series analysis. For the most important species biological data (e.g. sex, gonad index, otolith for age reading, etc.) and economic data should also be collected. An inventory of the various fishing gears in use should be carried out for comparing their efficiency and impact.

ii) <u>Offshore Fisheries</u> **The Group acknowledged** the work done by the Indian Ocean Commission) States (i.e. Comoros, La Reunion, Madagascar, Mauritius and Seychelles) on monitoring the tuna stocks within the frame of Regional Tuna Project, with assistance of ORSTOM (France).

The Group recommended that IOC request ORSTOM to assist the Eastern African countries (Kenya, Mozambique, and Tanzania) in training personnel in the methodologies for collection of fisheries statistics from artisanal tuna fisheries as well as industrial tuna fisheries which are actively transhipping through the Mombasa harbour. These statistics, currently non-existent, are of key importance for tuna stocks assessment in the Indian Ocean.

iii) <u>Coastal Fisheries</u> Artisanal fisheries which are active all along the East African coast represent a special opportunity to follow-up variations in shared-stocks distribution and abundance. The Group acknowledged the existing information on fish stock assessment gathered with the assistance of FAO (SWIOP Project). Also acknowledged were the efforts made by the departments of fisheries of the national governments on continuous collection of fish catch statistics. It was suggested that the setting up of up-to-date national inventories of major exploited species, status of knowledge and statistic collection in action would be of potential interst and would permit

identification of common questions. Senegal, which has a very important multi-species, multi-gears artisanal fishery, is ready to host any scientist interested in sharing his experience in artisanal fishery assessment.

The Group gave special attention to coastal shrimp exploitation. Shrimps have a specific recruitment process and are targeted at various stages of development by traditional and industrial fisheries which interact on recruitment and adult stock exploitation through various biological and socio-economic processes.

The Group stressed the need for establishment of a network of monitoring stations for collection of SST data. etc.

Dr. Okemwa informed on the Nairobi Conference on Sustainable Development of Fisheries in Africa, which will be held at UNEP Headquarters in 1995. **The Group** saw the Conference as an opportunity for scientists to present results of relevant OSLR activities in the Region. For this purpose the Group requests IOC and other organizations to support the participation of IOCINCWIO scientists.

6.3 LARGE MARINE ECOSYSTEMS

The Item was introduced by Dr. E. Okemwa, who briefed the Group on the deliberations and recommendations of the LME Symposium, Mombasa, 1993.

The Group strongly supported the Large Marine Ecosystem (LME) initiative in view of the fact that focusing on LMEs is one of the strategies of assessing and monitoring the changing state of coastal ecosystems.

There is a paucity of expertise in the region, both at the scientific and technical level, to develop LME studies. There is a lamentable lack of scientific understanding of the biological and physical components of the LMEs in the Western Indian Ocean, including that on changes in LMEs due to pollution, habitat degradation and over-exploitation of resources.

With reference to IOCINCWIO-III Action Plan, and Recommendation 8 of the LME Symposium, Dr. G. Kitaka informed that he had taken the initiative of the preparation of marine science country profiles for the region. **The Group urged** IOC to give priority to the completion of this work.

The Group recommended that a core monitoring programme should be formulated. This would include a Continuous Plankton Recorder (CPR) survey/Undulating Oceanographic Recorder (UOR) sampling strategy to measure variability in LME health. Such a programme would provide useful knowledge on the pelagic ecosystem.

An inshore sampling programme to measure species abundance, biodiversity and stock levels, and gather data on fish age, growth and size should also be formulated.

Given the magnitude of a programme designed to investigate an entire LME, and the cost implications, activities should initially focus on:

(i) Initiating in-shore LME studies for the estuaries in Kenya (Tana River Delta) and Tanzania (Rufiji River) in terms of nutrients dynamics and biodiversity;

(ii) Exploring the possibility of establishing a CPR/UOR survey;

(iii) Submitting a statement to the Regional Meeting of Ministers, Seychelles, 1996, with a

view to obtaining an endorsement of planned LME activities.

The Group recommended that a joint planning meeting should be held for the purpose of elaborating a LME operational framework for the Region. The Meeting should involve the managers of two or three key fisheries research institutions from the Region, and representatives of IOC, FAO, UNEP, IUCN, NOAA (USA), and ORSTOM.

Background information and suggestions for elements of the operational programme should be prepared and distributed to participants prior to the meeting. **The Group agreed** to take the responsibility for this work.

Dr. M. Ngoile offered IMS, Zanzibar, as host for the meeting.

The IUCN Representative expressed interest in helping in the organization of the Meeting.

6.4 HARMFUL ALGAE

Compared to other regions of the world, records of harmful algal occurrences in the Region, and associated detrimental effects on marine living resources, are very sparse. The IOC-FAO Harmful Algal Bloom Programme has therefore not been developed in the IOCINCWIO Region. Nevertheless, there are regular, and maybe increasing, occurrences of algal blooms in e.g., Mauritius. Aquaculture of shellfish is under development in the region (e.g. oyster farming in Kenya) and at some stage will require monitoring of potentially toxic algae in order to assure consumers and export-markets of the safety of seafood products. On a global scale, the annual losses of the shellfish industry, due to closed markets and reluctance among consumers to buy shellfish, are substantial. A developing shellfish industry should therefore be accompanied by at least very basic monitoring of potentially toxic species at the aquaculture sites.

As monitoring requires reliable identification of the causative organisms, IOCINCWIO-III earmarked training in the identification and taxonomy of harmful microplankton as a priority. In order to meet the regional requirements as precisely as possible, it had been decided to carry out a regional survey on the need for such training, available training facilities, and the availability of relevant equipment at the institutions of the trainees. The survey was carried out by the University of Mauritius during summer 1994.

After a short introduction of the HAB problem and the scope of the IOC-FAO HAB Programme, Prof. I. Fagoonee presented the results of the above-mentioned survey. The number of scientists potentially identified for training is 25, and two institutions were identified as feasible venues for a training course: The University of Mauritius, and the University of Dar es Salaam.

Prof. Fagoonee offered the University of Mauritius as host for the planned Taxonomy Training Course.

The Group took note of the result of the survey, and saw this first training activity as an opportunity to get a better overview of present and potential future problems with harmful algae.

6.5 MARINE MAMMALS

The theme was introduced by S. Aricò, IOC Secretariat. He referred to the IOCINCWIO Region as a part of the Indian Ocean Sanctuary, an area where whaling operations have been prohibited (following decisions of the International Whaling Commission), basically because of the great importance of the area with respect to breeding (and, to some extent, feeding) of marine mammals. The area is defined by the

coasts of Africa to 100°E (Northern Hemisphere) and 20°E to 130°E (Southern Hemisphere) and 55°S.

As far as the IOCINCWIO region is concerned, little information is available on local marine mammal populations, their relationships with fisheries activities, the impact of other human activities on them, the degree to which they are threatened, their dependance on natural habitats, etc.

The issue of whether and how to develop research activities on marine mammals can be approached from the perspective of making an assessment of marine biodiversity in the IOCINCWIO region both from the scientific and sustainable use viewpoints, as well as for developing prevention measures.

An issue of potential interest is that of the status of the endangered dugong Dugong dugon, which is normally associated with the seagrass bed habitat. They can be considered as part of the same ecological system, where an alteration of the natural habitats of these animals (due e.g. to pollution and other disturbances affecting the coastal zone) may also contribute to reducing the number of dugongs.

A proposal aimed at developing a pilot project on the status of dugongs in Kenya and Tanzania and their relationships with seagrasses is under development. The project could be carried out by KMFRI, Mombasa and IMS, Zanzibar, and is being developed with the assistance of the IOC Secretariat, which will collaborate with the two research institutions in identifying already available expertise.

The Group approved the proposal as of interest to the region, and **invited** IOC to help identify potential funding sources, after the completion of the project proposal.

Ms. M. Borobia, UNEP, briefed the Group on ongoing Marine Mammal Action Plan activities: (i) Survey of national legislation concerning marine mammal protection in Eastern African countries (compilation by UNEP), (ii) Regional Review on the Status and Conservation of Marine Mammals in the Eastern African Region (to be published by UNEP), (iii) Popular booklet on the Dugong (Dugong dugon) (to be published by UNEP), (iv) Field Guide of Marine Mammals of the Western Indian Ocean (to be published by UNEP), (v) Marine mammals and fisheries interactions in Tanzania (Tanzania Fisheries Research Institute, Dar-es-Salaam), (vi) Distribution, relative densities of dolphins and dugongs and their fisheries interactions in Mozambique (Universidade Eduardo Mondlane, Maputo), (vii) Assessment of marine mammal distribution off Madagascar and the influence of environmental degradation, (viii) Analysis of catch statistics of marine mammals in Kenya (Kenya Marine Fisheries Research Institute), (ix) Symposium and Workshop on Marine Mammals of East and West Africa regions, 1995.

Dr. P. Cayré informed the Group that France (ORSTOM) and Spain (IEO), have initiated a programme funded by EU targeted at the by-catch species of industrial purse seiners in both the Atlantic and Indian Ocean. This Programme includes on-board scientific observers and precise marine mammal sighting recording of accidental catches. **The Group acknowledged** that close contacts and exchange of information and results should be actively pursued by involved scientists and institutions.

The Group recognized that very little is known about distribution and abundance of large whales in the Western Indian Ocean. It was suggested that a mechanism be established for a sighting network, taking into account existing fisheries observer schemes. UNEP agreed to prepare a brief proposal which will serve as background for a call to interested scientists through the WIOMSA Window Newsletter. Ms. M. Borobia, recalled that the UNEP identification field guide for marine mammals would be useful in such a network.

6.6 OTHER AND FUTURE PRIORITIES

The Representative of IUCN, Dr. D. Elder, raised the question of introduction of species, for instance through development of mariculture and accidental introductions through ballast water. As an example, Dr. M. Ngoile referred to the most recent introduction of a strain of the seaweed Eucheuma spinosum from the Philippines in the WIO. The question of whether genetic engineered species have been introduced in the region also arose.

The representative of IUCN called for the Group's advice on whether species introduction is a priority or not at the national/regional level, and on related legal aspects.

The Group suggested that a study be initiated to provide documentation on species already introduced or proposed for introduction in the region, and that a mechanism be established for monitoring potential introductions, including a review of ongoing monitoring. Additionally the Group recommended that an effort be made to initiate the compilation of inventories of marine species with a view to providing inputs to the Biodiversity National Inventories called for by the Convention on Biological Diversity, for which GEF funding might eventually be sought.

The Group requested the representative of IUCN to investigate the possibility of organizing such an exercise in collaboration with IOC and other interested partners, such as UNEP, in light of its support to the elaboration of Biodiversity Country Studies.

Aquaculture of oysters, shrimps and seaweeds is established and in constant development in the region. The scientific knowledge required to ensure successful aquaculture is being built up in some of the IOCINCWIO countries, but needs to be further strengthened. **The Group suggested** that training workshops be organized on scientific methods to be used in oyster and shrimp farming. KMFRI and the Albion Fisheries Center were identified as appropriate venues for two future workshops. Training related to seaweed farming is already being organized with the support of SAREC.

The importance of better understanding the interaction between physical oceanography and ecological processes was emphasized. **The Group noted** the need for a review of physical processes at various scales (regional to estuarine), relevant to living resources in the Region. This review would be oriented towards future installation of coastal physical/chemical monitoring stations in Region.

Dr. M. Ngoile referred to post-graduate courses at the University of Gothenburg, Sweden, on Coastal Physical Oceanography in relation to Ecological Processes. **The Group encouraged** students and scientists in the Region to apply for the Course.

7. OSLR-IOCINCWIO WORK PLAN FOR THE INTERSESSIONAL PERIOD

Based on the deliberations under previous Agenda Items, **the Group prepared** a Work Plan for 1995-97, including costing with institutional commitments, IOC international parts, donor contributions, timing of events, and priorities.

The Work Plan includes activities to be initiated through the Group. Since the Work Plan does not include all identified priorities, **the Group prepared** a general list of Regional priorities

The List of Regional Priorities and the Work Plan were prepared in tabular form, and are included as Annex V and VI, respectively.

The Group empowered the Chairman to delegate specific work responsibilities to task teams in the inter-sessional period in order to facilitate development and implementation of activities.

8. ADOPTION OF THE SUMMARY REPORT

The Group recommended that it meet again in 1996. Prof. I. Fagoonee offered the University of Mauritius as host.

The Group adopted the Summary Report and the recommended Work Plan for IOCINCWIO OSLR 1995-97.

9. CLOSURE

The Technical Secretary expressed his appreciation of the excellent local arrangements made by Dr. E. Okemwa and his staff.

The Chairperson acknowledged the efforts of the Group and the Secretariat, and expressed his satisfaction with the constructive discussions during the Meeting. He closed the Meeting at 13.00 on Saturday 17 September 1994.

ANNEX I

AGENDA

1. OPENING

   1.1 WELCOMING OF THE PARTICIPANTS
   1.2 OBJECTIVES OF THE IOCINCWIO GROUP OF EXPERTS ON OSLR

2. ADMINISTRATIVE ARRANGEMENTS

   2.1 ADOPTION OF THE AGENDA
   2.2 ELECTION OF CHAIRMAN AND DESIGNATION RAPPORTEUR

3. CONSIDERATION OF IOCINCWIO-III AND RELEVANT ASPECTS OF UNCED

4. SUMMARY DESCRIPTION OF THE GLOBAL OSLR PROGRAMME

   4.1 REVISED STRUCTURE AND GOALS OF OSLR AS ENDORSED BY THE SEVENTEENTH SESSION OF THE IOC ASSEMBLY
   4.2 REGIONAL COMPONENTS (WESTPAC; IOCARIBE; SOUTH WEST ATLANTIC; IOCEA; IOCINCWIO)

5. PRESENTATIONS BY MEMBERS OF THE GROUP OF EXPERTS AND NATIONAL PROGRAMMES AND PRIORITIES

6. IDENTIFICATION OF PRIORITIES AND ACTION REQUIRED FOR A REGIONAL OSLR COMPONENT WITH REFERENCE TO IOCINCWIO-III

   6.1 FOLLOW-UP TO UNCED: INVENTORY OF CRITICAL MARINE HABITATS IN THE IOCINCWIO REGION
   6.2 RECRUITMENT AND STOCK ASSESSMENT
   6.3 LARGE MARINE ECOSYSTEMS
   6.4 HARMFUL ALGAE
   6.5 MARINE MAMMALS
   6.6 PROGRAMME FORMULATION
   6.7 FUTURE PRIORITIES

7. PREPARATION OF AN OSLR-IOCINCWIO ACTION PLAN FOR THE INTERSESSIONAL PERIOD, including costing with national commitments, IOC international parts, and donor contributions

8. ADOPTION OF THE SUMMARY REPORT

9. CLOSURE

ANNEX II

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ANNEX III

TERMS OF REFERENCE OF THE IOCINCWIO REGIONAL GROUP OF EXPERTS ON OCEAN SCIENCE IN RELATION TO LIVING RESOURCES (OSLR)

As specification to the general global framework Terms of Reference for Group of Experts in IOC Manual (part I), the Group is established to develop a regional component of the IOC-FAO OSLR Programme, and shall:

1.1 Identify and review regional priorities in marine living resources research.

1.2 Review and update the OSLR component of the IOCINCWIO Implementation Plan, and report on its state of implementation to the Regional Committee (IOCINCWIO).

1.3 Facilitate effective interaction and communication between research institutions, management authorities, and interested individual scientists and groups from the IOCINCWIO region, as well as with institutions and scientists from other regions, using inter alia the Heads of National Agencies network of the IOCINCWIO.

1.4 Identify needs for specifications and guidelines, and recommend to the Regional Committee procedures and methodologies for OSLR scientific studies in the IOCINCWIO region as required.

1.5 Advise the Regional Committee (IOCINCWIO) on TEMA-related needs and resources requirements in the region concerning OSLR.

1.6 Co-operate, as required, through proper channels, with other IOC Groups of Experts and the Advisory Bodies of the Commission, as well as with other interested individuals, groups and bodies.

1.7 Prepare and update a Work Plan for the IOCINCWIO-OSLR component with indications of activities, time, participating institutions, focal points, financial implications, potential funding sources, and provide this to the Regional Committee.

2. COMPOSITION

The GE-OSLR is composed of regional and international experts, nominated in accordance with the IOC Manual, on marine living resources selected from the rooster by the Secretary IOC with the advice of the IOCINCWIO Committee and the Chairman of the Group of Experts. Resignations should be communicated to the Secretary IOC in written form. Representatives of IOC Regional and other Subsidiary Bodies, as well as other IGOs and NGOs, can attend the sessions of the Group as observers, after having notified their interest in written form to the Secretary IOC.

3. MEETINGS

3.1 The Group will meet according to decisions taken by the IOC Executive Council and Assembly following proposals by the Regional Committee (IOCINCWIO).

3.2 The Group will, prior to the closure of each session, elect from its members a Chairperson, who will serve in that capacity until the closure of the next session.

3.3 Documentation and Reports will be prepared in English and distributed to participants well in advance to the following session.

ANNEX IV

OPENING SPEECHES

A. DR. EZEKIEL OKEMWA, DIRECTOR KENYA MARINE AND FISHERIES RESEARCH INSTITUTE

The Permanent Secretary, Ministry of Research, Technical Training and Technology, Prof. Karega Mutahi; Mr. Chair; Mr. Henrik Enevoldsen, IOC-UNESCO; Mr. George Kitaka, UNESCO/ROSTA; Dr. John Largier, FAO, Distinguished scientists; Ladies and Gentlemen,
It gives me great pleasure to be present amongst you on the inauguration of this first meeting of the iocincwio regional group of experts on ocean science in relation to living resources.

On behalf of the chairman of the board of management of kmfri and the staff, and on my own behalf, I wish to extend a very warm welcome to our guest from outside Kenya to Mombasa, and wish them a pleasant and memorable stay in our country.

Ladies and gentlemen, the government of the Republic of Kenya is very pleased to have the opportunity to host this very important meeting of the regional experts on ocean science in relation to living resources. In this regard, I wish to extend special thanks to the Intergovernmental Oceanographic Commission (IOC), the food and agricultural organization of the United Nations (FAO-UN), and the Kenya Marine and Fisheries Research Institute for sponsorship and support for this workshop.

The third session of the IOCINCWIO-III (Mauritius, 14-18 December,1992) established a regional group of experts on ocean science in relation to living resources (OSLR) under whose auspices this meeting is held today. The main objective of this meeting will be focussing the problems of fish stocks assessment and recruitment in the region. Other areas to be considered and discussed include identification of marine critical habitat, harmful algae, marine mammals, and large marine ecosystems, fellow-up to unced and programme formulation.

Mr. Chairman, there are several programmes we are carrying out in Kenya under ocean science and living resources (OSLR). For example, these include oyster culture in Gazi south of Mombasa, sea-grass marine plants aquaculture development in Kilifi, fish and shrimp recruitment project in Kenya. A project is going on marine mammals with more emphasis on sea turtles and dugongs.

Under bilateral and multi-lateral co-operation we are carrying out research on critical habitats: mangroves, sea grass beds, coral reefs.

Mr. Chairman, early 1993, KMFRI hosted an International Conference on Large Marine Ecosystems (LME). The conference was successful. Among the recommendations of the conference is to carry out studies on living resources of Western Indian ocean at regional level. We are seeking for funding for the regional project.

Mr. Chairman, recently we have been having incidences where fish have been reported to have died along Malindi and Lamu area. This may be due to harmful algal blooms.Harmful algal blooms can pose a threat to Public Health and Tourism, can cause mass mortalities of shellfish and fin fish and can result in great economic hardship to coastal fishing communities and aquaculture industry. Whether or not the outbreak of harmful algal blooms is caused by increasing eutrophication is the subject of an intense debate between scientists. People eating contaminated shellfish can become seriously ill, and might even die of it. This danger also presents a great economic threat to the aquaculture industry. Since most countries in the Western Indian Ocean lack the required expertise to cope with the negative impact of

harmful algal blooms, a degree of formal international co-operation in research and training is needed which does not exist at present. Towards this goal, we request IOC and FAO to develop an international programme on harmful algal blooms (HAB) for Western Indian Ocean countries.

Mr. Chairman, human intervention and climate changes are sources of increasing variability in the natural productivity in the Western Indian Ocean. The sources of large-scale changes in the yields of living marine resources species and pollution problems along the coasts of the countries of the western indian ocean that impact on natural productivity cycles need to be addressed, including eutrophication from high nitrogen and phosphate effluent from estuaries, the presence of toxins in poorly treated waste-water discharge, and loss of woodland nursery areas to coastal development.

Human population growth, industrial development, deforestation, etc.' Which directly alter the properties and processes of the marine ecosystem are also apparently acting to change the basic climatic context in which these processes and properties operate. The concentrations of carbon dioxide and other "greenhouse" gases in the earth's atmosphere have increased significantly in recent decades, leading to predictions of global climate changes. Although there is presently some controversy as to the precise nature of the changes that may occur, the gene-al scientific consensus is that substantial climate changes are likely to occur and to do so over a relatively short time (decades).

Monitoring programme on climate change on fisheries is urgently needed in our region. Deforestation cause soil erosion. We call upon Kenyan not to cut trees on hill tops because the top soil is eroded and is carried away to the sea. The siltation problems can be seen at Sabaki River and the area near Lamu. Siltation affects corals which in turn if spoilt will affect our tourism industry. The call I make now is cut one tree and plant another to safe-guard our tourism industry.

Ladies and gentlemen, the Government of the Republic of Kenya is very pleased to have the opportunity to host this very important OSLR meeting. In this regard, I wish to thank the Inter-Governmental Oceanographic Commission (IOC), FAO and the Kenya Marine and Fisheries Research Institute for the sponsorship and support for this course.

With the drought that is facing many third world countries now, more and more attention is now being shifted to fisheries as a source of cheap protein.

Finally, mr. Chairman, Ladies and gentlemen, allow me to sincerely thank dr. Henrik Enevoldsen of IOC, Dr. John Largier of FAO and all other participants for avalling themselves to attend this very important meeting. Once again I welcome all of you to Kenya and wish you a happy stay.

B. HON. DR. ZACHARY T. ONYONKA, MINISTER FOR RESEARCH, TECHNICAL TRAINING AND TECHNOLOGY

Mr. Chairman, distinguished scientists, Ladies and Gentlemen, It gives me pleasure to be with you in the first meeting of the inter-governmental oceanographic commission on the investigation of the north and central western indian ocean (iocincwio) - regional group of experts on ocean science in relation to living resources. On behalf of the government and people of Kenya, and on my own behalf, I wish to extend a very warm welcome to our guests from outside Kenya, and wish them a pleasant stay in our country. It is my hope that your participation in this forum will not only enrich the deliberations but that the outcome will enable us, as a region, to better understand and sustain our marine habitat for our own economic and environmental gains.

Ladies and gentlemen, the Government of Kenya is pleased to have the opportunity to host this very important meeting of the regional experts on ocean science in relation to living resources. In this regard, I wish to extend special thanks to the joint efforts of the united nation's and the Kenya Marine and Fisheries Research Institute for sponsoring and supporting this workshop.

Mr. Chairman, I am informed that this workshop is being held under the auspices of a regional group of experts who were identified in the third session of the Inter-Governmental Oceanographic commission on the investigation of the north and Central Western Indian Ocean, held in mauritius, in december, 1992.

Among the issues to be addressed will include:
- problems of fish stocks assessments
- identification of marine's critical habitat
- harmful algae
- marine mammals
- large marine ecosystems and
- the need for pollution control.

These are important issues especially in our continent where marine resources have not been fully exploited. We do have a chance through your advice, to avoid serious ecological and economical problems that result from human actions and recklessness.

Ladies and gentlemen, as you are all aware, the most important living ocean resource is fish. Marine plants such as seaweeds and algae are also assuming increasing importance in the world economy. These resources have, however, not been fully developed in this region, mainly because we lack enough understanding of the marine habitats such as mangroves, coral reefs, seagrass beds and wetlands which determine the productivity of the sea. This knowledge gap underscores the importance of thorough research in order to understand the nature and the character of these habitats. The knowledge acquired through such research will enable us to manipulate marine resources for our own economic good.

In this regard, I am happy to note that a number of research projects have been initiated; some of them here at KMFRI. I would like to mention one or two projects which may be directly connected to the objectives of this important meeting. In 1990, a project titled "dynamics and assessment of Kenyan mangrove ecosystem", was initiated at the KMFRI. This project, which, was sponsored by the Commission of the European Communities (EEC) involved scientists from Belgium, Netherlands and Kenya looked into nutrient dynamics. At its completion in 1992, research conclusions were used to prepare a new project proposal titled "Inter-linkages in Eastern Africa Coastal Ecosystem". The proposal was forwarded to the EEC who agreed to fund it. Mr. Chairman, I am equally happy to note that this project involves scientists from Kenya, Tanzania, Mozambique, Sweden, Belgium, Portugal and the Netherlands. As a region we eagerly look forward to receiving more and dependable information from the results of this project.

Ladies and gentlemen, I have been informed that fish stocks assessment has been an area of long term interests to FAO therefore, their participation in this meeting is significant to all of us. Further, the Government of Kenya would like to thank fao for its past and future support to this region. At the same time, I appeal to FAO and her sister U.N. Institutions like IOC, to consider assisting this region with a fisheries cum oceanographic research vessel which can work in both inshore and offshore waters on a regional basis. Such a facility would greatly enhance our capacity to conduct research.

Mr. Chairman, as has been stressed in a number of fora, including the elaborate discussion during the united nations conference on environment and development (UNCED), in Rio de Janeiro in 1992, the sustainability of our environment depends on the rate of addition to it and removal from it of hazardous substances. Should the rate of removal be slower than the rate of input, then the concentration of such substances will eventually build up to undesirable levels, often leading to environmental degradation.

In this regard, I need not emphasize the fact that some substances that find their way into our water systems could be harmful to the flora and fauna including fish. Through the food chain the effects of such pollution could be manifested in fish eating birds and mammals including human beings. It is clear therefore, that there is need to continuously monitor our marine systems for any trace of pollutants. The focus here should be on their sources, quantities and characteristics with a view to arresting their negative effects.

Ladies and gentlemen, by the very dynamic nature of the marine environment, and due to limited resources coupled with the scarcity of experts, it is imperative that most marine programmes including fish stocks assessment be undertaken on a regional basis. The need to develop regional programmes for the management of marine resources has in the past culminated with the enactment of the eastern and western africa region action plan for the protection, management, and development of the marine and coastal environment and related protocols. I am pleased to inform you that the Government of Kenya has ratified this convention and its protocols since 1990.

Under the plan, participating institutions recently received analytical equipment for monitoring pollution. I am informed that KMFRI received an atomic absorption spectrophotometer and a gas liquid chromatograph. The Kenya Government is most appreciative of this donation. I would, therefore, like to take this opportunity to thank FAO and UNEP for the kind gesture. I hope that the use of these equipments will be maximized in monitoring our marine and fresh water systems for any pollutants with a view to taking corrective measures.

In conclusion, I wish to once again thank the organizers of this meeting for their commitment to ocean science in relation to living resources in the western indian ocean region. Further, I would like to restate the Kenya Government's position that we regard environmental conservation as the only way to sustainable fisheries development.

Ladies and gentlemen, I wish you all fruitful discussions and also assure you of Kenya Government's support in all your endeavours.

With these remarks, it is my pleasure to declare this workshop of regional group of experts on ocean science in relation to living resources officially open.

ANNEX V

ONGOING REGIONAL ACTIVITIES IN RELATION TO RESEARCH ON MARINE LIVING RESOURCES

N. NTIBA
UNIVERSITY OF NAIROBI

KENYA PROGRAMMES AND PRIORITIES RELATED TO OCEAN IN RELATION TO LIVING RESOURCES (OSLR)

1. Programmes

The Kenya Marine and Fisheries Institute, Kenya Wildlife Service, in collaboration with National Universities, have quite a number of on-going programmes related to living marine resources. The include:

1. Fish and fishery studies programm.
A. Inventory of fish species, including their ecological studies at Gazi.
B. Oyster culture at Gazi
C. Recruitment of fish, prawns and coral.
D. Development of fish feeds.
E. Studies into the ecology of blackspot snapper, Lutjanus fulviflamma.
F. Studies into the biology of Scylla serrata and Thalamita crenata.
G. Sea weed cultivation studies.

2. Mangrove ecosystem.
a. Benthic fauna of Gazi bay.
b. Recolonization and rehabilitation on the South coast of Kenya.
c. Photosynthetic production of mangrove species at Gazi.
d. Rate of litter decomposition
e. Utilization and conservation of mangroves.

3. Marine Pollution
a. Effects on the biodiversity of seagrass bed areas by pollutants from the hotels in the Diani Beach area.
b. Effect of heavy metals on marine resource.

4. Coral Reefs
a. Diversity and abundance of fish in protected and unprotected coral reefs.
b. Ecological studies on the sea urchin, Echinometra mathaei in the Kenyan coral reef areas.

5. Studies of the ecosystems dynamics between mangroves, seagrass beds and coral reefs.

6. Phyto- and zooplankton studies of Gazi and Tudor creeks.

7. Marine resource data-base and Atlas.

8. Impacts on climate change on living marine resources

9. Monitoring program on:-
a. Sea birds
b. Marine turtles
c. Dugongs

10. Information and technology transfer.
a. Recoscix-WIO

Proposed Programmes

1. Recruitment and stock assessment
2. Inventories of marine flora and fauna
3. Identification of harmful algal brooms

A.M. HOGUANE
UNIVERSITY OF DAR ES SALAAM, MOZAMBIQUE

Mozambican coast has two main fishery areas of great economical and social interest: **Sofala Bank**, central Mozambique and **Delagoa Bight**, in the south. Apart from these there are several bays and coastal lagoons whose fishery activity supports the life of millions Mozambican people.

The main fisheries are the shallow water **shrimp, deep water prawn, lobsters, grey fish and scad and mackerel**, in the shelf and open sea and shrimp and fish in the bays and coastal lagoons.

Resources on the shelf and open sea are mostly exploited by industrial and semi-industrial companies and resources in the bays and coastal lagoons are mostly exploited by artisanal fishing.

The Institute for Fishery Research established in 1976 have concentrated its work on the shelf and open sea resources. In recent years the artisanal fishery has became even more important, in part due to the civil war. People have run from the most interior part of the country for shelter in the coastal areas and so, devoted to the fishing activity. The increasing importance of the artisanal fishing led to a creation of an institution to deal solely with the artisanal fishing.

The research on other resources apart from fisheries is being carried out by the University. These include the marine mammals, see grasses and coral reefs.

OBJECTIVES

Fishery research activity in Mozambique aims to acquire knowledge on fisheries and then advise the government in adopting the fishing policy for a sustainable exploitation.

ACTIVITIES

Surveys for biomass estimation of the main fishery resources (shelf and open sea) are carried out every year. Catch monitoring are conducted on board fishing vessels as well as in the fish ports along the coast.

The estate of exploitation of these resources were defined: The shallow water shrimp in Sofala Bank and deep water lobster were thought to be under an intensive exploitation. And so, some management measure were introduced. There has been recommended not to increase the fishing effort for these fisheries. For shrimp, further measure, consisting of increasing the mesh size of the trawl nets (twice) and fishing is prohibited during the recruitment period.

Other resources are thought to be in a satisfactory state. Scad and mackerel, after years of intensive exploitation, are not being exploited for almost two years.

There has not been yet made studies of recruitment. But surveys for shallow water shrimp in Sofala Bank are carried out during recruitment season. The result is then used to estimate the catches for the following fishing season.

Oceanographic studies have been carried out in order to support the fishery research. The main objective has been to establish the relation between the environmental conditions and fish abundance and distribution.

The main environmental conditions of the major fishery areas have been identified. Attempt to establish relation between some environmental parameters and fish abundance are being made.

Studies of the mangrove ecosystem both physical environment and biology are in course. Hope these will help to understand the environment influence on the living resources at their earliest stage of life.

FUTURE ORIENTATION

The research activity will continue to be the monitoring of fish stocks with emphasis on those resources of great economical importance (source of foreign currency) and those of great social importance (those providing sustainable base for the local communities). Artisanal fishing is to be paid more attention in the future.

Fishing of scad and mackerel and other open sea resources are to be encouraged.

PERSONNEL/TRAINING

The institute for fishery research has recruited in recent years many young scientists. Most of them are graduated in general biology from local University. They still need a great deal of "specialized" training.

Senior staff of the Institute in collaboration with the University are involved in training the young scientists. Some of the staff were sent abroad to read further education. There are some in State, Portugal, Britain and Norway studying for M.Phil and PhD.

AIDS/SUPPORT

The research activity are mostly supported by NORAD. It should be mentioned that there would not be any research activity without the kind support from NORAD. The government funds hardly covers the salaries.

Field work have been conducted on board of ships of opportunity. These include the R/V Dr. Fritjof Nansen, some russian and former West Germany research vessels. Since the fall of the Soviet Union we have received no support from Russia, neither from Germany. Surveys have bee conducted from fishery vessels hired for the purpose. These vessels are not equipped and not suitable for research activity.

A research vessel is very expensive to purchase and even more expensive to run for a single institution or even a country. We would like to stress the need for more national and regional cooperation. Sharing the resources available within a country or in the region may reduce quite considerably the expenses and hence, the dependence from outside.

G. GORAAH
ALBION FISHERIES RESEARCH CENTER, MAURITIUS.

All actions and programmes concerned with ocean sciences in relation to Living Resources are implemented by the Albion Fisheries Research Center, Mauritius. It is best to overview the Marine Resources and ongoing programmes through the following sub sectors viz:-

(i)Artisanal Fishery;
(ii)Banks fishery;
(iii)Oceanic Fishery;
(iv)Aquaculture and;
(v)Marine conservation.

1. Artisanal Fishery

This is the main source of fresh fish supply in the country. About 2,800 professional fishermen earn their livelihood from fishing in the lagoons and near reef areas. The fishermen use 8 - 10 m boats and fish mainly with Large Nets, Gill nets, Basket traps, fishing lines and harpoons. The total yearly catch is estimated at 1,600 tons and the catch per fisherman day stands at 5kg/day.

As the fishery is being exploited to its limit, fishermen are encouraged to venture further off the reef. Fish Aggregating Devices (FADS) have been placed 8 - 10 km off the reefs to lure pelagic fishes. Fishing on the FADS yield about 500 tons of fish/year.

One of the main tourist attractions to Mauritius is the Big Game fishing competitions. The Big Game Fishery which revolves mostly around the capture of marlins yield about 600 tons/year.
Some Management measures which are applied are limitation on the number of nets, mesh size regulation for nets and the application of a close season from October to February for Large Nets and Gill Nets. The Fisheries Protection service and the National Coast Guard are the enforcement agencies which enforce the provisions of the Fisheries Act.

The ongoing programmes in this sub-sector comprise of the following:
-A fish stock assessment programme for six commercially important fish species.
-A fish toxicity programme for the screening of potentially ciguateric fishes.
-A catch assessment survey of the fishery.
-A programme for the setting and follow up on FADS.
-Exploratory fishing and production of bathymetric charts.

2. Banks Fishery

About 17 mother vessels each equipped with 15-20 dories exploit the oceanic banks of Saya de Malha, Nazareth, Cargados Carajos and the Chagos archipelago. This fishery assures the regular supply of frozen white fish Lethrinus sp. in the local market. About 5,000 tons of gutted and gilled frozen fish is landed from this fishery. As the fishery is being exploited beyond its maximum sustainable yield the following tools have been applied to check the fishery:-
a. vessels operate under a license;
b. vessels have a catch quota allocation;
c.the price of white frozen fish is controlled and a fixed price at retail is implemented.

A catch assessment survey of this fishery is ongoing for obtaining catch and effort data and length frequencies of the different species.

3. Oceanic Fishery

Tuna is the only fish which is fished and processed on an industrial scale in Mauritius. Tuna on account of its migratory nature has led to the creation of the Indian Ocean Commission which comprises of five island states viz. Mauritius, La Reunion, Madagascar, Comoros and the Seychelles, to establish the Regional Tuna Project. The main objective of the project is to develop a rational management strategy

for the exploitation of the stock and assist member countries in developing their tuna Fisheries. Mauritius has three tuna purse seiners which fish mostly in the western Indian ocean. The yearly catch of these vessels stand at 8,000 to 10,000 tons of tuna.

4. Aquaculture

Marine fish culture in barachois dates back to over a century. The giant fresh water prawn, Macrobrachium sp. and the red Tilapia are farmed in fresh water and brackish water farms on a commercial scale. Marine Shrimps, Penaeus sp. and Oysters are farmed to a lower extent. The annual production of aquaculture produce stands at 100 tons.

The ongoing programmes on aquaculture are:-

-mass hatchery production of marine shrimp post larvae and pilot production trials with the development of appropriate local feeds.

-mass production of monosex red Tilapia fingerlings and development of appropriate culture techniques.

5. Marine Conservation

Mauritius has a fringing reef of about 150 km long. The reef lies about 100 meters from the shore line except in the South East where it extends few Kilometers from the coast. The lagoon is shallow (1-4 m deep) except where channels occur.

Coral reefs which are highly productive and vital forms of ecosystem provide the habitat for a diverse range of marine organisms. Besides checking on beach erosion, it breaks off violent waves so as to provide calm waters in the lagoon. They help in the formation of white coral sand and the white sandy beaches which are tourist attractions. Studies have shown that quite a large extent of the reef has been damaged.

Marine Conservation programmes which are presently being implemented by the Albion Fisheries Research Center are the following:-

-Coral reef studies through transects on a time series so as to evolve a sound marine environment plan;

-Establishment of Marine parks and reserves with legal backup.

-Replanting of Mangroves through the setting up of a mangrove nursery.

-Studies on chemical, physical and biological parameters of lagoon water under influence from effluent outfall mainly from sewage and industrial waste.

I. FAGOONEE
FACULTY OF SCIENCE, UNIVERSITY OF MAURITIUS

I. COASTAL ECOSYSTEMS

Coastal ecosystems (including coral reefs, mangroves, estuaries, rocky shores and lagoons) are increasingly threatened by growing development pressures and short-sighted management policies which focus on human activities rather than on the systems which sustain them. The siting of industrial plants or tourist hotels directly at the edge of the sea may foreclose options for fishing and other marine-dependent activities by degrading or destroying nursery grounds or polluting in-shore areas.

Biological, physical, socio-economic and legal and institutional information is needed for coastal management. The systematic collection and analysis of data in selected areas will allow the quantification of existing conditions, the identification of information gaps and projection of future trends. Data collection and analysis will result in an understanding of the carrying capacity or limits for sustainable sue of the system and an ability to predict the effects of changes to the system. Environmental impact assessment will be used to determine whether development activities are likely to adversely affect coastal ecosystems and the value of the goods and services provided by coastal ecosystems.

II. CORAL REEF STUDIES AND SEA-LEVEL RISE

Coral reef polyps live in symbiosis with unicellular algae. In response to environmental stress due to climatic changes, water quality variations, sediment loading, terrestrial and coastal development activities and other pollution parameters, the polyps and symbiotic zooxanthellae respond differently. Variation in response by different coral species may also occur. The growth rate of the polyps (cell division, branching) and algal density indices vary in consequence. Thus coral polyps could be used as a bioindicator sensor for monitoring coral reef responses to water quality changes. A long time-series study is needed at different sites around the islets of Mauritius. Reef mapping on a long-term basis will be carried out to detect variation in distribution patterns, state of health and regeneration. Aerial photography and satellite imagery will be sea-truthed for this purpose on a time series scale.

III. EFFECT ON COASTAL FISHERIES

Global Change Processes will have a profound effect on coastal fisheries. Sea-level rise will flood coastal areas and seriously affect fish habitats.

Selected fish habitats are already being studied. Baseline data are therefore available for these habitats. The effects of any rise in sea-level or in temperature on fish populations under study can be monitored.

The project should however, be expanded to include other fish habitats which do not yet form part of the present study. Flooding of mangrove areas will seriously affect nursery grounds of several marine species of economic importance. Baseline data on this habitat are lacking at the moment and need to be built up as soon as possible.

The effect of sea-level rise on fishermens' villages and population, and on industrial fishing infrastructure should also be studied. The economic impact of loss of fishing activity and of fishing grounds, although not of direct scientific impact, is of the utmost importance for certain countries.

IV. PRIMARY PRODUCTIVITY AND EUTROPHICATION EFFECTS

In polluted marine areas, nutrient availability for primary production is considerably perturbed. The department will monitor such fluctuations at selected sites around the coastline and investigate their ecological consequences. During recent years, there has been repeated occurrence of toxic red tides in Mauritian waters and this seems to be increasing with time. Worldwide epidemics of toxic algal blooms, accompanied by marine mammal, fish and invertebrate die-offs, human deaths and illness, and ecosystem dysfunction, are also frequently reported. The physiological, chemical and toxicological nature of the biotoxins involved are also not understood. The major repercussions of harmful algal blooms (HABs) are on marine ecology, aquaculture, seafood safety and general public health. Attempts will be made to develop methods to minimize the environmental and economic consequences of HABs.

V COASTAL ZONE DATABASE FOR MAURITIUS

An environmental information and mapping system will help scientists and managers to understand and effectively manage resources in the ecologically sensitive and economically important coastal waters of Mauritius. Geographical Information Systems (GIS) softwares such as IDRISSI and ARCINFO are currently being implemented/developed to provide information for the entire coastal zone of Mauritius on such diverse topics as geology, coastal wave and current climates, socio-economic data, fisheries, recreational centres, bathymetry, critical habitats, sewage disposal, oil spills and leakages, effluent discharges, etc. Such a GIS system designed as an integrated spatial database with maps and datasets overplotted in a topological spatial relationship will be instrumental in the decision-making process on coastal planning and development, especially with regard to reconciling the often conflicting uses of the coastal area. This database will also provide a library of sources and information with which to explore, test and develop hypotheses. Data sources include archives, ground truthing measurements, and through observation systems, such as remote sensing using aerial photography and high-resolution satellite imagery. Such *in situ* data collection over a period of five years and beyond, will culminate in the

development of coastal phenomena models involving water circulation patters, sediment transport and accompanying beach and sea-bed migrations, subsequently allowing the development of predictions of sea-level rise and storm surge impacts on the coastal zone.

JOEL N. DE LESTANG
SEYCHELLES FISHING AUTHORITY

The two main organizations involved with the Exploitation and Management of Living Marine resources in Seychelles are The Department of Environment and the Seychelles Fishing Authority.

The Department of Environment has the principal duty to protect and manage the marine parks and endangered marine species. Recently, Laws have been passed promoting a total ban on the capture, possession and sale of turtles and turtle products. The World Bank has sponsored a programme for Artisans who had been involved in that trade. The Department also has the duty to implement the total ban on the capture of Marine Mammals.

The Seychelles Fishing Authority is responsible for all aspects of Marine Fisheries i.e. Research and Development, Management, Extension service, Monitoring and Control of the EEZ. The Seychelles EEZ is approximately 1 million sq.km and in addition it has a considerable continental shelf, (38,000 sq.km). The Fishery can be divided into two subsectors:- The Artisanal Fishery and the Industrial Fishery.

a.The Artisanal Fishery targets demersal species utilizing hand lines and traps with annual landings of appropriately 5,000 tons.
The major priority of the Government is to modernize the existing fleet with better built and equipped boats with the objective of improving catch rates and hence the living standards of the fishermen.

b.The Industrial Fishery is entirely dominated by Licensed tuna purse seiners and Longliners. There are approximately 50 tuna purse seiners licensed, landing an annual average catch of 250,000 tons. The tuna is caught both within and outside the Seychelles EEZ but most of the transhipment is carried out in the Seychelles Port of Victoria. (Other regional ports where the tuna is transhipped include Mombasa and Antsiranana (Diego).

The main priority of Government concerning the Industrial Fishery is to develop its own tuna fishing capability in particular since it has a Tuna Canning Factory requiring 15,000 - 20,000 tons of tuna annually

Research Programmes

The SFA has a 22 meter research vessel which conducts several ongoing research programmes. These include development of new fishing techniques, and collection of biological data for stock assessment purposes. Some of the research programmes of the Agency include:-

-Catch Assessment Survey - collection of Artisanal Fisheries Statistics which are published on an annual basis;
-Trap fisheries stock Assessment - collection of Length Frequency/biometric data for Siganus sp. and Lethrinus sp. in 1993. Data collected will be utilized to make a preliminary stock assessment of these species.
-Fish stock assessment of major commercial species of groupers and snappers have already been published but research is still ongoing for these and other commercial species.

Aquaculture

A pearl oyster spat collection programme has indicated interesting potential for future pearl oyster culture. A giant clam farm has now been in operation for the last 3 years and has gone into production with the spawning of 80,000 larvae.

Spiny Lobster

A research and management programme has been started since 1992 with the opening of a limited 2 months fishing seasons.

ORSTOM

This is a French body undertaking scientific research mainly on tuna and oceanography which works in close cooperation with scientists from the Seychelles Fishery Authority. In addition ORSTOM also coordinates the Regional Tuna Project funded by European Community (EEC).

Summary

1.National priority is to develop the industrial tuna fishing capability.

2.To establish management plans, in particular for the inshore and for coastal waters. The Government feels that in view of its increasing human pressure on living resources the implementation and enforcement of these management plans will be crucial for sustainable development of both the inshore and offshore fishery. In this context priority is being given to review and update the present fisheries legislation. There is presently an urgent need to enforce this legislation and monitor their implementation so that the management plans can be effective.

M. NGOILE,
INSTITUTE FOR MARINE SCIENCE
TANZANIA

POLICY:

Tanzania is committed to the protection and sustainable utilization of her living resources. The national commitment, which has recently been enhanced by the UNCED discussions, is expressed by the development of Environmental Policy and the national conservation strategy. These processes are at different stages of implementation. the Zanzibar Environmental Policy has been adopted by the Government and the environmental legislation is in preparation. The policies and legislation call for an integrated approach in the protection and management of coastal and marine resources.
The management of the fisheries resources is guided by:-
-On the mainland of Tanzania - the Fisheries Act of 1970 and the Fisheries Regulations of 1975.
-On the Islands of Tanzania - the Fisheries Act of 1989.

Also in preparation is the Marine Parks Act for the mainland and the Nature conservation Trust for the Islands. The environmental policies and subsequent management plans being developed in Tanzania are based on scientific information which is being collected by the institutions in the country. The type of information being collected relevant to OSLR include:-

OSLR RESEARCH ACTIVITIES

Baseline Surveys on Coral Reefs:

These surveys included the laying of permanent transects on some of the coral reefs on Unguja Island, Zanzibar and the proposed area for the marine park on Mafia Island, Tanzania mainland. These studies have assisted in the formulation of the environmental policy for Zanzibar Islands and the marine parks act and together with the management plan for Mafia Island Marine Park. The permanent transects on Unguja Island are being monitored on an annual basis. Other studies include surveys on Misali Island, Pemba, Zanzibar and the Fumba Peninsular on Unguja Island. The latter is for providing information on the state of the reefs especially with regard to the fish populations to allow community based management on the reefs. Coral reef research and monitoring will continue in Pemba, Unguja and Mafia Islands.

Fish Stock Assessment.

Fish landing, statistics is being collected by the Departments of Fisheries both on the mainland and the Islands as part and parcel of getting estimates of annual landings and the revenue generated by this sector. The scientific activities include studies on the biology and population dynamics of small

pelagics, age and growth of sail fish, inventory of the species which support the holothurian, assessment of the prawn stocks (Rufiji Delta), fishery and reproductive biology of squid, the dynamics of trap fishery.

Mangroves:

The mangroves of Tanzania have been surveyed. Aerial surveys with ground truthing have been conducted on Tanzania mainland. The outcome of these surveys is a comprehensive management plan for the mangroves on Tanzania mainland. A detailed study on the mangroves of Chwaka Bay, Zanzibar has been completed as a Ph.D. thesis. Other studies include the transport of materials (nutrients, and organisms) between mangroves, seagrasses and coral reefs.

Other Studies:

Zoo and phytoplankton studies, primary productivity, seaweed culture and its impact, pollution and the its effect on living organisms, location of nesting grounds of turtles, etc.

CAPACITY BUILDING:

Undergraduate Training:-

The University of Dar-es-Salaam, Department of Zoology and Marine Biology offers courses leading to Bachelor of Science degree with major in marine Biology.

During the 1st year zoology courses are taught to undergraduates to prepare them understand the basics of animal science before they begin to specialize the Marine Biology major from the second year the students also take courses in Botany where they study courses such as phycology.

During 2nd year those who major in Marine Biology take the following courses:-
-Physical and chemical oceanography
-Ichthyology.
-Primary and secondary production limnology
-Marine Biology Field Course.

During 3rd year the students take the following courses:-
-Marine Benthic ecology
-Marine Resources
-Aquaculture
-Sea Fisheries Biology
-Estuarine ecology
-Marine Pollution
-Biology of crustaceans

The Faculty of science offers postgraduate degrees by research in marine sciences including research in physical oceanography, marine pollution, marine chemistry, marine botany, marine fisheries. The researcher being conducted have a strong emphasis on sustainable utilization of resources and management.

The Institute of Marine Science, which is part of the University of Dar-es-Salaam but based on Zanzibar Town, provides the platform and facilities for the research work by the postgraduate students and also the undergraduate marine field course.

M. BOROBIA
UNEP REPRESENTATIVE

It is with great pleasure that UNEP is participating at this meeting, attesting to the long standing cooperation with IOC in many issues concerning Oceans. It is also an excellent opportunity to reiterate our position in relation to the Ocean Science and Living Resources (OSLR) programme stated by UNEP representative to the 25th IOC Executive Council meeting which encouraged " strengthening in the

coordination between the OSLR programme of IOC and the Marine Living Resources component of our Oceans Programme".

The "protection of marine living resources" is, by decision of our Governing Council, one of the three components constituting UNEP's Oceans programme. Recognizing FAO's role and mandate, UNEP has concentrated on species and ecosystems which are not commercially exploited by fisheries. A large part of the activities undertaken by the Oceans and Coastal Areas Programme Activity Centre (OCA/PAC) in the framework of this component are directly related to the conservation of marine biodiversity and living resources. Of particular interest to this meeting are activities carried out as contribution to the implementation of the Protocol concerning Specially Protected Areas and Wild Fauna and Flora in the Eastern African Region adopted in 1985 by the parties to the Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region and those under the Global Plan of Action for the Conservation, Management and Utilization of Marine Mammals (MMAP). These activities in the in the region are directly related to marine mammals, critical marine habitats and their living resources and are an integral part of UNEP's programmes also contributing to the implementation of Chapter 17 of Agenda 21 on Oceans and the Convention of Biological Diversity for which UNEP provides the interim Secretariat.

As such, coordination between our activities in this area is very desirable and we reiterate once again, our willingness to cooperate with the IOC Secretariat in issues of mutual interest covered by our Regional Seas Programme.

Inventory of critical marine habitats in the Eastern African region

The objectives of the above mentioned Protocol are " to protect and, as appropriate, improve the state of the wild flora and fauna and natural habitats of the Eastern Africa region, among other means by the establishment of specially protected areas. To assist Governments in the implementation of this protocol and as a contribution to the Eastern African Action Plan the following activities are on-going:

Indian Ocean Coral Reef Initiative

UNEP-OCA/PAC, in collaboration with the IUCN and SAREC, has initiated a process for the development of a Regional Strategy for the Protection and Management of Coral Reefs and associated Ecosystems of the East African Region. A regional meeting of experts/workshop is to be held in Nairobi during November 1994 (date yet to be determined) to gain agreement on a Common Methodology for the Monitoring and rapid Assessment of Coral Reefs of the East African Region and procedures for developing a strategy document. The existing Regional Seas Programme structure will be used for the development and implementation of the strategy. It is intended to extend the strategy to the entire Indian Ocean region in the future.

Eastern African Coastal and Marine Environment Resource Database and Atlas

The Eastern African Coastal and Marine Environment Resource Database and Atlas is a project coordinated and funded by the Regional Seas programme of UNEP with the support of leading institutions in the region and the Belgian Government and it is carried out in the framework of the Eastern African Action Plan. The main task of the project is to collate existing information on natural resources and to summarize this information in country map sheets. Information relevant to the country maps will be stored in a Geographic Information System (GIS) data base, allowing regular updating. Biological resources include ecosystems such as coral assemblages, mangroves, estuaries etc.. and endangered species (both plant and animal) as well as commercial fisheries. A 100 page text book with general coverage of parameters considered by the project will accompany the Atlas. Phase one has concentrated on Kenya, having KMFRI as the lead collaborating agency and it is expected to be completed in 1994.

Two reports have been published under the Regional Seas Reports and Studies Series which are of relevance to this GE-OSLR:

UNEP/IUCN. Conservation of coastal and marine ecosystems and living resources of the Eastern African Region. RSRS No. 11. UNEP 1982. 83pp.

UNEP/IUCN. Marine and coastal conservation in the East African region. RSRS No. 39. UNEP 1984. 290pp.

Conservation and Management of Marine Mammals

The Global Plan of Action for the Conservation, Management and Utilization of Marine Mammals (MMAP) was developed between 1978 and 1983 jointly by UNEP and FAO, in collaboration with other inter-governmental and non-governmental bodies concerned with marine mammal issues, and was adopted by UNEP in 1984 (Governing Council decision 12/12 I of 28 May 1984). As envisaged by the Plan (recommendation No. 36), major international agencies concerned with marine mammals were invited to join in a Planning and Co-ordinating Committee (PCC), composed of both Intergovernmental (UNEP, FAO, IOC/UNESCO and IATTC) and Nongovernmental organizations (IUCN, WWF, Greenpeace and IFAW) through which they co-ordinate their work in this field. All are signatories to a Memorandum of Understanding with UNEP on co-operation in the implementation of the MMAP concluded in December 1991. UNEP has assigned a Secretary to the Action Plan since 1985.

The basic objective of the Plan is to promote the effective implementation of a policy for conservation, management and utilization of marine mammals which would be widely accepted to governments and the public. The MMAP is built around five concentration areas, namely, policy formulation, regulatory and protective measures, improvement of scientific knowledge, improvement of law and its application and enhancement of public understanding.

UNEP efforts in the Eastern African region have increased following a Regional Training Workshop on Marine Mammal Conservation held at UNEP HQ in 1991. Since then, a number of activities have been since proposed by national organizations to improve current state of knowledge needed for sound management. These have concentrated in: (i) assessment of interactions between marine mammals and coastal artisanal fishery operations (principally gillnets) with monitoring of incidental catches; (ii) awareness campaigns; (iii) preliminary sighting surveys aimed at obtaining information on distribution and occurrence.

To further assist in the enhancement and capacity of Eastern African countries to cooperate for the study, conservation and management of marine mammals, UNEP will encourage the development of a regional management plan for the endangered dugong (also in line with Article 4 of the Protocol Concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region).

D. ELDER
IUCN MARINE AND COASTAL CONSERVATION PROGRAMME IN EASTERN AFRICA

The IUCN Eastern Africa Regional Office (EARO) initiated a Marine and Coastal Conservation Programme in August, 1992. This programme was prompted largely in response to the overwhelming emphasis on land-based ecosystems, wildlife and protected areas in East Africa, and the crucial need for conservation action in the seas of the region.

The IUCN Eastern Africa Marine and Coastal Conservation Programme (EAMCP) is attempting to catalyze a Western Indian Ocean Marine Biodiversity Programme that would comprise the following four principal components:
- a coral reef initiative
- a threatened species initiative
- marine protected areas initiative; and

- integrated coastal zone management.

These components are addressed by the EAMCP at three levels: regional, national and sub-national.

At the Regional level EAMCP is focussing on:

1. Western Indian Ocean Coral Reef Programme.

The EAMCP has catalysed interest among SAREC, IMS Zanzibar, UNEP OCA/PAC and others to collaborate in developing and implementing a comprehensive series of activities aimed at reef conservation in the WIO. A preliminary meeting held in July in Zanzibar is soon to be followed by one hosted by UNEP OCA/PAC in Nairobi. The objective of this second meeting will be to gather together reef scientists of the region to discuss and agree on a standard methodology for rapid reef assessments.

2. Turtle Action Plan and Training

At the urging of the Kenya Wildlife Services (KWS), EAMCP has undertaken to convene a workshop on turtles that will both lead to formulation of a regional action plan and enable "hands-on" training on turtle research and management. EAMCP is exploring convening the workshop along the Tongaland coast of South Africa in collaboration with the Natal Parks Board, the Queensland National Parks and Wildlife Service of Australia and the Marine Turtle Specialist Group of IUCN.

3. Marine Protected Areas

As a follow-up to the global review of marine protected areas (MPAs) undertaken by the IUCN Commission on National Parks and Protected Areas, for the World Bank, EAMCP has stimulated interest in having the WIO as a first region for follow-up. This initiative is still in the early stages of formulation.

At the National level, EAMCP is directly involved in the following activities:

1. Kenya Coral reef GIS and Management Strategy

EAMCP is working with KWS and KMFRI in the development of this project.

2. Turtle Training and Advice

EAMCP has responded to requests by KWS for assistance with their turtle programme by:-
- a one day training course;
- advice and materials on request;
- drawing the Kenya turtle activities into a broader regional programme and the global turtle action plan of the IUCN Marine Turtle Specialist Group.

3. Dugong Aerial Survey and Observer Training

EAMCP (together with UNEP OCA/PAC, Eden Wildlife Trust, Centre for Dolphin Studies and the IUCN Sirenian Specialist Group) is helping KWS plan and implement a training programme for pilots and other observers of the KWS Airwing. This activity will lead to an intensive two-day survey of the entire Kenya coast in November 1994 for dugongs (as well as turtles and cetaceans).

4. Biodiversity Conservation and National Parks Seychelles

EAMCP will implement a joint project in Seychelles, with funding from the EU starting in January 1995 aimed at Marine Biodiversity Conservation. In addition to reviewing and revising the National Conservation Strategy of Seychelles, the project will develop management plans for several marine protected areas.

At the sub-national level, EAMCP is involved in two main activities:-

1. Rehabilitation of Curieuse Island National Marine Park

This project, which is supported by France, is in its second and final phase before full

implementation of management activities.

2. Tonga Integrated Coastal Zone Management

In 1987 IUCN coordinated a study of the Tonga coast resources, their uses, and the status of the environment. EAMCP has worked with the Regional Government authorities of Tonga to assist them develop a comprehensive ICZM project for the entire 150 km coast.

Full funding for the first three-year phase of the Project has been secured from Ireland, and the Project began in mid-July, 1994. EAMCP has provided four technical advisers to this project and provides technical back-up to the Tanzanian Project Manager, his staff and the technical advisers.

ANNEX VI

RECRUITMENT AND FISHERIES MANAGEMENT, DEFINITION; IMPACT OF RECRUITMENT ON THE VARIABILITY OF THE EXPLOITED MARINE POPULATIONS; FACTORS AFFECTING RECRUITMENT

Patrice Cayré

DEFINITIONS

The abundance of exploited populations is very often naturally highly variable; under certain circumstances, this can have dramatic consequences in the economic and social fields concerned by fisheries.

The usual methods for modelling appear quite inefficient/inappropriate to represent and predict this variability, and to give pertinent indications for the management of fisheries. After almost a century of active research, the mechanisms of recruitment remain widely unknown for most species because little is known of the causes of this variability of recruitment.

Recruitment in this context indicates the total number of young fish entering the fishing ground for the first time, thus becoming available, and in some conditions, vulnerable, to fishing.

In the vocabulary and concepts used in fish stock assessment, the word **cohort** is used in relation to recruitment, and the following is a definition of the word in this context:

- a cohort is made up of all young fish born during the same spawn. A cohort is a synonym of **year class xxx** when there is a single, limited spawning season during the year. For tropical species there are generally several spawning seasons and batches of eggs produced. In this case, **micro-cohorts** for each batch occur within the same year, and compose the **age class** of the year.

- a cohort passes from one **age group** to the next. The first year will be noted as 0 and following ones 1,2,3 etc.

The age at recruitment, noted as **Tr**, is the age at which the young recruit becomes available to fishing gear. Different ages of recruitment should be considered for each type of fishing gear; practically speaking, the age at recruitment is the mean age at recruitment for all the different types of fishing gear.

The recruit can be available (i.e., present in the fishing grounds) but not vulnerable to fishing gear (e.g., the mesh size of the trawl net is too large to catch these recruits); in such a case, a distinction must be made between the age at recruitment, **Tr**, and the age at first capture, **Tc**. The portion of the catchable population is then comprised between Tc and Tm, (maximum size or age catchable by the different types of fishing gear).

The global model used for stock assessment considers that recruitment is controlled by the biomass of adult stocks at a given moment, or sometimes several years before the time of recruitment.

Structural models used for stock assessment, especially the yield per recruitment model, consider that the total volume of biomass of recruits entering the fishery each year, noted as **Br**, is independent of the biomass of the genitors, and thus cannot be affected by exploitation, unless **Br** reach a given very low level. In other words, recruitment cannot be affected by any regulation or assessment of the fishery, if

the total biomass of the adult reproductive biomass remains over a critical level. Cushing (1973, 1977), Jones (1977) and several authors put forward **compensatory mechanisms** which are under control of the density of the population to explain this relative stability in recruitment. These mechanisms act through the biology and physiology of the population: survival of larvae, growth, natural mortality, fecundity, etc. If the stock is reduced too far, the numbers of recruiting fish are reduced, and the stock is further reduced.

Many scientists involved in stock assessment consider that the simplest form of regulation of a fish population is in the density dependent growth of adults. Then, recruitment is very often considered as stable and constant in the models.

Obviously, recruitment is a biological process controlled by both the population, and, in great part, by the environment. It then appears very unrealistic to consider the recruitment as stable and constant, without, at least, taking into account environmental factors as a prime explanation.

MAIN PROCESS DETERMINING THE SUCCESS OF RECRUITMENT

Several processes summarized by Lasker (1989) can be invoked as determinant to the success of recruitment. Obviously, we can consider that they are derived from the Hjort's hypothesis (1914, 1926):

The hypothesis of the **critical period** (Hjort 1914,1926) states that the strength of a year class will be fair if the hatching of eggs matches the bloom of the nutrients which are of vital importance to the feeding of larvae. Many research actions undertaken in recent years in this respect, are more tentative than decisive; they indicate the complexity of the mechanisms which determine the recruitment. The following new-hypothesis or elements of explanation represent the main scientific advances.

The **ocean stability** hypothesis (Lasker, 1981). Circulation, winds, currents and the general process and conditions which determine the local dynamics of the ocean in spawning grounds where the larvae are released, must be convenient for accessibility (distribution, concentration) of nutrients.

The **match/mis-match** hypothesis (Cushing, 1975) states that the hatching of eggs must match the bloom of nutrients.

The **larval transport** hypothesis (Parrish *et al*, 1981) states that, for spawning, the reproductive portion of the population must avoid the area where currents tend to disperse larvae or transport them to zones where conditions of larval development and nutrition are not convenient. Iles and Sinclair (1982) developed this hypothesis when showing how the existence of "retention areas" are determinant to the recruitment of small pelagics.

The theory of **vagrants** in a population (Sinclair, 1988) points out how the reproductive strategy is important for the conservation of a given population. It shows that in a highly dispersive environment, there must be a critical number of individuals which must return to the place where they were born. The number and size of a population of the same species would be controlled, determined, and linked to the number and volume of hydrological features convenient for reproduction. Variations in the couple physiology-biology should determine the variability of recruitment.

FLUCTUATIONS OF ABUNDANCE AND RECRUITMENT

The main questions which arise are:

For a given species, what is the importance of the variation of the recruitment?
Which are the natural factors which control or influence recruitment?
Is it pertinent to initiate a research programme targeted on the factors controlling the recruitment,

with the hope and object of identifying a method to predict recruitment?

To answer these questions two situations have to be considered: a constant and stable recruitment, and a variable recruitment; below follows an analysis of the mechanisms responsible for this stability, and/or variability.

Stable recruitment

Species living in a given ecosystem have their own biological characteristics and dynamics. These characteristics alone will affect the demography and abundance of the reproductive biomass, when there is no exploitation, or a very reduced one. The reproductive biomass will control the number of eggs released, and for a larger part, the recruitment and abundance of the population an equilibrium level, depending on interactions with other species of the ecosystem, and the competition between the different ages of the species.

If all the environmental and biological factors which affect and constitute the ecosystem are stable and do not fluctuate, a constant recruitment can be explained by continuing production of eggs. This situation is never observed.

The explanation of constant recruitment is due to random fluctuation of several factors and parameters. It can therefore be deduced that there exists a mechanism which tempers and regulates the fluctuations of all these parameters, and provokes constant recruitment.

Variable recruitment

In this situation environmental factors which influence the ecosystem are responsible for the fluctuation of recruitment. These environmental factors can act at different levels:

(i) the biology and physiology of the adult (reproductive) part of the population. The availability and quality of food, dependent upon the environment, can have a direct impact on fecundity (e.g., tropical small pelagic species).

(ii) the variability of the environment do not affect the reproduction of the species, but affect the hatching of eggs and the survival of the larvae. Recruitment will then be controlled by:

- a) the hydrological environment affecting the survival and development of larvae;
- b) the synchronism between the availability and bloom of the food necessary to the development of the different early stages;
- c) the ratio between the abundance of larvae and the abundance of the food available
- d) cannibalism between the different stages of development of the species;
- e) predators action (by other species)
- f) diseases.

Each one of these factors and processes can act collectively or independently. Most of the time they act collectively. For instance, if larvae are affected by a, b or c, they will have more chance to be affected by the others.

(iii) the environmental parameters affect both adults and early stages.

In conclusion, five types of recruitment regulation are distinguishable:

A. the recruitment mostly depends on the fecundity of the adult part of the population when the environmental factors and competition within the species, and with other species are stable. This is a very theoretical and unrealistic case;

B. recruitment depends on the fecundity of the adult part of the population, and on environmental factors, but there is a regulating factor in the ecosystem mechanisms which induce constant recruitment;

C. recruitment is mainly a function of the fecundity of the adult part of the population, and this fecundity is affected by the environment;

D. recruitment is mainly influenced by the environment which controls and influences only the early stages, but does not affect fecundity.

E. recruitment depends on fecundity and also on the survival of eggs and larvae.

Consequences

(i) If a species shows a constant recruitment from year to year, situation B must be considered, and the regulatory mechanism or factors must be investigated.

(ii) If the recruitment is highly variable, situations C, D, or E must be considered; generally E is the most frequent. Nevertheless, in tropical areas, situations C or D seem to be realistic (e.g., *Sardinella Aurita*, case C; tropical tunas, case D).

CONCLUSION

The variability of recruitment appears to be mainly a consequence of the reproductive strategy of the species, and of the variability of the environment. The early stages are potentially mostly affected, and their pelagic behavior is determinant to the success of the recruitment.

The mathematical models and methods in use are mostly too inefficient to represent the biological reality and mechanisms governing the recruitment. The main results obtained in practical stock assessment are those which give some indication of the critical abundance level under which the adult population must not fall in order to ensure recruitment, and so allow exploitation.

For fisheries restricted to islands or banks, the geographic scale which determines the recruitment could be of greater importance than the time scale variability. A long pelagic phase in the development at the early stages could be of major importance in regard to any local or restricted measures, regulation and research.

The comparative strategy seems the most appropriate to investigate recruitment, its mechanisms and its determinism. As a general observation, differences in recruitment of stocks of fish appear to become pronounced from decade to decade (e.g., the Russell cycle described in the English Channel between 1925 and 1979). The feasibility of undertaking a research programme on recruitment must be very well evaluated due to the complexity of the topic. Many other factors than recruitment may be determinant for fisheries (e.g. economic ones). is also of key importance to identify and separate the variability induced by climate and environment on resources, from the effects of fisheries or economy upon the exploitation.

ANNEX VII

REGIONAL PRIORITIES IN RELATION TO RESEARCH ON MARINE LIVING RESOURCES

RESEARCH STUDIES & METHODOLOGY IMPROVEMENT
Development of an inshore sampling programme for LME oriented studies, to measure species abundance, circulation, productivity, biomass, biodiversity, stock levels, and gather data on age, growth and size.
Improvement of techniques for resolving seagrass beds from satellite images.
Standardization of coral reef research methodology
Compilation of inventories of marine species as inputs to the Biodiversity National Inventories called for by the Convention on Biological Diversity
Availability of research vessels for oceanographic research
Participation of IOCINCWIO scientists in the Nairobi Conference on Sustainable Development of Fisheries in Africa, UNEP Headquarters, August 1995, with the view to present results of relevant OSLR activities in the Region.
DATA COLLECTION AND EVALUATION
Workshop on collection and comparison of available data on marine critical habitats
Collection of catch-effort data on coral reef and lagoon based fisheries including length frequencies for time series analysis, and oceanographic data.
Documentation on already introduced or proposed introduced marine species in the Region, and establishment of a mechanism for monitoring potential introductions, including a review of ongoing monitoring.
Preparation and update of an inventory of fishing gear used in the Region, to be based on existing literature
Establishment of a system of coastal oceanographic monitoring stations
TRAINING & CAPACITY BUILDING
Training on scientific methods to be used in oyster and shrimp farming.
Training on marine mammal surveys
Training on Environmental Impact Assessment Studies (EIA)
Participation of regional scientists to the Fundamental and Applied Marine Ecology (FAME) Course, to be based at KMFRI, Mombasa with the involvement of several universities in the Region.
Training on the coupling of physical-ecological processes

ANNEX VIII

IOCINCWIO GE-OSLR WORK PLAN 1995-1997

PROGRAMME ACTIVITIES OF HIGH PRIORITY	ESTIMATED COST	PARTICI PANTS	FOCAL POINT / CO-ORDINATOR	IMPLEMEN TATION DATE / TIME FRAME
GENERAL				
Preparation of Marine Science Country Profiles	to be estimated	All	IOC - ROSTA	1994-95
Support the establishment of a regional marine science e-mail network	xxx	All	IOC Secr.	a.s.a.p.
IOCINCWIO GE-OSLR-II	$ 20.000	All	IOC University of Mauritius	1996
Inventorying of Critical Marine Habitats				
I. Coordinate with UNEP to avail data (satellite images and database) on seagrass distribution II. Prepare a project proposal for ground truthing of registered seagrass distribution	no cost no cost	All	IOC Secr. KMFRI in coop with UNEP, IUCN and IOC	Oct-Nov 1994 Jan-Feb 1995
FISH STOCK ASSESSMENT				
Identification of new approaches to catch assessment surveys and update of existing surveys on major exploited species (coastal fish/shellfish)	cost to be estimated	All	Chairman GE-OSLR	1995-97
Training course on catch landing statistics for off-shore tuna fisheries	$ 5.000	main land states	IOC to approach ORSTOM	1995-96
Participation of two IOCINCWIO scientists in the IOCEA Training Course on Acoustics	$ 5.000	All	IOC Secr.	1994

LARGE MARINE ECOSYSTEMS				
Organization of a LME Planning Meeting to: • formulate LME core monitoring programme •formulate in-shore sampling programme •exploration of feasibility of establishing a CPR route in the Region •prepare statement on the LME concept and planned LME programme activities in the Region, for the Ministers Meeting, Seychelles, 1996 Preparation of background information and suggestions for elements of on operational LME programme	$ 10-20.000	All	Organization : Chairman GE-OSLR Funding and cosponsorship: IOC to co-ordinate with UNEP, FAO, IUCN, NOAA (USA), ORSTOM (France) Task team: J. Largier & N.J. Ntiba	First half 1995
Capacity building on physical oceanography in relation to ecological processes: •Training •Review of existing knowledge	cost to be estimated	All	IOC to invest. poss. through the post graduate programme of University of Gothenburg IMS in coop with IOC	1994-95 1995-97
HARMFUL ALGAE				
Training Course on the Taxonomy and Biology of Harmful Marine Phytoplankton. IOC Manual on HAB will be available for the Course.	$ 20.000 SAREC	All	University of Mauritius, IOC	Summer 1995

MARINE MAMMALS				
Documentation of sighting of whales in WIO: •call for interest in the Region through WIOMSA	no cost first phase	All	UNEP WIOMSA	1994
Pilot project on status of dugongs and their interaction with seagrasses off Tanzania and Kenya	$ 15.000 donor to be id.		Tanzania - IMS Kenya - KMFRI	1995-97
BIODIVERSITY				
Compilation and publication of a Check Lists on species diversity in: (i) mangroves (ii) coral reefs (iii) seagrass beds to be based on existing literature	$ 15.000 IOC-ROSTA	All	KMFRI through institutions in the Region	1995

82. Second Meeting of the UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
83. Seventh Session of the JSC Ocean Observing System Development Panel
84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region