

**LAND-OCEAN INTERACTIONS IN THE COASTAL ZONE (LOICZ)**

Core Project of the  
International Geosphere-Biosphere Programme: A Study of Global Change (IGBP)



The logo for WOTRO features the word "WOTRO" in a green, sans-serif font. A stylized green wave or arrow shape is positioned above the letter "O", pointing upwards and to the right.

REPORT OF THE  
**WOTRO/LOICZ WORKSHOP: LOICZ IN AFRICA**

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**LOICZ MEETING REPORT No. 10**

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## **SUMMARY REPORT**

### **1. Official Opening of the workshop & Welcoming remarks**

1.1 Dr M. Ntiba, convenor of the local organising committee, called the workshop to order and invited Professor L. Ogallo, Chairman of the Kenyan National LOICZ Committee to welcome participants on behalf of the committee.

1.2 In welcoming participants Professor Ogallo, expressed his appreciation of the opportunity provided to the Kenyan National IGBP committee and the Kenyan LOICZ Committee to host the first workshop in Africa concerned with the implementation of the LOICZ Core Project of the IGBP. He hoped that participants would have the opportunity to visit other parts of Kenya and that the workshop would be successful in developing a regionally co-ordinated research programme to address the critical issues facing the coastlines of Africa and the research goals of LOICZ.

1.3 Dr J.C. Pemetta, Project Manager, of the Land-Ocean Interactions in the Coastal Zone (LOICZ) Core Project of the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU), welcomed participants on behalf of the financial co-sponsors of the meeting, namely the LOICZ Core Project of the IGBP and the Netherlands Foundation for the Advancement of Tropical Research (WOTRO). He apologised on behalf of Dr Renée van Kessel of WOTRO, who was unfortunately unable to attend the workshop and to whom he would be reporting the outcome on his return to the Netherlands. Dr Pemetta noted the co-sponsors were anticipating that the meeting would identify the priorities for LOICZ research in Africa, and that both the sponsors and the IGBP expected the workshop to result in a clearly articulated set of research activities for implementation in the region.

1.4 Professor Ogana, Honorary Secretary of the Kenyan National Academy of Sciences welcomed participants on behalf of the National Academy and the Kenyan National IGBP Committee and apologised on behalf of the Chairman, Professor S. Wandiga, whose flight from West Africa had been delayed. He presented Professor Wandiga's address in which he noted the importance that the international community placed on sustainable development of the coastal zone through such agreements as Agenda 21, adopted at the United Nations Conference on Environment and Development held in Rio de Janeiro, in 1992. He noted the increasing pressure on coastal areas and resources and that these pressures were resulting in rapid rates of change to the coastlines of Africa. Professor Wandiga's address is attached as Appendix A to this report.

1.5 Professor Ogana then called on Professor K. Mutahi, Permanent Secretary, Ministry of Research, Technical Training and Technology to address the participants and to formally open the workshop.

1.6 In opening the workshop, Professor Mutahi thanked the co-sponsors for their financial support that had made the meeting possible and expressed the hope that this collaboration would continue beyond the workshop, which marked the start of LOICZ research activities in Africa. Professor Mutahi noted the importance of the coastal zones to the economies of African countries; that the populations of these countries doubles every twenty years; and, that as a consequence, the human driving forces of change in the coastal zones were likely to increase quite rapidly over the next few decades.

1.7 Professor Mutahi expressed the hope that the workshop would result in the development of an appropriate research agenda which would enable policy and decision makers to understand the nature of present changes, in order that rational development and management of coastal areas could be subsequently implemented. Professor Mutahi's address is attached as Appendix B to this report.

### **2. Administration & Organisation of the workshop**

#### **2.1 Administrative and organisational matters**

2.1.1 As Chairman of the session, Professor Ogallo invited Dr Pemetta to brief participants on the organisational and administrative matters relating to the conduct of the meeting. Dr Pemetta indicated that the workshop was expected to result in the production of a formal report (this

document) which would serve as a record of the discussions and agreements reached during the workshop. This report would be approved by the participants prior to closure of the meeting. To ease the job of the rapporteurs he kindly requested that all participants provide the rapporteurs of each session with a brief synopsis, in writing, of their interventions.

2.1.2 Dr Pemetta introduced the documentation prepared for the meeting and indicated that additional documents tabled by participants would be duplicated and circulated as background information for use in the discussions.

## **2.2 Purposes and expected outcome of the workshop**

2.2.1 Dr Pemetta informed participants that the co-sponsors expected the workshop to produce a well co-ordinated outline for LOICZ research in Africa. By the end of the meeting a final framework proposal for regionally co-ordinated research should be produced and agreed by the workshop participants prior to closure of the meeting.

## **2.3 Introduction of workshop participants**

2.3.1 Professor Ogallo invited participants to briefly introduce themselves and their interests in coastal research. A full list of participants is attached as Annex I to this report.

## **2.4 Introduction of the Co-Chairs of the workshop**

2.4.1 Dr Pemetta proposed on behalf of the co-sponsors, that Dr E. Okemwa and Dr L. Awosika be asked to co-chair the meeting since they had acted as convenors of the African regional discussions at the Second LOICZ Open Science Meeting in Manila, in April, and were therefore in a position to guide the workshop towards its goals. The workshop participants accepted Drs Okemwa and Awosika as co-chairs and noted that they would assume their responsibilities at the commencement of the afternoon session.

## **2.5 Approval of the workshop draft agenda and draft programme**

2.5.1 Professor Ogallo invited participants to consider the draft agenda for the meeting which was approved and is attached as Annex II to this report. Annex III provides a list of documentation available to the workshop.

## **3. Background to the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU) and to the Land Ocean Interactions in the Coastal Zone (LOICZ) Core Project of IGBP**

3.1 Dr Pemetta outlined for the participants the organisation, structure and research agenda of the International Geosphere-Biosphere Programme: A study of Global Change, which was established by the International Council of Scientific Unions in 1986. The programme is organised around a series of scientific questions and uncertainties concerning the functioning of the Earth System under conditions of global change. He informed participants that these scientific questions and uncertainties were addressed by Core Projects, each of which was centred on a Core Project Office (CPO), funded through national sources. The Core Project Offices served as the point of liaison with the national research communities and as the co-ordination centre for the implementation of the research agenda.

3.2 The entire IGBP programme is overseen by a Scientific Committee (SC-IGBP) which is responsible for the integrity of the programme as a whole, and for oversight of the Core Projects and Framework Activities. The three Framework Activities provide the mechanism for integrating the results of the Core Projects: the Data and Information System (IGBP-DIS) provides guidance on data matters including collection, management and exchange; the Global Analysis Interpretation and Modelling (GAIM) framework activity aims to integrate the results of the programme and to provide an Earth System perspective; while the System for Analysis Research and Training (START) provides the mechanism for regional level co-ordination and aims to support global participation in the IGBP research agenda.

3.3 Dr Pemetta informed the workshop that the Core Project Office for LOICZ was located in the Netherlands Institute for Sea Research and that although it was generously funded by the Netherlands Government, this funding was for the co-ordination and management functions and not for funding the research work directly. One function of the Core Project Office was however, to broker projects on behalf of developing country scientists and to facilitate the transfer of the necessary resources to enable their participation in the project. In addition, the Office aimed to foster linkages between developed and developing country scientists in addressing the LOICZ research agenda. He noted that the LOICZ office had opened in November 1993 and that following completion and publication of the Implementation Plan, research activities had commenced in Southeast Asia centred on Focus 4 of the LOICZ Implementation Plan.

3.4 The work of the LOICZ Core Project is guided by an International Scientific Steering Committee, that had determined the initial priority area for research as being centred in the Southeast Asian region. In addition, the Steering Committee had directed the Core Project Office to attempt to mobilise support and activities in as wide a range of countries as possible. The present workshop "LOICZ in Africa" had therefore been convened to explore the nature of the African regional priorities from within the wide research agenda laid out in the LOICZ Implementation Plan.

3.5 During discussion it was noted that the pool of qualified coastal scientists in Africa was not large and that many individuals were involved in a wide variety of international programmes and initiatives. To avoid duplication of effort and to ensure the optimum use of scarce human resources, LOICZ has entered into a memorandum of understanding with the Intergovernmental Oceanographic Commission (IOC) and was collaborating with UNEP's Regional Seas Programme and with IUCN-The World Conservation Union to ensure that the planned activities of these organisations did not conflict, and that where possible, existing regional networks of coastal scientists would be used to implement LOICZ. This was viewed as a more cost effective mechanism for co-ordinating LOICZ activities at a regional level, rather than creating new networks which duplicated existing systems and placed additional burdens on the limited pool of expertise in the region.

#### **4. Background to IGBP Framework Activity, System for Analysis Research and Training (START)**

4.1 Professor Eric Odada, START/ENRICH Liaison Officer provided the workshop participants with an overview of the START Framework Activity of the IGBP, and of the ENRICH initiative of the European Commission, including their objectives, functions and role in promoting Global Change Research and capacity building in the African Region.

4.2 ENRICH was launched by the Commission of the European Union to support policy objectives relating to global change issues. Its major role is to facilitate collaboration between developed and developing countries and to develop a critical mass of resources and capabilities for global change research, drawn from both the industrialised and developing countries including Africa.

4.3 One of the programmes of the Commission that is addressing LOICZ related research is the "European Land Ocean Interaction Studies" (ELOISE) programme. This programme is not restricted to research within Europe but provides opportunities for studies outside Europe, and for non-European partners having interests and ongoing activities in various aspects of global change and coastal systems to collaborate with European partners. In Africa there exist numerous opportunities for such research and concerted efforts must be made through the LOICZ CPO to develop collaborative studies in global change and coastal science in Africa.

4.4 START is a Framework Activity of the IGBP and its primary roles are to encourage global change research and to develop regional networks of collaborating Institutions.

4.5 In continental Africa, three Regional Research Networks have been established and these cover Northern Africa (NAFCOM), the Mediterranean (MEDCOM), and Southern Africa (SAFCOM). The function of these regional research networks is to provide a regional framework for global change activities including research, training, capacity building, data management, synthesis and modelling, and a mechanism for communication between scientists and policy/decision makers.

4.6 START is addressing key questions of sustainable development by strengthening the scientific basis for sustainable development, improving communications amongst scientific and technological communities and decision makers and the general public at large.

4.7 In conclusion, Professor Odada emphasised the importance of coastal zones as a resource for food production, recreation and tourism, transport and defence which contribute significantly to the economies of developing countries in Africa. However, human activities such as desertification, damming of rivers, poor land use and agricultural practices which occur inland, affect the coast and may alter the role of coastal systems in the functioning of the Earth system as a whole, due to their cumulative effects world-wide. Due to the importance of the coastal zone in Africa the LOICZ CPO needs to work closely with African scientists and overseas development agencies to identify problems and issues affecting the coastal zones of Africa and to address these issues through research as a contribution to the IGBP Global Change Studies.

4.8 Dr Kodjo Amegee, Scientific co-ordinator for the Northern African Regional Committee for START (NAFCOM) then made a brief presentation of the history and functions of this committee. He noted that the area encompassed by NAFCOM included 25 African countries, nine of which have a national global change committee and designated LOICZ contacts.

4.9 The decision to establish NAFCOM was taken during the workshop "Africa and Global Change", held in Niamey, Niger in 1992. Subsequently the International START Secretariat (based in Washington DC, USA) obtained funds from UNDP/GEF to address the following immediate objectives:

- ◆ establish a Secretariat in Accra, Ghana for NAFCOM;
- ◆ develop research agendas for the four topics identified as priorities during the Niamey workshop; and,
- ◆ develop an electronic communications network among scientists in the region and with scientists outside the NAFCOM area.

4.10 NAFCOM has established a regional research centre at the University of Ghana, at Legon and a regional research centre for Past Global Changes (PAGES/IDEAL) has been established at the University of Kenya, Nairobi. Two workshops have been held, publication of the resultant research agendas is in hand, and a regional inventory of scientists in the NAFCOM region is being compiled.

## **5. Introduction of the LOICZ Implementation Plan and the LOICZ research agenda**

5.1 In introducing the LOICZ Implementation Plan and research agenda Dr Pemetta noted that this had been developed by the Scientific Steering Committee and widely reviewed by a network of more than 1,000 scientists in 124 countries. The Plan lays out the research priorities under each of the four foci and provides details of the nature of the research required to address the scientific issues and uncertainties identified by the IGBP as requiring elucidation through the LOICZ Core Project.

5.2 Dr Pemetta provided the workshop with a brief overview of each focus and the manner in which it was envisaged that the Project activities would be co-ordinated through the Core Project Office. He briefed participants on the development of the framework activities of the project (networking, development of a typology, modelling, information and data management) which are seen as the "glue" that holds the project components together.

5.3 In conclusion Dr Pemetta noted that, the Scientific Steering Committee recognised that the regional research priorities would differ in different regions and that it was not anticipated that all research activities would be addressed in all countries, he expressed the hope that the workshop would identify the priority areas for global change research in the coastal zones of Africa and that a coherent and appropriate research framework would be developed by the participants during the course of the next few days.

## 6. Overviews of current research in Africa related to LOICZ

### 6.1 Western Africa

#### 6.1.1 Bénin

6.1.1.1 Dr Kolawolé Adam informed the workshop that since 1987 coastal zone research had been carried out under the guidance of the Coastal Management Committee concerned with coastal erosion, marine pollution and coastal land use. Of these activities only the coastal erosion project had been fully implemented. He informed the workshop that the proposed focus of new coastal research in Bénin was directed towards the implications of sea level rise on socio-economic activities, in line with LOICZ Focus 4. This research proposed to undertake a prospective study of the current dynamics of the coastal environment including assessments of current coastal erosion rates and rates of loss of mangroves.

6.1.1.2 Dr Adam noted that the current LOICZ National Sub-committee was a multi-disciplinary team drawn from the Departments of Geography, Geology and Botany of the University of Bénin, the Centre for Environment and Development in Africa (an NGO) and the Port Authority. The primary long-term interests of this committee were concerned with providing a better scientific understanding of the functioning of the coastal systems and communities in order to provide a sound scientific basis for sustainable management and use of the coastal zone.

6.1.1.3 It was suggested that the coastal erosion problems of Bénin appeared to have their origins in transboundary problems and that hence the understanding of the causes and processes could only be addressed from a sub-regional perspective.

6.1.1.4 During discussion the issue of how to integrate national priorities into regional and global programmes was raised. It was noted that in addition to such problems, the Western African region also suffered from a language barrier between francophone and anglophone countries which mitigated against close collaboration between the two research communities. The possibility of involving organisations such as the African Association of Universities (AAU) and the West African Science Association (WASA) as channels of communication was briefly discussed.

#### 6.1.2 Cameroon

6.1.2.1 Dr Youmbi presented a paper on current research activities carried out in Cameroon in the field of Fisheries and Oceanography. He reviewed the administrative and legislative framework relevant to these endeavours and provided an overview of the physical and biological characteristics of the coastline of Cameroon. He noted the complex river network, numerous industries and problems stemming from coastal agro-industrial plantations and the high density coastal population. The coastal zone and coastal resources of the country are thus subjected to high rates of exploitation and increasing rates of change and degradation.

6.1.2.2. In presenting an overview of current research in Cameroon, Dr Youmbi noted that heavy metal pollution was not significant but that enhanced rates of nutrient inputs from agro-industry and human wastes were significant sources of change in coastal waters. He noted that the major constraint to Cameroon participation in LOICZ research was an inadequate funding base for the small but highly skilled pool of researchers in the country.

6.1.2.3 During discussion it was noted that a number of the issues raised as being important in the coastal areas of Cameroon would be addressed through the Large Marine Ecosystem Project on the Gulf of Guinea (*vide* 6.1.9 below). It was noted however that this project focuses on pollution and biodiversity, neither of which had been identified as a focal area of high priority for LOICZ Research.

#### 6.1.3 Côte d'Ivoire

6.1.3.1 Dr Kouadio Affian provided an overview of the current research capacity and activities in Côte d'Ivoire. He noted that there are three main institutions whose activities encompass the envisaged goals of LOICZ. These are: the Université Nationale de Côte d'Ivoire; Centre Recherches Océanologiques; and, the Centre Ivoirien Antipollution. He noted that there was extensive expertise

in the use of satellite imagery and aerial photographs in the study of coastal geomorphology and the continental shelf of the country; projects concerned with sedimentary processes, the dynamics of mangrove systems; sediment flux from rivers to oceans, atmospheric physics and coastal aquaculture.

6.1.3.2 During discussion the extensive collaboration between Côte d'Ivoire and the Organisation de Recherche Scientifique et Technique Outre Mer (ORSTOM) in the fields of coastal erosion, fisheries and hydrography was noted. The high relevance of the combined research proposal from Côte d'Ivoire, Togo and Bénin on coastal erosion to other west African countries was also noted and it was agreed that this would be examined in further detail during the sub-group discussions.

#### 6.1.4 Gambia

6.1.4.1 Ms Isatou Sissoho presented a summary of LOICZ related research activities in the Gambia which include four major areas; pollution monitoring under WACAF II concerned with microbial, pesticide and land-based sources of pollution and studies of their transport and distribution in coastal waters; coastal zone management studies particularly in relation to coastal erosion; climate change studies related to mitigation options and alternatives for reducing greenhouse gas emissions, waste management and land use; and, coastal fisheries management studies. The major organisations involved include the Government Departments of Waste Resources, Fisheries and Environment with the majority of funding being provided through the African Development Bank, Food and Agriculture Organisation, World Health Organisation, United Nations Development Programme and the United Nations Environment Programme.

6.1.4.2 Several questions were raised concerning the failure of coastal protection measures such as the use of timber groynes and the problems resulting from a lack of formal co-operation with neighbouring Senegal. It was recognised that the causes of erosion might well be found outside the national boundaries of the Gambia, which has a relatively short coastline.

#### 6.1.5 Ghana

6.1.5.1 Mr Julius Wellens-Mensah made a presentation on some of the current LOICZ related activities in Ghana in which he noted that there existed 12 centres of excellence/expertise currently involved in LOICZ related research in coastal and near-shore areas. Current research includes activities concerned with the implications of sea level rise for low-lying coastal land, sediment dynamics on beaches in the Accra area (LOICZ Focus 2); measurements of solute and sediment discharge from major rivers to the sea (Focus 1) monitoring of dynamic changes including erosion and the performance of coastal protective structures (Focus 2 and 4); monitoring of pollution and land management and environmental change in coastal land (Focus 4). Proposed new and additional activities include aerial transport of organic pollutants; monitoring of gas emissions and the impacts of development on the water quality of coastal lagoons.

6.1.5.2 Dr Chris Gordon presented a summary of the programmes currently undertaken by the Volta Basin Research Project (VBRP) which relate specifically to LOICZ activities. These range from sediment transport (Focus 1), land use (Focus 4) to the socio-economic impacts of environmental change (Focus 4). He informed participants that Ghana is implementing a coastal wetland management project which shares similar objectives to LOICZ

6.1.5.3 Several questions were raised concerning the impacts of the Volta Dam on erosion along the coast and it was noted that even before construction of the dams the river carried comparatively very little sediment. Hence siltation is not a major problem and coastal erosion results from other factors. The problem now is to monitor and reduce the rate of siltation above the dams.

6.1.5.4 It was noted that erosion is threatening the coastal town of Keta and that plans are in hand to protect the town from further devastation through the use of various interventions including the armouring of the foreshore with rocks. The road to carry the rock to the coast has been constructed and the project will take off as soon as funding becomes available.



## 6.1.6 Nigeria

6.1.6.1 Dr Awosika provided the workshop with some basic data concerning the Nigerian coastline which is 853 Km in length; the EEZ covers 113,898 Km<sup>2</sup> compared with the total land area of 923,768 Km<sup>2</sup>. He noted that the total population was around 88.5 million of whom around 25 million people live in the coastal zone, largely concentrated in the metropolis of Lagos.

6.1.6.2 Dr Awosika noted that there are four major institutions involved in research in the coastal zone: the Nigerian Institute for Oceanography and Marine Research; the University of Lagos, the University of Calabar and the University of Port Harcourt. In addition there are several other universities in the coastal states that collaborate with NIOMR in executing coastal research.

6.1.6.3 Current research in Nigeria related to LOICZ includes projects on: marine geology and geophysics of the continental margin; research in coastal erosion and dynamics; climate change and sea level rise impact studies; pollution studies in the coastal zone; and biological and fisheries assessment programmes. Other research activities include the LME project which is about to commence in the Gulf of Guinea and IOC programmes in the region which include GLOSS, OSNLR, OSLR and GOOS. These activities are primarily related to LOICZ Foci 1, 2 and 4.

6.1.6.4 A question was raised concerning the impact of extraction of large volumes of oil on subsistence processes in coastal areas, and whether there were any studies of these potential impacts. It was noted that no such studies had been undertaken but that the areas where oil is extracted consist of consolidated sedimentary rocks that are not near the coastal areas of high erosion.

6.1.6.5 It was noted that Lagos has been projected to become the third largest coastal city world-wide by the year 2015 and that this would have implications in terms of coastal management in the area. It was further noted that this was one of the reasons why a new capital at Abuja has been built, but that notwithstanding, rural-urban migration is still a problem as Lagos is seen by many young people as the place to obtain personal advancement and development. During the discussion it was noted that socio-economic projections were often misleading since they failed to adequately take account of the adaptive behaviour of individuals and societies. The case of Male', the capital of the Maldives, was noted where the current population exceeds by far, the projected carrying capacity determined in the mid-seventies for the island as a whole.

## 6.1.7 Sierra Leone

6.1.7.1 The background papers prepared by Drs Reynold and Raymond Johnson were noted by the workshop as were their apologies for absence due to prior commitments elsewhere.

## 6.1.8 Togo

6.1.8.1 Dr Adoté Blivi informed the workshop that the LOICZ sub-committee in Togo had a membership of fifteen researchers including engineers, coastal scientists and socio-economists mainly drawn from the Universite du Bénin, Lomé. Five working groups had been formed to address the LOICZ research agenda, WACAF II and issues of biodiversity and sustainable development. The first of these working groups was concerned with research relating to coastal erosion, sediment budgets and continental shelf sediment fluxes; the second on coastal land-use; the third on the socio-economic impacts of coastal change including coastal erosion and eutrophication of the lagoons; the fourth concerned with pollution studies and the fifth with modelling.

6.1.8.2 Dr Blivi noted that to date each working group had completed a thorough literature review and developed framework project proposals covering: the biogeochemistry of trace gas exchanges in the coastal waters of Bénin (in collaboration with German researchers); the impacts of dam construction on the littoral environment; development of integrated coastal zone management plans; and assessment of the socio-economic impacts of coastal changes.

## 6.1.9 The Gulf of Guinea, Large Marine Ecosystem Project of the UNDP/GEF

6.1.9.1 Dr Jacques Abe made a brief presentation concerning this project which was due to commence in the near future and which involved a collaborative programme of research involving: Bénin, Cameroon, Côte d'Ivoire, Ghana and Nigeria and which involved a three year work plan to:

- ◆ strengthen regional institutional capacities to prevent and remedy pollution of the Gulf of Guinea and associated degradation of critical habitats;
- ◆ develop an integrated information, management and decision making support system for environmental management;
- ◆ establish a comprehensive programme of monitoring and assessment of the health of the Gulf of Guinea;
- ◆ prevent and control land-based sources of industrial and urban pollution; and,
- ◆ develop national and regional strategies and policies for the long-term management and protection of the health of the Gulf of Guinea.

6.1.9.2 During discussion it was noted that this project consisted of a number of disparate elements, some of which would be relevant to LOICZ, but that the primary objectives of this project were management rather than research related, and that the focus of activities was the installation of pollution control technologies, monitoring of a wide range of heavy metal and organic pollutants and assessment of their effects on fish stocks. Overall therefore the project might have little direct relationship to LOICZ goals although, depending upon the nature of agreed LOICZ research in Africa, there might be the possibilities for sharing of databases and expertise.

## 6.2 Eastern Africa

### 6.2.1 Comoros

6.2.1.1 Ms Ali Fatouma gave some basic information concerning the Comoros which is an archipelagic (island) country in the Indian Ocean, having a land area of 1,862 km<sup>2</sup>, a population of 450,000 inhabitants giving a density of 247 people km<sup>2</sup>. Gross national product is 522 US\$ *per capita*. As all the Islands have a small land area, the coasts are very important for development. The high density of the coastal population results in many environmental problems and rapid rates of environmental degradation.

6.2.1.2 At present the Comoros do not have many research institutions or activities related to LOICZ. There are two research centres:

- ◆ CNDRS (National Centre of Documentation and Scientific Research) which has an observatory for Karthala Volcano
- ◆ INRAPE (National Institute of Research in Agriculture, Fisheries and Environment)

6.2.1.3 Research is not well developed at present and has not been oriented towards LOICZ and IGBP objectives since the Comoros does not have a national IGBP committee. There are two regional projects related to LOICZ which involve the Comoros, the EAF/5 sponsored by FAO/UNEP, and the Indian Ocean Environment Programme sponsored by the European Union which includes activities on environmental auditing and socio-economic investigations of sand and coral extraction; health of coral reefs; inventory of the state of the resources of the marine environment; development of national plans for sustainable management of natural resources; and a series of small scale specific pilot projects. In addition the Comoros has submitted a project on Biodiversity for possible funding by the Global Environment Facility. Another environmental programme sponsored by the World Bank has some coastal zone activities concerning protection of the coast and its resources.

6.2.1.4 The coastal zone is important to the development of Comoros since fisheries and tourism are major contributors to the National economy. The Comoros has developed a national policy on environment, and major problems in the coastal zone include coastal erosion, sand and coral extraction and research on these problems is planned.

## 6.2.2 Ethiopia

6.2.2.1 Professor G.M. Zinabu noted that following the independence of Eritrea, Ethiopia had become a land-locked country. He informed the workshop that past research in aquatic ecology had involved a number of studies of the Rift Valley lakes which indicated that these were extremely productive systems. He noted that there was the possibility of collaborative research with Eritrea involving fluvial discharge, since a number of large rivers including the Blue Nile and Juba (Genale) originate in Ethiopia passing through other countries into the Mediterranean Sea and Indian Ocean, respectively.

6.2.2.2 During discussion it was noted that the very high productivity of some of the Ethiopian lakes resulted from their water chemistry, in which nitrate and phosphate are not limiting, and their shallow depth such that much of the water body was within the euphotic zone.

## 6.2.3 Kenya

6.2.3.1 Dr Ntiba informed the workshop that Kenya participates in several research programmes within the framework of the Intergovernmental Oceanographic Commission including, GLOSS and GIPME, that are related to activities outlined in the LOICZ Implementation Plan. Among the institutions collaborating on coastal research in the country are the National Universities, Kenya Marine and Fisheries Research Institute, Coast Development Authority, Kenya Wildlife Service, the National Museums of Kenya and the Tana and Athi Rivers Development Authority.

6.2.3.2. Current research programmes include: fish and fishery studies; mangrove and coral reef ecosystem research and research on the interlinkages between these coastal ecosystems; marine pollution; phyto- and zooplankton studies of Gazi and Tudor creeks and the Tana estuary; compilation of a marine resource data-base and regional atlas, of which Phase 1 covering Kenya is completed and should be published by December; studies of the impacts of climate change; monitoring programmes; activities in the fields of information and technology transfer; hydrodynamic studies and research on changes in coastal morphology; river estuary and delta process studies; and studies of biodiversity.

6.2.3.3 Most of the research related to LOICZ in Kenya is carried out by local scientists in co-operation with regional and international scientists through such programmes as UNEP's Regional Seas Programme; IOC's programmes of monitoring sea level and coastal flooding; SAREC funded programme on physical oceanography; the West Indian Ocean Marine Science Association (WIOMSA) activities; Kenya-Belgian Project in Marine Sciences; EEC-STD2 project on structure, and function of mangrove ecosystems in Kenya. (1990 to 1992); EEC-STD3 project on inter-linkages between coastal marine ecosystems in the Eastern Africa Region; the Netherlands Indian Ocean Project on oceanic and marine processes in Kenyan coastal waters.

6.2.3.4 In conclusion Dr Ntiba stated that, Kenya has some experience in research related to LOICZ and can fully participate in the implementation of the LOICZ research plan in Africa. In this context it was recognised that one of the common problems in the region involved changes in the land-sea flux of materials and the impacts of these changes on coastal ecosystems such as mangroves, seagrass beds and coral reefs, and the consequent socio-economic impacts on people. He expressed the hope that the region can put together a LOICZ research plan targeting this particular issue to provide regionally, comparable scientific data, for a better understanding of land ocean interactions that can be used as the basis for sustainable management of the coastal zone.

## 6.2.4 Mauritius

6.2.4.1 Mr Dharamdar Doorga gave a brief overview of the situation in Mauritius in which he noted that due to its comparatively small land area and high population density Mauritius was subjected to high rates of anthropogenic change. He noted that the coastline is 322 km in length and that the coastal zone was important for cultural, environmental and economic reasons.

6.2.4.2 Mauritius has a National Physical Development Plan which aims to achieve integrated development of the resources of the country as a whole and that development involves mechanisms for the control and regulation of development, particularly in coastal areas where environmental impact assessments are mandatory. He noted however that there were problems of enforcement of existing regulations due to a shortage of trained manpower.

6.2.4.3 During discussion the issues of coastal setback were examined and it was noted that the minimum setback is 15 metres from high water but that this could be varied on a case by case basis and that in vulnerable areas this was much further inland. It was also noted that under the Environmental Protection Act, the Ministry of Environment and Quality of Life had the power to impose appropriate mitigation measures to address identified environmental impacts. It was noted however that Mauritius lacked a well developed research capacity and infrastructure.

#### 6.2.5 Mozambique

6.2.5.1 Mr Domingo Gove noted that Mozambique has one of the longest coastlines in East Africa; that threequarters of the population of the country is concentrated in the coastal zone; and, that marine resources are the main source of dietary protein for the population. Despite its importance to the subsistence and commercial sectors of the economy of the country, little research has been carried out and there is a critical shortage of trained scientists.

6.2.5.2 Several institutions are involved in research on coastal and marine issue: the University Eduardo Mondlane; the Fisheries Research Institute; the National Institute of Hydrography and Navigation; the Ministry of Environment; and the Ministry of Agriculture and Fisheries. Some current research includes work on heavy metal pollution in Mozambican waters, mainly Maputo Bay, and some work on physical oceanography. Virtually all research in the country is funded from overseas sources including SAREC, NORAD, IUCN and the United Nations Agencies.

#### 6.2.6 Somalia

6.2.6.1 Mr Kulmiye presented an overview of conditions along the Somali coast which he noted was 3,300 km in length with an associated continental shelf area of around 35,000 km<sup>2</sup>. This coastline can be geographically divided into the North coast bordering the Gulf of Aden and the East coast which faces the Indian Ocean. Oceanographic conditions along the East coast are determined by the seasonal reversal of the monsoon winds. The coastline includes both sandy beaches and rocky shores, mangroves, coral reefs and seagrasses are found along the southern reaches of the coast.

6.2.6.2 Mr Kulmiye noted that a number of direct anthropogenic influences were resulting in changes to the Somali coast including pollution and destructive fishing practices. The extent of these changes was not known since current research was minimal as a consequence of civil unrest.

6.2.6.3 It was noted during discussion that the Shabelle River does not discharge to the Ocean but ends in an extensive swamp some 30 Km East of the Juba River. Extensive discussion surrounded the issue of the seasonal upwelling which occurs off the Somali Eastern coast near Cape Hafun under the influence of the reversal of the northern Indian Ocean surface currents. This upwelling occurs towards the end of October and it was noted that although seasonal upwelling was known from other areas along the African coast the driving force for the Somali upwelling was different since it results from the monsoon change in dominant wind direction.

#### 6.2.7 South Africa

6.2.7.1 Dr Geoff Brundrit provided an outline of the nature of the South African coastline, current research and possible contributions to LOICZ from South Africa, in which he noted that;

- ◆ the South African coastline can be divided into West, South and East coast sections. There are few natural harbours and the South and West coasts have fishing and mining industries but low human densities, as compared to the East Coast;
- ◆ Since 1994 there have been 26 LOICZ related projects covering aspects of all LOICZ foci. Of these 9 projects have already been completed.

6.2.7.2 Dr Brundrit informed the workshop that in 1995 another project (Sea and Coast Programme, phase one) was initiated. covering coastal communities and living resources, mariculture and offshore living resources and society. Phase 2 will commence in 1996 and will include biodiversity and conservation, weather and climate, and ecotourism.

6.2.7.3 Dr Brundrit noted that there are good prospects for institutional, bilateral and regional co-operation in LOICZ related research and that the major coastal issues of importance in South Africa at the present time involved issues such as: urban development of coastal cities; and coastal industrial developments related to fishing and mining.

#### 6.2.8 Tanzania

6.2.8.1 Professor A.K. Semesi of the University of Dar es Salaam made a brief presentation in which she noted that Tanzania has a coastline of 800 km with some offshore islands (Zanzibar, Pemba and Mafia). Most current coastal research work in the country is supported by SAREC, NORAD, NUFFIC, SIDA, UNEP, and the EC through collaborative short-term research projects.

6.2.8.2 The research is mostly carried out by the University of Dar es Salaam including the Departments of Botany, Geology, Zoology and Marine biology, the University's Institute of Marine Science on Zanzibar and foreign collaborating universities. The research involved includes work on water quality and nutrient transfer studies, primary production, nitrogen fixation, carbon uptake mechanisms, halocarbon production, hydrodynamics and tidally induced flow, mangrove and coral ecology, socio-economic aspects of resource use.

6.2.8.3 A multidisciplinary approach has been used in implementing projects and a few sites have been selected to overcome the shortages of equipment and manpower. MSc and Ph.D students play a major role in data collection and execution of the research. Collaboration with overseas universities has been very valuable and regional collaboration is also seen as a mechanism for strengthening research capacity and should be encouraged.

### 6.3 Mediterranean Action Plan

6.3.1 Professor M'hamed Brini, made a brief presentation on the Mediterranean Action Plan which was seen as the most important integrated programme related to the Environment of the Mediterranean Basin. UNEP serves as the Secretariat for the Action Plan and the Barcelona Convention. The primary objectives of the MAP are to protect the Mediterranean against pollution, to monitor the sources and levels of contaminants, and to examine and advise the governments of the region of the likely consequences of present development and environmental trends. He noted that to fulfil this mandate the Action Plan had a number of components including MEDPOL concerned with pollution; socio-economic components under the Blue Plan and the Priority Actions Programme; and an institutional and legal component. In addition the MAP had, since 1988 fostered and supported various studies concerned with the impacts of global climatic change and sea level rise on the Mediterranean Basin and on some 14 selected case study areas the results of which had been or are currently being published by UNEP and by Edward Arnold.

6.3.2 During discussion it was noted that the LOICZ Core Project Office is already co-operating with the Mediterranean Action Plan Co-ordinating Unit, in the development and refinement of Focus 4 related research in the Mediterranean Basin. It was further noted that the START region for the Mediterranean covered the same geographic area as the Mediterranean Action Plan and the proposed LOICZ regional integrative research on the socio-economic impacts of global change in coastal systems.

## 7. LOICZ/coastal research priorities in Africa

### 7.1 Presentation of the report of the African Regional discussions held in Manila, April 1995.

7.1.1 Dr Okemwa presented a brief outline of the discussions and recommendations resulting from the African regional session held in conjunction with the Second LOICZ Open Science Meeting in Manila, April 24 -27 1995 (Document LOICZ/Wkshp/95.8/4).

7.1.2 During the subsequent discussion the following observations were made:

- ◆ Focus 4 of LOICZ appeared to have a comparatively high priority in all sub-regions of the African continent.
- ◆ Focus 2 and Focus 4 research were viewed as being complementary and that in the case of economically important issues such as coastal erosion Focus 4 could not be adequately addressed without simultaneously undertaking Focus 2 research.

7.1.3 In responding to queries concerning the fate of the recommendations made by the African regional group in Manila, Dr Pemetta informed the workshop that the Scientific Steering Committee had made a recommendation to the SC-IGBP for Dr L. Awosika to be appointed to the Committee, but that the power to appoint members of IGBP Steering Committees rested with the SC-IGBP and not with the Steering Committee itself.

7.1.4 Dr Pemetta further noted that the present workshop was a direct response to one of the recommendations of the African regional group in Manila, and that the LOICZ Scientific Steering Committee had recommended that the third LOICZ Open Science Meeting be convened in Africa in September/October 1996. During discussion it was suggested that the South African LOICZ community might be willing to host such a meeting.

## **7.2 Plenary discussion**

7.2.1. It was noted during discussion that neither LOICZ nor IGBP were donor agencies but that the LOICZ-CPO can assist scientists in developing countries to identify potential research partners and to secure funds to execute agreed research. Dr Pemetta and Dr Odada noted in this regard that the ELOISE science plan produced by the Commission of the European Union and seen as the chapeau under which the Commission would support IGBP/LOICZ research contained an appendix specifically dealing with ELOISE in Africa. It was possible therefore for good projects, developed in partnership between African and European scientists to secure funding under this chapeau.

7.2.2 It was further noted that major supporters of research activities were increasingly attracted to wider regional projects of significant development and management value rather than to smaller scale, narrowly focused, research.

7.2.3 The workshop agreed that from both a logistic and a scientific perspective the START division of Africa into Northern and Southern regions was inappropriate for implementing coastal research since the oceanic conditions in the Atlantic and Indian Ocean were quite different, the nature of the continental shelves and the geological processes were different, the dominant habitats were different, and the socio-economic conditions were different.

7.2.4 It was generally agreed that a division into Eastern and Western coastal sub-regions was most appropriate, that the Mediterranean coastline of Africa should be included in the Mediterranean region, as was done by both UNEP's Regional Seas Programme and by START and that the Red Sea and Gulf regions should be treated separately from the Eastern African continental, Indian Ocean coastline. The workshop agreed therefore that for the purposes of discussing regional research priorities, participants would work in two sub-groups corresponding to the Eastern and Western coastlines of Sub-Saharan Africa with the insular countries of the Eastern Indian Ocean participating in the eastern African group and the South African representatives participating in both.

## **8. Initial sub-regional group discussions**

8.1 During the initial sub-regional group discussions the priorities for research to be included in the framework programme for each sub-region were identified and discussed.

## **9. Reports of sub-group discussions and plenary discussion of the African LOICZ research priorities**

9.1 The Chairman of the Western African sub-regional group informed the workshop participants that the identified priority for that region centred on changes in flux of materials from land to ocean and its relationships to the critical problem of coastal erosion which was of major importance to most countries of the western African region.

9.2 The group had identified four topics for elaboration in the framework research proposal namely: sediment fluxes and the impacts of dams; palaeogeographical reconstruction's of shorelines during the Holocene; effects of coastal erosion on socio-economic activities in the coastal zone; and evaluation of past management interventions in the control of coastal erosion.

9.3 The Chairman of the Eastern African sub-regional group informed the workshop participants that the identified priorities for the Eastern African sub-region centred on the interactions between mangrove, seagrass and coral reefs and the physical environment and the intra-annual variability in nutrient availability in coastal waters.

9.4 To address these issues the eastern African sub-group had identified three project areas which needed to be elaborated in the outline proposal: coastal ecosystem health; coastal change and sedimentation/erosion processes; and the socio-economic impacts of global and regional changes in coastal ecosystems.

9.5 A brief discussion ensued during which the similarity between the second project area for the eastern African region with that of the western African region was noted. The meeting agreed to reconvene in the two sub-groups and further elaborate the draft framework project proposals overnight, for subsequent consideration in plenary.

## **10. Drafting of Framework Research proposals**

10.1 The two sub-groups drafted and discussed the framework project proposals taking into account the initial plenary discussions.

## **11. Plenary discussion & finalisation of the Framework Research Proposals**

11.1 The reports of the two sub-groups, namely the framework research proposals drafted by each group were presented to the plenary session, discussed, amended and approved and are attached as Annex IV and V to this report.

11.2 The workshop authorised Dr Pemetta, the LOICZ Core Project Manager, in consultation with Dr Okemwa and Dr Awosika, the Co-chairs of the workshop to finalise the documents in line with the discussion and agreed amendments, and requested the assistance of the Core Project Office in presenting these proposals to potential funding sources, and collaborating institutions in Europe and elsewhere.

## **12. Approval of the report of the workshop**

12.1 The rapporteurs reports for the various plenary sessions were presented to the workshop, and discussed. Suggestions for amendment and additions were tabled and the report was unanimously adopted by the participants as it appears in this document.

12.2 The Core Project Manager was authorised, in consultation with the Co-chairs to edit and finalise the report for publication on behalf of the participants.

## **13. Closure of the workshop**

13.1 In concluding the business of the meeting Dr Awosika thanked Dr Pemetta, the LOICZ Core Project, the Netherlands Foundation for the Advancement of Tropical Research (WOTRO) and the Kenyan National Academy of Sciences, the Kenyan National IGBP and LOICZ Committees for all their support to the organisation and implementation of the workshop. He expressed the hope that

this marked the start of a successful LOICZ in Africa programme which would contribute substantively to our understanding of the role of coastal zones in the functioning of the Earth System and the responses of such systems to global change. He invited Professor Wandiga to formally close the workshop.

13.2 Professor Wandiga, Chairman of the Kenyan National Academy of Sciences expressed his appreciation to Dr Pemetta for his support and efforts in making the workshop a reality. He also expressed his appreciation for the hard work and effort expended both by the members of the National organising committee and the participants in making the workshop a success. He invited all participants to a dinner hosted by the National Academy which would mark the end of the first LOICZ in Africa workshop and closed the formal business of the meeting at 1700 hours.



**WORKSHOP  
'LOICZ IN AFRICA'**

**7-9 August, Hotel Panafric, Nairobi, Kenya**

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**WELCOMING ADDRESS BY PROFESSOR S.O. WANDIGA  
Chairman, Kenya National Academy of Sciences;  
and National Committee for IGBP-Kenya,  
on the occasion of the opening of the first LOICZ Workshop in Africa  
7-9 August, Nairobi, Kenya**

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Professor K. Mutahi, Permanent Secretary, Ministry of Research and Technical Training and Technology; Dr John Pemetta, IGBP-LOICZ Core Project Manager; Distinguished Guests, Ladies and Gentlemen. I should like, on behalf of the Kenyan National Academy of Sciences, and of the National Committee for IGBP-Kenya to welcome you all, first to Kenya and then to this auspicious meeting of eminent scientists mainly from the coastal states of Africa. It is for our National Committee a very happy occasion and indeed an honour to have you with us for this workshop.

Ladies and Gentlemen, this workshop, which is the first in Africa concerned with IGBP-LOICZ, has the task of identifying research priorities and implementation strategies for the LOICZ project in the African coastal zone. That the world has great interest in the coastal zone has been emphasised by the adoption of Agenda 21 at Rio de Janeiro by the United Nations Conference on Environment and Development which identified the future of coastal zones and areas as prime concerns to be addressed by societies and governments.

We here, are all aware of the importance of coastal zones as places of settlement, and in many cases, as places endowed with both living and non-living resources beneficial to humanity. Yet, threats to these zones now arise from a number of important sources including activities occurring in the settlements and those that may be associated with Global Changes being currently experienced or anticipated.

These threats place at risk, assets, both developed and undeveloped, that are within the coastal zone. Thus, it is now very necessary to determine in both qualitative and quantitative terms, the likely impacts and response options that may be adopted to minimise the likely consequences of the occurring or anticipated changes. Therefore, it is necessary to determine:

- a) the nature of the resources under threat;
- b) the nature of the threats to these resources; and,
- c) what has to be done to minimise the consequences of cumulative effects arising from all changes.

I am happy to report here that in Kenya, we have concluded two important studies of our coast with the assistance of the Oceans and Coastal Areas, Programme Activity Centre (OCA/PAC) of UNEP. You will certainly be hearing more of these during the course of this workshop.

I believe that you have similar experiences gained in your coastal zone related activities. This workshop offers you a very good opportunity to share your experiences and to compare notes. Your individual contributions will be important for the planning of research activities and strategies for the African coast.

Distinguished Guests, Ladies and Gentlemen, I wish to conclude by extending our sincere gratitude to the IGBP-LOICZ Core Project Office and the Netherlands Institute for Tropical Research (WOTRO) for their financial sponsorship of this workshop. It is my hope that African research efforts related to coastal zone issues will in future be strengthened and continue to find support, not only from these two sponsors, but also from others interested in the coastal zone.

It is now with pleasure that I invite the Permanent Secretary, Ministry of Research, technical training and Technology, Professor Karega Mutahi, to share with us a message and to officially open the workshop.

Thank you.

7-8 August, Nairobi, Kenya  
on the occasion of the opening of the LOICZ Workshop in Africa

Ladies and Gentlemen, this workshop is the first in Africa organized with IGBP-LOICZ, the task of identifying research priorities and implementation strategies for the LOICZ project in the African coastal zone. The world has been alerted to the coastal zone as a critical area for development and the adoption of Agenda 21 in 1992 is leading to the United Nations Conference on Environment and Development which identified the issue of coastal zone and seas as a high priority to be addressed by societies and governments.

We face the all aware of the importance of coastal zones as areas of settlement, and in many cases, as places endowed with both living and non-living resources essential to humanity. Yet, threats to these zones now arise from a number of sources including activities occurring in the settlements and those that may be associated with Global Change being currently experienced or anticipated.

These threats pose a new, complex, both developed and undeveloped, and are within the coastal zone. Thus, it is now necessary to determine in both qualitative and quantitative terms, the likely impacts and response options that may be adopted to minimize the likely consequences of the occurring or anticipated changes. Therefore, it is necessary to determine:

- a) the nature of the resources under threat
- b) the nature of the threats to these resources and
- c) what has to be done to minimize the consequences of cumulative effects arising from all changes.

I am happy to report here that in Kenya, we have organized the important coastal zone work with the assistance of the Ocean and Coastal Area Programme Activity Centre (OCAAPAC) of UNEP. You will certainly be hearing more of these during the course of the workshop.

I believe that you have similar experiences gained in your coastal zone related activities. This workshop offers you a very good opportunity to share your experiences and to compare notes. Your individual contributions will be important for the planning of research activities and strategies for the African coast.

**WORKSHOP  
'LOICZ IN AFRICA'**

**7-9 August, Hotel Panafric, Nairobi, Kenya**

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**WELCOMING ADDRESS BY PROFESSOR KAREGA MUTAHI  
Permanent Secretary, Ministry of Research,  
Technical Training and Technology,  
on the occasion of the opening of the first LOICZ Workshop in Africa  
7-9 August, Nairobi, Kenya**

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Mr Chairman, Project Manager, Distinguished Researchers, Workshop Participants, Ladies and Gentlemen. It is my pleasure to join you in the opening of this important workshop. It is also an honour for me to be amongst the eminent scientists and researchers gathered in this room.

Mr. Chairman, before I make my remarks I wish to warmly welcome all the visitors to our country and wish them a happy stay in Kenya. In addition, I appeal to them to take time to interact with the rest of Kenyans who are not their colleagues in the fields of science and research.

Ladies and Gentlemen, we in Kenya feel most honoured to host this important meeting. For this reason we thank those charged with the implementation of the Land-Ocean Interactions in the Coastal Zone Core Project of the International Geosphere-Biosphere Programme of the International Council of Scientific Unions; the Netherlands Foundation for Tropical Research; and, the Kenya National Academy of Sciences for their joint efforts in organising this workshop. I also, urge them to keep up this good partnership in scientific work.

Mr. Chairman, apart from appreciating the honour of holding the first LOICZ workshop on this subject in Africa we, also thank the organisers for addressing pertinent issues that have serious bearing on the future of mankind.

Coming from the Ministry in charge of Research, Science and Technology I am particularly interested in your planned analysis of issues of Land-Ocean Interactions in the Coastal Zones of our continent. I am also, very eager to see the scientific plan you intend to develop, focusing on Africa's surface where land ocean and the atmosphere meet and interact. These are very critical issues that we in Africa have not paid enough attention to.

Mr. Chairman, coastal zones constitute about 18% of the earth's surface area. In addition to this these zones are also host to over two thirds of all the worlds cities, are inhabited by about 60% of world's population and produce 90% of all the world's fish. Apart from these important contributions, coastal zones provide major tourist attractions and in this regard, these zones have become major foreign exchange earners for their countries.

Given the above, and others reasons, one must appreciate that coastal zones are strategic to the economies of Africa and the world as a whole. We are, therefore grateful that LOICZ research is aimed at completing the International Geosphere Biosphere Programme geared to the understanding of the global changes in this general area. As scientists whose efforts are targeted at this noble goal your efforts will not succeed without careful planning, at continental level and also full understanding of the nature of the dynamic interactions in our coastal zones, I, therefore hope, that during your deliberations you will address the following among the many issues in your agenda.

1. How changes in the atmosphere, land and sea affect our coastal zones and alter their roles in the global cycles.
2. How changes in the coastal zones are expected to influence and effect their uses by people

3. The development of the provision of a sound scientific basis for future integrated management of our coastal zones.

Ladies and Gentlemen, given the brains gathered here I have no doubt that understanding of the above issues is within your capabilities. I am, as such, raising these issues with you because we in this continent can only understand our coastline through you and your collaborators in other continents.

Mr. Chairman, allow me to point out that Africa's population doubles every twenty years and that our countries have serious limitations of resources. In this regard we are likely to see much more pressure being exerted on our coastal zones than we have seen before. We must be prepared to face this reality if we are to avoid serious economic and environmental problems. It is in this context that you must deliberate on the issues I have raised here. In other words, most of African resources are likely to be directed towards feeding the increasing population, providing services related to health, education, infrastructure etc. and little going to research programmes.

To survive the pressure that emerges from a rapidly growing population we need serious inputs from researchers and scientists like you, into our planning process. Therefore, given the critical role coastal zones can and do play in the global economy you must advise and do so honestly

Mr. Chairman, research and technology development are very expensive undertakings For this reason and considering the weaknesses of our African economies we still need donor support. I would, therefore, appeal to the donor community to view research on coastal zones of Africa and other developing areas as an important area for joint efforts and co-operation. Our joint efforts should, however, be viewed as service to humanity rather than merely to third world countries.

Ladies and gentlemen, allow me to point out that to develop an ideal research programme that answers our questions is not always easy. This is because the animals and the processes we choose to study are complex and often beyond our control. For this reason we need a viable network through which we can continue learning from each other I appeal to you to discuss the subject of networking and to establish modalities through which exchange of information and experiences can easily take place. You, also, need to integrate the social sciences in your work so as to ensure adoption and application of your recommendations and technologies by non scientists.

Mr. Chairman, as you interact in this and other meetings I urge you to note that the networks you build play critical roles of strengthening not only our scientific ties, but also cultural and political ties between our countries. You should as such consolidate the links and the ties you have established for the good of all.

Finally, I wish to thank the sponsors and the organisers of this workshop for making it a reality. I also thank participants for availing themselves to this important meeting.

With these remarks, it is my pleasure to declare this workshop officially open.

Thank you.

**WORKSHOP  
'LOICZ IN AFRICA'  
7-9 August, Hotel Panafric, Nairobi, Kenya**

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**'LOICZ IN AFRICA' WORKSHOP**  
7-9 August, Hotel Panafric, Nairobi, Kenya

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**AGENDA**

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- 1. Official Opening of the workshop & Welcoming remarks**
- 2. Administration & Organisation of the workshop**
  - 2.1 Administrative and organisational matters
  - 2.2 Purposes and expected outcome of the workshop
  - 2.3 Introduction of workshop participants
  - 2.4 Introduction of the Co-Chairs of the workshop
  - 2.5 Approval of the workshop draft agenda and draft programme
- 3. Background to the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU) and to the Land Ocean Interactions in the Coastal Zone (LOICZ) Core Project of IGBP**
- 4. Background to IGBP Framework Activity, SysTem for Analysis Research and Trainig (START)**
- 5. Introduction of the LOICZ Implementation Plan and the LOICZ research agenda**
- 6. Overviews of current research in Africa related to LOICZ**
  - 6.1 Western Africa
    - 6.1.1 Bénin
    - 6.1.2 Cameroon
    - 6.1.3 Côte d'Ivoire
    - 6.1.4 Gambia
    - 6.1.5 Ghana
    - 6.1.6 Nigeria
    - 6.1.7 Sierra Leone
    - 6.1.8 Togo
    - 6.1.9 The Gulf of Guinea, Large Marine Ecosystem Project
  - 6.2 Eastern Africa
    - 6.2.1 Comoros
    - 6.2.2 Ethiopia
    - 6.2.3 Kenya
    - 6.2.4 Mauritius
    - 6.2.5 Mozambique
    - 6.2.6 Somalia
    - 6.2.7 South Africa
    - 6.2.8 Tanzania
  - 6.3 The Mediterranean Action Plan
- 7. LOICZ/coastal research priorities in Africa**
  - 7.1 Presentation of the report of the African Regional discussions held in Manila, April 1995.
  - 7.2 Plenary discussion
- 8. Initial sub-regional group discussions**
- 9. Reports of sub-group discussions and plenary discussion of the African LOICZ research priorities**
- 10. Drafting of Framework Research proposals**

**11. Plenary discussion & finalisation of the Framework Research Proposals**

**12. Approval of the report of the workshop**

**13. Closure of the workshop**

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- 10. Drafting of Framework Research Proposals
- 9. Reports of sub-group discussions and plenary discussion of the African LOICZ research priorities
- 8. Initial sub-regional group discussions
- 7. LOICZ coastal research priorities in Africa
  - 7.1 Presentation of the report of the African Regional discussions held in Mauritius
  - 7.2 Plenary discussion
- 6.2 The Mediterranean Action Plan
  - 6.2.8 Tanzania
  - 6.2.7 South Africa
  - 6.2.6 Somalia
  - 6.2.5 Mozambique
  - 6.2.4 Mauritius
  - 6.2.3 Kenya
  - 6.2.2 Ethiopia
  - 6.2.1 Comoros
- 6.1 The Gulf of Guinea, Large Marine Ecosystem Project
  - 6.1.8 Togo
  - 6.1.7 Sierra Leone
  - 6.1.6 Nigeria
  - 6.1.5 Ghana
  - 6.1.4 Gambia
  - 6.1.3 Côte d'Ivoire
  - 6.1.2 Cameroon
  - 6.1.1 Benin
- 6. Overview of current research in Africa related to LOICZ
- 5. Introduction of the LOICZ Implementation Plan and the LOICZ media campaign (START)
- 4. Background to IGBP Framework Activity, Evolution for Analysis, Research and Training (START)
- 3. Background to the International Geosphere-Biosphere Programme (IGBP) of the International Council of Scientific Unions (ICSU) and to the Land Ocean Interactions in the Coastal Zone (LOICZ) Core Project of IGBP
  - 3.5 Approval of the workshop draft agenda and draft programme
  - 3.4 Introduction of the Co-Chairman's Workshop
  - 3.3 Introduction of workshop resolutions
  - 3.2 Presentation of resolutions at the workshop
  - 3.1 Administrative and organisational matters
- 2. Administration & Organisation of the workshop
- 1. Official Opening of the Workshop: Welcoming remarks

**'LOICZ IN AFRICA' WORKSHOP**  
**7-9 August, Hotel Panafric, Nairobi, Kenya**

**LIST OF DOCUMENTS**

**DISCUSSION DOCUMENTS**

<u>Document code</u>	<u>Title</u>
LOICZ/WKSHP/95.8/1	Preliminary draft agenda.
LOICZ/WKSHP/95.8/2	Preliminary draft programme.
LOICZ/WKSHP/95.8/3	Country research capacity and current research statements presented to the Second LOICZ Open Science Meeting, Manila, April 1995.
LOICZ/WKSHP/95.8/4	Report of the African Regional discussions, Second LOICZ Open Science Meeting, Manila, April 1995.

**INFORMATION DOCUMENTS**

LOICZ/WKSHP/95.8/Inf. 1	Draft List of participants
LOICZ/WKSHP/95.8/Inf. 2	List of documents (this document)
LOICZ/WKSHP/95.8/Inf. 3	Summary of the Status of IGBP & LOICZ Formal contact points in non-Mediterranean Africa.
LOICZ/WKSHP/95.8/Inf. 4	Extract from "ELOISE" Science Plan.
IGBP Report No. 33	LOICZ Implementation Plan.
Amegee, K	NAFCOM research activities related to LOICZ.
Armah, A.K.	LOICZ-Ghana, research capacity statement.
Brini, M.	The Mediterranean Action Plan.
Brundrit, G.	Overview of South African Research Relevant to LOICZ.
Folack, J & T.J. Youmbi,	Development of Land-Ocean Interactions Research Programme in Cameroon Coastal Zone.
Gordon, C.	The Volta Basin Research Project, University of Ghana, Legon, Ghana.
Gove, D.F.	Current Research Activities in Mozambique related to LOICZ
Kulmiye, A.J.	An overview of the Somali Coast.
McLachlan, A.	South African Projects relevant to LOICZ, as of June 1994.
Nguli, M.	An Overview of LOICZ-related Coastal Physical Oceanography in Kenya Marine and Fisheries Research Institute.
Ntiba, M.	Summary of Activities and interests of Kenya related to LOICZ.
Ochiewo, J.	Impact of Human Activities on the Kenyan Coastal Zone Resources.
Sissoho, I.	Overview of Current Research in the Gambia related to LOICZ.
Wakwabi, E.	Studies Related to LOICZ/IGBP in the Field of Fisheries ecology at Kenya Marine and Fisheries Research Institute.

**Outputs:**

- Mass balance for sediment transport and retention.
- Input data for the development of local, sub-regional and regional sediment morphodynamics.
- Improved methodological framework for studying sediment flux studies.
- Models of sediment flux in the sub-region.

11. Primary and secondary data collection of the Framework Research Proposal
12. Approval of the report of the 'LOICZ IN AFRICA' WORKSHOP  
7-9 August, Hotel Transatlantic, Nairobi, Kenya
13. Closure of the workshop

LIST OF DOCUMENTS

Document code	Title	Discussion documents
LOICZWKSHPR68 B1	Preliminary draft agenda	
LOICZWKSHPR68 B2	Preliminary draft programme	
LOICZWKSHPR68 B3	Country research capacity and current research statements presented to the Second LOICZ Open Science Meeting, Manila, April 1985	
LOICZWKSHPR68 B4	Report of the African Regional discussions, Second LOICZ Open Science Meeting, Manila, April 1985	
LOICZWKSHPR68 B1	Draft List of participants	
LOICZWKSHPR68 B2	List of documents (this document)	
LOICZWKSHPR68 B3	Summary of the status of IGBP & LOICZ Formal contact points in non-Mediterranean Africa	
LOICZWKSHPR68 B4	Extract from "EDGE" Science Plan	
IGBP Report No. 33	LOICZ Implementation Plan	
Amegaa, K.	NAFOM research activities related to LOICZ	
Amah, A.K.	LOICZ-Ghana research capacity statement	
Bini, M.	The Mediterranean Action Plan	
Grundt, G.	Overview of South African Research Relevant to LOICZ	
Fotack, J & T.J. Young	Development of Joint-Ocean-Interior Research Programme in Gambia Coastal Zone	
Gordon, C.	The Volta Basin Research Project, University of Ghana, Legon, Ghana	
Gove, D.F.	Current Research Activities in Mozambique related to LOICZ	
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**WORKSHOP  
'LOICZ IN AFRICA'  
7-9 August, Hotel Panafric, Nairobi, Kenya**

**THE WESTERN AFRICAN/ATLANTIC OCEAN REGION  
FRAMEWORK PROJECT PROPOSAL**

**Theme: Coastal changes and stability: implications for sustainable development**

***General Rationale for LOICZ activities in the sub-region***

The Western African coastal area forms a distinct socio-economic unit of the eastern Atlantic seaboard. Records have shown that coastal changes resulting from both natural and anthropogenic activities have had adverse effects on the sustainability of the socio-economic activities in the region. The areas of change include: coastal erosion; deforestation; salt water intrusion and subsidence. The need then arises to undertake a project on coastal change and stability and the implications for sustainability of coastal values. Such a project could form a foundation for understanding the nature of the processes responsible for the observed changes.

**Project 1. Title: Sediment Fluxes**

(An expanded pre-proposal for this project is attached as Appendix A below)

**LOICZ focus 2.1**

**Rationale**

It has been established that coastal erosion is one of the most serious environmental problems along the West African coast. Erosion or accretion is a result of deficit or accumulation of sediments. Response measures to abate coastal erosion normally require a knowledge of the processes that lead to the sediment deficit. Hence sediment flux studies of the source and depositional environments are required for understanding the processes which are important in determining the success or failure of erosional intervention measures.

**Objectives:**

- ◆ Determination of the source, nature and dynamics of sediments and transport mechanisms in the fluvial and coastal environments.
- ◆ Quantification of the sediment load carried by the major rivers to the coastline.
- ◆ Determination of the role of vegetation in sediment flux in the coastal zone.
- ◆ Development of sediment flux models.

**Methodology:**

- ◆ Examination of historical data set.
- ◆ Measurement of discharge and concentration of sediments in major coastal rivers.
- ◆ Granulometric and mineralogical analysis of sediments, in the source, transport and depositional environments.
- ◆ Determination of the sediment load
- ◆ Process studies in coastal environments including the contribution of wetlands and mangroves (shore-profile, bathymetry, physical parameters measurements, satellite imagery processing, GIS)

**Outputs:**

- ◆ Mass balance for sediment transport and retention,
- ◆ Input data for the development of local, sub-regional and regional sediment morphodynamics.
- ◆ Improved methodological framework for initiating sediment flux studies.
- ◆ Models of sediment flux in the sub-region.

**Duration:**

Pilot phase of three years covering the following rivers.

Cameroon	(Sanaya, Wouri)
Nigeria	(Calabar, Ogun, Niger)
Bénin	(Mono)
Togo	(Mono)
Ghana	(Volta, Pra, Ankobra, Tano)
Côte d'Ivoire	(Comoe, Bandama, Sassandra)
Sierra Leone	(Mano)
Guinea	(Konkoure)
Senegal	(Senegal)
Gambia	(Gambia)

**Estimated Budget:** US\$ 500,000

**Lead Institutions:**

Cameroon	Ministry of Fishes and Oceanography
Nigeria	Nigerian Institute for Oceanography and Marine Research
Bénin	Université National du Bénin
Togo	Université du Bénin, Lomé
Ghana	University of Ghana Accra
Côte d'Ivoire	National University of Abidjan
Senegal	Université Chaiq Anta Diop

**Project 2. Title: Palaeogeographical, Palaeoenvironmental And Historical Reconstruction Of The Shoreline**

**LOICZ focus 2.3****Rationale**

Previous research indicates that there has been a significant retreat of the shoreline of many western African countries. Existing information reveals that Holocene coral reefs exist in the waters of the Gulf of Guinea, an area where reefs are no longer found. Changes in various physical processes such as wave dynamics, tides and currents; and meteorological factors could be responsible for this shoreline retreat. In order to understand the processes of ongoing coastal change it is important to reconstruct the palaeo-shoreline in order to generate the information required for the development and validation of improved models of coastal evolution.

**Objectives:**

- ◆ Reconstruct the palaeogeography of and past processes in, the west African coastal zone;
- ◆ Formulate conceptual models of the responses of different coastal systems which have resulted from past global change.

**Methodology:**

- ◆ Collection of available data that exist in the following west African countries, Ghana, Togo and Nigeria or in the sub-region.
- ◆ Geophysical survey of dead Holocene coral banks along the coastline this survey will be concentrated on areas where information already exist for these coral banks. This survey will also include the use of side scan sonar, shallow seismic hydrographic survey and echo sounders.
- ◆ Cores from the geophysical studies will be analysed using radio carbon dating, biostratigraphic, micro-palaeontological methods. Sequence stratigraphic analysis will be linked with sea level change.

**Outputs:**

- ◆ Compilation of existing data in a map.
- ◆ Local and regional Palaeogeographical reconstruction.
- ◆ Data on local and regional sea-level history.
- ◆ Input data for the development and validation of improved models of coastal evolution under varying scenarios of sea-level change.

**Estimated Budget:** US\$ 150,000

**Duration:** Five Years

**Lead Institutions**

Togo:	Université du Bénin, Lomé
Nigeria:	Nigerian Institute for Oceanography and Marine Research
Ghana:	University of Ghana
South Africa:	Department of Oceanography
Côte d'Ivoire:	Centre de Recherches Oceanologiques
Bénin:	Centre for Environment and Development in Africa
Cameroon:	Research Centre for Fisheries and Oceanography
Gambia:	Department of Water Resources

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**Project 3. Title: Effects Of Coastal Erosion On Socio-Economic Activities**

**LOICZ focus 4.2.**

**Rationale**

The west African coastal zone is currently densely populated and is experiencing high rates of population growth. The major urban centres, industries and lowland agriculture are located in this zone. As a result of these pressures, this area is subject to greater environmental change in general than inland areas, and at the same time environmental processes such as coastal erosion have major impacts on coastal resources and their use, on human populations and activities carried out in the area. This situation has become more acute in recent years. This study is aimed in the short term at assessing how erosion affects the lives of people in the coastal areas. A longer term aim is to develop the scientific basis for improved integrated coastal zone management in the sub-region.

**Objectives:**

- ◆ Assessment and classification of social and economic changes caused by coastal erosion.
- ◆ Develop forecasts of dynamic change in coastal environments and socio economic feed back.
- ◆ Assessment of the physical and human value of the extent and response of the population to coastal erosion.
- ◆ Develop tools for forecasting the effects of coastal erosion on social and economic activities.
- ◆ Define guidelines to manage the socio-economic changes caused by coastal erosion.

**Methodology:**

- ◆ Evaluation of coastal resources.
- ◆ Inventory of coastal settlements that have disappeared.
- ◆ Inventory of infrastructure and facilities of coastal urban area,
- ◆ Migration patterns of affected coastal communities.
- ◆ Assessment of social problems caused by relocation of displaced communities, demographic pressure on land and changes in the structure of demographic unit.
- ◆ Assessment of economic problems of relocation: effects on fishing, farmlands, and other activities.

## Outputs

- ◆ Improved scientific and economic methodology for damage cost valuation.
- ◆ Quantify at a national level, the economic effects of coastal erosion.
- ◆ Local case studies providing data for model building and validation.
- ◆ Guidelines for sustainable development of coastal socio-economic activities in different coastal environment.
- ◆ Development of tools for forecasting the effects of coastal erosion on social and economic activities.

**Estimated Budget:** US\$ 300.000

**Duration:** 5 years

First phase: 2 years inventory and assessment  
Second phase: 2 years dynamic studies of the different aspects.  
Third phase: 1 year compare and finalise the data.

## Lead Institutions:

Togo:	Universite du Bénin, Lomé
Nigeria:	Nigerian Institute for Oceanography and Marine Research
Ghana:	University of Ghana
South Africa:	Department of Oceanography
Côte d'Ivoire:	Centre de Recherché Oceanologiques
Bénin:	Centre for Environment and Development in Africa
Cameroon:	Research Centre for Fisheries and Oceanography
Gambia:	Department of Water Resources

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## Project 4. Title: Evaluation Of Past Management Interventions For The Control Of Coastal Erosion

### LOICZ focus 4.3

#### Rationale

Attempts have been made along the coast of the sub-region to protect important structures and facilities, with varying degrees of success depending on the locality and the intervention measures adopted. The project aims to evaluate past management interventions for coastal erosion with a view to examining the underlying factors resulting in their success or failure. A cost-benefit analysis of the interventions will be carried out. This will lead to the development of guidelines for selection and application of the improved measures to combat coastal erosion

#### Objectives:

- ◆ Determination of the efficiency of past management interventions in altering coastal erosion
- ◆ Determination of the economic costs and benefits of management interventions.
- ◆ Determination of the causes of success or failure of past management interventions.
- ◆ Definition of guidelines for the development of adequate management measures.

#### Methodology:

- ◆ Inventory of the different types of management interventions, both structural and non-structural, and their locations.
- ◆ Examine the causes of 'failure' and quantify the extent of the failure.
- ◆ Assess the efficiency or effectiveness of successful interventions by comparing pre and post-intervention situations and make a cost effective comparison, e.g. using cost per unit length of protected coastline as an index.
- ◆ Quantify the benefits derived in economic terms, where possible.
- ◆ Assess the negative impacts of successful intervention measures and quantify the cost of these impacts
- ◆ Compare the costs and benefits (cost benefit ratio) and complete a full cost benefit analysis.



**Outputs:**

- ◆ Criteria for classifying intervention measures with respect to their efficiency.
- ◆ A set of identified causes of 'failure' cases and experiences.
- ◆ Assessment report of intervention measures under different social, economic and cultural settings.
- ◆ Improved methodological framework for initiating management intervention measures.

**Estimated Budget:** The estimated total is US\$ 300,000 based on project implementation in 10 countries

**Duration:** 3 years.

**Lead Institutions:**

Bénin:	Centre for Environment and development in Africa
Cameroon:	Research Centre for Fisheries and Oceanography
Côte d'Ivoire:	Centre de Recherché Oceanologiques
Gambia:	Department of Water Resources
Ghana:	AESC (Hydro Division)
Nigeria:	Nigerian Institute for Oceanography and Marine Research
Togo:	Centre Universite du Bénin Lomé, Togo.

Potential participants from Guinea, Senegal and Sierra Leone yet to be identified.

## Project 1 Expanded Project Pre-proposal

**Title: Sediment Flux from Rivers to the Gulf of Guinea**

**Country coverage:** Côte d' Ivoire, Ghana, Bénin and Nigeria

Total Budget per country: US\$ 661,850

Country contribution: US\$ 196,350

Donor Assistance: US\$ 462,500

**Project duration:** Three (3) years

### Objectives:

1. to determine the role of dams in sediment retention
2. to evaluate the flux of detritus reaching the ocean
3. to determine the path of the sediment plume on the continental shelf
4. to identify the factors that control sediment pathways on the continental shelf

### Justification:

Coastal erosion along the West African coast is becoming more and more alarming, threatening human life and personal property, as well as industrial and tourist infrastructure such as petroleum refineries, airports, ports and hotels. The severity of the coastal erosion in Ghana is underlined by the gradual disappearance of Keta town and in Togo by the exposure of previously buried beach rocks. The situation is critical in Bénin. In Côte d'Ivoire and Nigeria, coastal erosion has devastated large expanses of beaches and mangroves resulting in increased frequency and severity of inland flooding.

Understanding the causes and the controlling factors that determine the rates of coastal erosion requires a regional approach to quantifying the volumes of sediment contained in coastal waters, rates of land-ocean flux, and changes in the flux resulting from dam construction and alterations to river discharge as a consequence of various anthropogenic interventions.

This project aims to define the role of dams in altering the flux of suspended materials from land to ocean using a multidisciplinary approach involving sedimentology, geophysics, geochemistry, limnology, satellite image analysis and geographic information systems applied simultaneously. This work expands on previous sedimentological and geophysical studies through the application of diachronic and multispectral analysis of turbid plumes using SPOT and LANDSAT imagery.

### Methodology:

#### 1. Examination and evaluation of existing literature and data sets

Information from existing databases such as FRENDA, GLORI, GEMS Water and national records will be examined to assess their suitability for use as a source of historical data which may be of value to the project objectives in providing pre-intervention baseline data.

#### 2. Determination of the role of dams in sediment retention

Samples from river systems with impoundments will be collected at sites above and below the dams. These sites will be located by use of GPS (Global Positioning Systems) instrumentation. At each site a number of replicates of a given volume of water will be taken from different depths. These will be filtered through pre-dried and weighed 45 micrometre glass fibre filter paper to determine the concentration of suspended sediments. River discharge will be measured at various sites on the rivers. The composition of bottom sediments will be determined through sedimentological analysis of core samples from the reservoirs and by the use of an echo sounder provided with an appropriate transducer. Bottom sediments will be collected by grabs and dredges. Attempts will be made to determine the amount of sediment retained in the dams since construction through comparison of previous topographical and bathymetric data with the outputs from this study.

**3. Evaluation of the composition and flux of detritus reaching the ocean**

Suspended particle concentrations at the surface, mid depth and bottom of estuaries will be determined following the procedures outlined above, the organic carbon content of suspended sediments (POC) will be determined following the method of Johnson (1949). Dissolved Organic Carbon (DOC) content of the water will be analysed using the sulphochromic method. An estimation of the amounts of deposit will be made through a comparison of bathymetric maps and the use of sedimentological data from the sediment cores

**4. Determination of the path of the turbid plume in the continental shelf and the parameters controlling that path**

Two approaches will be used to determine the pathways of suspended solids in the near shore environment. The first will be based on daily estimates of estuarine expulsions along transects, the second will use remote sensing and Geographic Information Systems. SPOT and LANDSAT images will be analysed using a computerised image processing system. From SPOT data only the channels (XS1 and XS2) which are appropriate for suspended sediment analysis will be used. On the other hand, only the thermal channel from LANDSAT will be used monitor surface temperature. The two types of imagery are required as different levels of resolution are needed for various aspects of the programme. In order to standardise the radiometric values obtained with satellite sensors, *in situ* measurements (i.e., reflectance of detritus, transparency, water temperature and salinity) will be carried out using standard oceanographic methods and landfield spectroradiometers (Cimel CE 310 for SPOT images and Spectron SE 590 for LANDSAT images)

**5. Analysis of satellite images and use of GIS**

All the data from the field studies and image processing such as radiometric data, suspended solid concentration, POC, DOC etc. will be entered into a GIS database (ArcInfo and Pamap). This will be used to furnish information on the circulation of estuarine water, the structure of the plumes of turbid water in the near shore area as well as the role of parameters such as the tides and the currents in the distribution of suspended materials in the waters of the continental shelf.

**Further information**

Geochemical analysis will be carried out in laboratories of countries involved in the project. In cases of difficulty, the laboratory of the Geochemistry Department of the University of Bordeaux will be used. The Centre Universitaire de Recherche en Teledetection of the University of Abidjan and the Remote Sensing Centre of the University of Ghana would handle satellite image processing.

Provisional Budget per country in US\$ based on four participating countries

ITEM	Year One		Year Two		Year Three	
	Regional Input	Funding Agencies	Regional Input	Funding Agencies	Regional Input	Funding Agencies
Salaries	65,300	0	65,300	0	65,300	0
Communications	150	600	150	600	150	600
Documentation/Literature	150	500	150	500	0	0
Satellite images	0	7,750	0	7,750	0	7,750
Image processing	100	1,000	100	1,000	100	1,000
Sample collection/analysis	0	6,000	0	6,000	0	2,000
Field trip expenses (fuel, allowances)	100	9,000	200	11,000	100	9,000
Sedigraph	0	7,750	0	0	0	0
Stainless Steel Sieves, with shaker	0	3,300	0	0	0	0
Chemicals	0	800	0	800	0	800
Glassware	0	350	0	0	0	0
Vacuum pump	0	450	0	0	0	0
GPS	0	2,000	0	0	0	0
Radiometer (Cimel CE 310)	0	5,500	0	0	0	0
Spectroradiometer (Spectron 590)	0	15,500	0	0	0	0
Echo sounder	0	4,000	0	0	0	0
Calibration target	0	1,200	0	0	0	0
Current meter	0	6,500	0	0	0	0
Micro-computer, peripherals & software	0	6,000	0	0	0	0
Four-wheel drive vehicle	0	37,500	0	0	0	0
6 man rubber dinghy with outboard	0	10,000	0	0	0	0
Overseas Fellowships (2 per year)	0	20,000	0	0	0	0
Report preparation	0	10,000	0	10,000	0	10,000
Workshops	0	30,000	0	30,000	0	30,000
Seminars	0	50,000	0	50,000	0	50,000
<b>Totals</b>	<b>65,800</b>	<b>235,700</b>	<b>65,900</b>	<b>117,650</b>	<b>65,650</b>	<b>111,150</b>

**WORKSHOP  
'LOICZ IN AFRICA'**

7-9 August, Hotel Panafric, Nairobi, Kenya

**THE EASTERN AFRICAN/INDIAN OCEAN REGION  
FRAMEWORK PROJECT PROPOSAL**

**Theme: Land-ocean interaction studies along the Eastern African coastal zone: implications for sustainable development**

**Introduction**

The Eastern African region between Cape Town and the upwelling zone in Somali and in particular the coastal zone, present unique and interesting challenges to the study of land-ocean interactions for several reasons: it is a monsoon shelf with characteristic coastal ecosystems such as mangroves, seagrass meadows and coral reefs; it is subject to dramatic oceanic influences such as those associated with the boundary between the East African coastal current and the Somali current; and it is also a zone where major rivers such as the Tana, Sabaki, Rufiji, and Zambezi enter the Western Indian Ocean. The catchment and basin dynamics and sediment delivery are therefore important factors influencing change in coastal environments. Typically the ecosystems in this zone exhibit high productivity which is largely due to river inputs and an efficient recycling of nutrients, which tend to limit production in coastal ecosystems. Consequently these ecosystems are expected to also show a strong response to current reversals and to climatic and anthropogenic forcing through modification of freshwater input, sediment transport and carbonate flux, nutrients and pollutants.

Since limited research work has been done in this region, important basic questions are yet to be answered:

- ◆ How do the mangrove seagrass meadows and coral reefs interact with the physical environment?
- ◆ What is the response of these systems to the human influence?
- ◆ Does the biological and nutrient enrichment seen during part of the monsoon season result from river input, seeping, or invasion of remnant water from the Somali current? and,
- ◆ What are the causes of observed shoreline erosion?

**Proposal**

To address these questions, we propose to study the following with the aim of understanding better the interactive role of coastal ecosystems in the land-ocean zone.

**Project 1. Title: Coastal Ecosystem Health, Implications for Sustainable Development and Economic Uses of East African Coral Reefs and Mangroves.**

**Objectives:**

- ◆ Identify the major functional biotic components of mangroves, coral reef and sea grass communities.
- ◆ Evaluate the role of mangroves in trapping and stabilising sediments.
- ◆ Identify and quantify the major anthropogenic factors stressing these systems.
- ◆ Quantify the contribution of mangrove and sea grass systems to the emission of greenhouse gases (methane, DMS).
- ◆ Identify and quantify the economic value of these ecosystems.
- ◆ Develop a sound scientific basis for forecasting change under different social, cultural and environmental conditions.

**Activities:**

- ◆ Identification will be made of the major components of the flora and fauna of mangrove, coral reefs and sea grass communities at specific sites which represent both pristine and impacted areas. Examples of selected sites are Mafia Island, Rufigi Delta, Malindi, Ungwana Bay, Maputo Bay and Inahaca Island, Bazaruto, Kismayo, Comoros and Mauritius.
- ◆ Studies of sediment trapping in and by mangroves will be undertaken in sites near river mouths and on open coastlines such as the Tana River and Rufigi Deltas and Karanga Island.
- ◆ At the selected sites identified in the first activity above, the effect of different species of mangroves trees and sea-grasses on sedimentation and erosion rates and processes will be established. Special attention will be given to the effects of episodic events.
- ◆ The role of the different ecosystem components in nutrient and carbon cycling (sources and sinks) will be determined.
- ◆ Surveys will be undertaken in selected areas to determine the nature and extent of human impacts on the composition and functioning of these ecosystems. Special attention will be given to mangrove clear-felling, salt production, dynamite fishing, tourism, urbanisation and land-use in watersheds.
- ◆ Measurements will be made of the gradients of methane and DMS in the anaerobic sediments of mangroves and sea grasses at selected sites in Kenya and Tanzania.
- ◆ Studies will be undertaken to determine the value in economic terms of the various ecosystem functions in mangroves, coral reefs and sea grasses.
- ◆ In order to facilitate the collection, compilation and exchange of information, a common data base will be established to service the various activities carried out within the context of the project. This data base will include data from all participating countries within the region.
- ◆ Ecosystem models of these components will be developed on the basis of the data collected and will be used to study their interrelationships.
- ◆ Determine the response of mangroves and coral reefs to environmental forcing including changes in climate and sea level.

**Potential participants:**

## Potential lead organisations Eastern Africa:

Tanzania	University of Dar es Salaam including IMS, Zanzibar. Contact: A. Semesi
Kenya	KMFRI. Contact: E. Okemwa University of Nairobi. Contact: M.J. Ntiba National Museum. Contact: H. Oyieke
Mozambique	University of Maputo. Contact: D. Gove
South Africa	University of Cape Town/Oceanographic Institute (Durban). Contact: G. Brundrit

## Collaborating European Institutions:

Sweden	University of Stockholm. Contact: R. Johnston University of Uppsala. Contact: Pedarsen
Belgium	Free University of Brussels. Contact: De Haas
Netherlands	Netherlands Institute of Ecology. Contact: Heip Netherlands Institute for Sea Research. Contact: Lindeboom

**Project 2. Title: Coastal changes in Eastern Africa: sedimentation erosion processes in relation to global change.****Preamble:**

Most of the shorelines of the region are undergoing change and erosion. Affected environments include beaches, mangrove areas and some wetlands. The causes of the erosion process and its future trends are not well understood. However increasing human pressure especially on mangroves and reefs that play an important biogeomorphic function in stabilising shorelines, is apparent along the entire coast of the region.

**Objectives:**

- ♦ Characterise and determine the vulnerability of different coastal environments to erosional and accretional changes driven by natural and anthropogenic forcing.
- ♦ Quantify the capacity of individual coastal systems to supply and retain sediments.
- ♦ Assess the contribution of rivers to the coastal sediment budgets.
- ♦ Determine shoreline evolution trends.
- ♦ Determine the quantities and physicochemical characteristics of sediments delivered to the coastal zone and their temporal variations.

**Justification:**

Coral reefs, mangroves and seagrass beds form important ecosystems in the Eastern African region. Available baseline studies indicate that these ecosystems are undergoing rapid change, due to natural and anthropogenic influences.

**Methodology:**

- ♦ Carry out visual assessment and characterisation of the major coastal types.
- ♦ Sample coastal deposits along predetermined transects perpendicular to the shoreline at selected representative sites.
- ♦ Analyse samples for textural, physical and chemical parameters.
- ♦ Determining accretion rates from cores and direct measurement of sedimentation flux.
- ♦ Taking shore profiles on seasonal basis.
- ♦ Measure flow velocity, hydraulic radius and channel width in order to compute discharge at the river mouth.
- ♦ Determine sediment load at river discharge.
- ♦ Measure salinity, temperature, and current velocities at various stations at the study sites and obtain coastal meteorological data.

**Outputs:**

At the end of the investigation period the following shall have been achieved:

- ♦ Thematic information on the different coastal types indicating their relative vulnerability to shoreline change.
- ♦ Data on factors responsible for erosion/accretion processes.
- ♦ Data on the functional roles of mangrove, sea grass beds and coral reefs in relation to shoreline stability.
- ♦ Data on sediment contribution from the major rivers.
- ♦ Data on distribution and nature of sediments brought into the coastal ecosystems.
- ♦ Data on temperature salinity and current velocity.
- ♦ A descriptive model on the erosional and deposition processes.
- ♦ Information on the response of coastal ecosystems to changes in climate, land use, and geographic factors.
- ♦ Quantification of erosion and accretion rates within the different coastal systems.

**Input:**

Scientific staff from each Eastern Africa institution carrying out LOICZ related activities available research equipment, and laboratory space.

**Potential Participants****Potential lead institutions**

Kenya	Kenya Marine and Fisheries Institute Nairobi University Kenyatta University Moi University Coast Development Authority Kenya Wildlife Service
Tanzania	University of Dar-es-Salaam Institute of Marine Sciences

Mozambique	University of Eduardo Mondlane, Marine Biological Station at Inhaca
South Africa	Institute of Oceanography, Durban University of Cape Town
Mauritius	Ministry of Environment and Quality of Life, Port Louis, Mauritius
Comoros	INRAPE, Ministère de l'Agriculture, Pêche et Environnement CNDRS BP 169, Moroni, Comoros

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**Project 3. Title: Socio-economic impacts of Global and Regional changes on coastal ecosystems along the Eastern Africa coastline.**

**Rationale:**

The Eastern African Coastal Zone resources have been and continue to be modified by global change with socio-economic drivers of change such as population growth, increasing rate of urbanisation, increasing industrialisation and intensification of agriculture causing stress and degradation to the resources. However, information on global change impacts is quite limited in the region.

**Objectives:**

**Short-term**

- ◆ To conduct economic valuation of resources within selected study sites in the Eastern Africa coastal ecosystems.
- ◆ To establish a collaborative multidisciplinary regional research teams to collect and analyse data.
- ◆ To investigate the socio-economic relationship between people and coastal resources.

**Long-term**

- ◆ Developing models for the Eastern African Coastal processes.
- ◆ Forecasting of future anthropogenic coastal changes based on models developed in the above.
- ◆ Develop a database for model building and validation.
- ◆ Develop modalities for data and information exchange.
- ◆ Assessment of the future impacts and development of mitigation strategies.

**Outputs:**

- ◆ Economic valuation of coastal ecosystems particularly mangroves, beaches and coral reefs.
- ◆ Data on socio-economic forces driving change in coastal ecosystems.
- ◆ Database on socio-economic processes including relationships between community dependence on coastal resources and rates of change in coastal environment.
- ◆ Conceptual and semi-quantitative models of the coastal processes.
- ◆ Forecasts of anthropogenically induced coastal changes.

**Methodology:**

- ◆ Economic assessment of coastal resources using *inter alia* contingent valuation method - (CVM) and travel cost method (TCM).
- ◆ Surveys will be undertaken in selected study sites to determine the nature and extent of human impacts on coastal ecosystems. Specifically the following techniques will be applied:
  - \* Participatory approaches including participant observation;
  - \* Key informant interviews;
  - \* Resource survey inventory;
  - \* Focus group discussions;
  - \* Secondary data analysis;
  - \* Ethnographic methods;
  - \* Social mapping of critical resources;
  - \* Case studies.



### Study sites

Country	Site
Kenya	Mombasa
Tanzania	Zanzibar
Mauritius	Grand Bay
Mozambique	Maputo
Comoros	Moroni
South Africa	Port Elizabeth
Seychelles	Mahe
Madagascar	Nosy be'
Reunion	Port St. Denis
Somalia	Mogadishu

**Proposed duration:** 10 years divided into phases

Phase I:	3 years
Phase II	3 years
Phase III	4 years

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The total estimated budget for all three project elements is as follows:

Budget	ECU	
Equipment	500,000	500,000
Chemicals	250,000	250,000
Transport	100,000	100,000
Expert exchange and services	150,000	150,000
Field allowance	180,000	180,000
Salaries (scientists, post docs, PhD, assistants)		1,800,000
Miscellaneous	20,000	20,000
Total		3,000,000 ECU