

**G**lobal

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**Intergovernmental Oceanographic Commission**

*Workshop Report N°158*

## **THE IOCARIBE USERS AND THE GLOBAL OCEAN OBSERVING SYSTEM (GOOS) CAPACITY BUILDING WORKSHOP**

**San José, Costa Rica**

22-24 April 1999

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## 1. INTRODUCTION

The IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE) and the Global Ocean Observing System (GOOS) Capacity Building Workshop was convened in San Jose, Costa Rica, 22-24 April 1999. The purpose of the Workshop was to inform IOCARIBE countries about the GOOS, and to identify and discuss capacity building needs and priorities for the development of GOOS in the region.

Participants were invited from all IOCARIBE countries and from international Organizations active in the region. A list of participants is given in Annex I.

The meeting was co-sponsored by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the Earth and Life Science Council of the Netherlands Foundation for Scientific Research, and the Swedish International Development Agency.

The meeting took place at the Auditorium of the “Ciudad de la Investigación” of the University of Costa Rica (Ciudad Universitaria Rodrigo Facio).

The agenda is included in Annex II. The meeting was chaired by Dr Jan H. Stel (IOC), who was assisted by Ms Janice Trotte (IOC) in facilitating the meeting.

At the opening ceremony, Professor Manuel M. Murillo, “Director de la Oficina de Asuntos Internacionales y Cooperación Externa”, presented a warm welcome to the experts participating in the Workshop and, on behalf of the University of Costa Rica and the Organising Committee, expressed his wish that the outcome of the meeting would be a specific proposal for the future establishment of a regional component of GOOS for the Wider Caribbean. Such a proposal should desirably be considered by the IOCARIBE Sub-Commission at its Sixth Session, scheduled to take place in San José, the following week. Prof. Murillo also pointed out the importance that, through their insertion in GOOS, IOCARIBE Member States could contribute and derive benefits from the operational oceanographic programmes being coordinated by the IOC.

Mr José J. Chaverri, representing the “Ministerio de Relaciones Exteriores y Culto” also welcomed the participants on behalf of the Government of Costa Rica. He stressed the economic and social impacts that hurricane Mitch has exerted on Central American countries and urged Workshop participants to bear in mind the importance of being able to increase the capacity of Caribbean countries to forecast natural hazards and respond to them in a timely fashion. He also manifested the importance that his Ministry has been placing in scientific matters as a whole, bearing in mind the need to be better prepared to limit the devastating effects of natural phenomena we cannot yet predict. He finally mentioned that the Government of Costa Rica has recently proposed a national scientist to a Director’s post in the World Meteorological Organization (WMO), reassuring the support of the Country to operational projects in the Caribbean region.

Dr Stel welcomed the participants on behalf of the IOC. In his speech, he stressed the importance of awareness creation towards the general public, policy makers and politicians. He drew the attention to the striking difference between the economist’s and ecologist’s view towards the use of our home planet. In economy one “discounts”. This is a system to make rational choices when resources are scarce. As a consequence, economists “discount” the future. By doing this they consider “values” in the future less relevant than the ones of today. Ecologists, however, start from a different perspective. They consider the future as important as the present. They are sceptical about improvements of technology and human behaviour unless they are proven. As a consequence, there is a need for a new global governance, which does not only include new forms of governmental cooperation and the development of new institutions but also the active involvement of the civilian society. Some signals of change in this respect are:

- Unilever controlling some 20% of the world's white fish market in Europe and Northern America decided to only buy fish that has been caught and produced in a sustainable way;
- volunteers in India and Ecuador, among other countries, replanting mangrove areas in order to repair the damage from shrimp farming.

Good governance means investing in capacity to govern. Rightfully the United Nations Convention on the Law of the Sea (UNCLOS) and the United Nations Conference on Environment and Development (UNCED) indicate that capacity building is a prerequisite for a successful sustainable development of the coastal area and the Exclusive Economic Zone (EEZ). Although capacity building has to take place at a national and regional level, it is a global responsibility which can be achieved by raising awareness and new approaches in the cooperation between the government, the private sector and the civil society. The revenues of a tax of one tenth of a percent on global industrial and recreational activities would result in a budget of some 500 million US\$; that is to say, five times the present budget of the International Maritime Organization (IMO) and the Food and Agriculture Organization (FAO) together. The oceans of the future have to become our oceans. Oceans are about people; they are about you and me. The text of his speech is given in Annex III.

## **2. ARRANGEMENTS**

### *Adoption of the Agenda*

The agenda was introduced by the chairman and was adopted by the meeting

### *Designation of a Rapporteur*

The chairman proposed Prof. Christopher Mooers of the Rosenstiel School of Marine and Atmospheric Science of the University of Miami, USA as Rapporteur for the meeting.

### *Logistics and Administration*

Ms Janice Trotte informed Workshop participants that through the generous contribution made by the Dutch Government and the Swedish SIDA/SAREC funding agency, a few attendees have received an IOC grant to participate in the Workshop.

## **3. PRESENTATION OF GOOS**

### **3.1 WORKSHOP OBJECTIVES (Jan Stel)**

Dr Jan Stel explained the objectives of the Workshop. He said that this workshop aims to examine the needs and the capabilities available to start developing a regional GOOS. And, as an immediate follow up, to recommend a pathway to follow, including capacity building needs for initiating the process.

At the end of the Workshop, feasible initial steps and a management structure need to be recommended. In recent years, several workshops of a similar nature have led to promising initiatives for regional GOOS activities; for example, MedGOOS (for the Mediterranean Sea) and NEAR-GOOS (for the Northeast Asian Region of WESTPAC) have now commenced and are a close analogue to what may be needed for the Wider Caribbean. Thus, the challenging objectives of this workshop should be attainable.



### 3.2 GOOS ORGANIZATION, OBJECTIVES AND PRINCIPLES (Janice Trotte)

A presentation on the basic principles, concepts and aspects of GOOS was made by Janice Trotte, on behalf of the GOOS Project Office. She described the rationale for the creation of GOOS and also the economic significance for setting up such a system of observation for the world's oceans.

GOOS is a global project co-sponsored by IOC, WMO, United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). It is supported by governments and implemented according to a set of principles to which all participants adhere. There is no single model to follow and its implementation is to be fully based on the regional vocation. Individual countries are free to participate, provided they accept those principles.

The design of GOOS to date has been based on the four modules that constitute GOOS and on the stage of implementation of pilot projects that have been developed in other regions.

The concept of GOOS as a user-driven project has been strongly stressed in the presentation and also served to underpin some ideas on how to proceed in the process of setting up a regional GOOS programme for the Caribbean.

GOOS will capitalise on the already existing activities in the region and the scientific data sets already available for the Caribbean, to be converted into products of beneficial use by society and governments, as well as other users, yet to be identified by the participating countries. GOOS will, to the extent possible, utilise successful results of various other initiatives such as the Tropical Atmosphere Ocean Array (TAO), the Pilot Research Moored Array in the Tropical Atlantic (PIRATA), among others.

Many aspects relating to the new concept of Operational Oceanography have been discussed, bearing in mind that it refers to a new way of acquiring and using oceanographic information to produce deliverables of practical use to the region.

GOOS is likely to ramp up in the Caribbean through the creation of national structures that would ultimately contribute to build awareness of GOOS in those countries and promote the optimal use of the regional resources already in place.

The Capacity Building component is highly important to promote GOOS in the Caribbean, which presents some level of diversity in terms of the available logistic, operational and human resources to carry out the required GOOS tasks.

Several capacity building activities were envisaged as to be immediately deployed or implemented in the region, such as the facilitation of training, provision of coordinated use of available institutional infra-structure, resources etc.

The GOOS Web site (<http://ioc.unesco.org/goos/goos.htm>) includes much relevant information on GOOS and links to related sites.

### 3.3 GOOS CAPACITY BUILDING GOALS (Jan Stel)

Some concepts in capacity building were introduced by Dr. Jan Stel. He said that the major policy pulls for the development of marine science and technology in the next century are (i) the implementation of United Nations Conference on Environment and Development (UNCED)'s programme of actions listed under 'Agenda 21' and (ii) the United Nations Convention on the Law of the Sea (UNCLOS)'s various provisions reflected in a number of articles on the rights and obligations of countries. These relate among others to the exploration and exploitation of marine resources in the Exclusive Economic Zone (EEZ). The costs to implement Rio's actions is an estimated US \$ 120

billion per year. This is two times the present official development aid (ODA) from the member countries of the Organization for Economic Cooperation and Development (OECD). Since 1970, the ODA effort of the OECD has more or less remained at the same level of some 0.3% of GNP, instead of the UN accepted target of 0.75% in 1970. The major funding mechanism for implementing UNCED requirements is the Global Environment Facility (GEF), a joint programme of the World Bank, the United Nations Environment Programme (UNEP), and the United Nations Development Programme (UNDP).

No clear-cut procedures for the development and strengthening of a marine research capability exist. A number of elements can, however, be identified at different levels. These are: (i) human resources at the level of the individual scientist (micro-level), (ii) the necessary institutions (meso-level) and (iii) an enabling national environment which is willing to support and sustain a marine research activity (macro-level). These levels must be seen in relation to each other and as expressions of a single system.

- (i) On the micro-level, the following capabilities and requirements are important:
  - a) the capacity to formulate a project and to carry out the entire project cycle (including transferring the results to the public at large, policy makers and politicians);
  - b) appropriate qualifications through further academic training (M.Sc. and Ph.D.);
  - c) motivation, and the opportunity to undertake operational oceanographic activities, including research;
  - d) external contacts (national and international), networks, and membership in professional associations; and
  - e) access to information (libraries, databases etc.) and equipment.
- (ii) At the level of institutions, capacity is needed for:
  - a) the development of policy; the development and management of projects and programmes (priority-setting, coordination, monitoring, and the publication and dissemination of results to users);
  - b) the acquisition and management of funds;
  - c) the training of staff;
  - d) the provision of adequate incentives and working conditions (time, financial resources, salaries, libraries, laboratories, equipment, funds for travel etc.);
  - e) a network of external contacts, which provide links to other operational research centres, funding agencies, voluntary Organizations, business, government bodies etc.; and
  - f) monitoring and evaluation of projects and programmes.
- (iii) An "enabling national environment" concerns aspects such as:
  - a) commitments at the national level to a policy and a set of measures aimed at promoting and maintaining a marine capacity, including adequate and sustained funding of institutions, infrastructure and programmes;
  - b) mechanisms for steering marine activities towards topics that are of relevance to the economic, social, cultural and political development of society, and possibilities for various groups to articulate their interests;
  - c) links between basic and applied research, policy, and practise (involvement of research users in prioritising, implementing and disseminating research); and
  - d) a professional environment, including formal associations, standards, mobility, incentives, and a research tradition.

The partnership approach is based upon the mutual interest (learning by doing) of the scientific communities of the partners in the industrialised and southern countries. As part of a long-term (10 years) bi- or multilateral commitment to joint scientific research programmes, capacity building activities are an intrinsic part of partnership programmes. Funds for the scientific component of the programmes should be granted by relevant national science foundations. Funding for the capacity building component is sought through national and international ODA Organizations as well as sources such as the European Union, World Bank, Inter-American Institute for Global Change (IAI), UNEP, GEF, the Association of Caribbean Development Bank (CDB) etc. Partnership programmes form a flexible instrument to integrate capacity building activities at the individual, institutional, national and regional level. Within a partnership donors can integrate their activities by 'adopting' an institution or country. The linking with science foundations guarantees the transfer of high quality products.

### 3.4 GOOS BENEFITS (Janice Trotte; Jan Stel)

Ms Janice Trotte presented several examples of benefits in participating in GOOS, such as the laying of the foundations for the creation of an early warning storm surge system, ships meteorological routing, management of ports and harbours, climate forecasts, preparing for epidemics etc. All the examples provided made a strong case to the cost benefit approach of GOOS and how governments and society as a whole could benefit from the utilisation of operational data. Impacts of *El Niño* Southern Oscillation (ENSO) forecasting on agriculture were shown, with a clear demonstration on how that information could help planning crop production and the following harvest season for impacted areas.

A case-study was demonstrated for the North-eastern region of Brazil, that led to substantive savings for the agricultural sector. A graphic showing the impacts on grain harvest after the 1987 El-Niño event, when no forecasting information was taken into consideration, and therefore leading to a crop production equivalent to 10% of the total expected value, was compared to the 1992 harvesting season for the same region, when forecasting information was taken into consideration and a planned response considered. The result was that a drought resistant seed was chosen and therefore the crop production was 80% of the total expected value, much higher than the one obtained in 1987. This single action has resulted on an economic gain of some US\$ 2.0 billion dollars for the agricultural sector of Brazil.

After demonstrating other values of operational data use for forecasting malaria epidemics in Colombia and maize yield crop in Zimbabwe, Janice described the rationale for setting up the first operational observing system for the Tropical Atlantic.

The motivation for setting up the Pilot Research Moored Array for the Tropical Atlantic (PIRATA) derived from scientific evidence already achieved on how much impact natural forcings (both climatic and oceanographic) can exert on the economies and social welfare of nations bordering the Tropical Atlantic, especially over their coastal zones.

The design of the ATLAS buoys that compose the PIRATA array and a demonstration of its data output, as obtained on the Internet, was provided to participants. PIRATA can serve as a good demonstration project on how to try implement similar observing systems in other regions.

As a final remark, it was made clear that no one country or agency related to GOOS by itself could perform the whole suite of activities required to permanently observe the state of the oceans and therefore a concert of actions between all observing systems, satellite agencies, existing strategies etc. is to be achieved, for the benefit of all States.

### 3.5 EUROGOOS AND SEA WATCH (Jan Stel)

Dr Jan Stel gave a brief overview of the development of EuroGOOS, the association of European agencies for developing operational oceanographic systems and services in European seas, and for promoting European participation in the Global Ocean Observing System (GOOS). EuroGOOS member agencies are already deeply committed to conducting operational oceanography, and delivering products to customers. Extensive customer search has been carried out, and EuroGOOS has identified both the customer community and the products they need. The scale of the business generated in operational oceanography could be of the order of 5,000 jobs, with a turnover of the order of 500 million ECU per year.

EuroGOOS was established in December 1994, based on a Memorandum of Understanding (MOU), which was signed by European institutions interested in the development of operational oceanographic activities in the seas of Europe. The members are now 31 agencies from 16 countries. EuroGOOS has established an office at the Southampton Oceanographic Centre in the UK. The office was funded by the National Environmental Research Council (NERC) for a period of five years (until 1999). Six regional task teams have been established for EuroGOOS to devise the following projects: Atlantic, Arctic, Baltic, Mediterranean, North West Shelf, Global, and two underpinning programmes on capacity building in developing countries and generic support in strategic sectors.

A EuroGOOS Plan, published in 1997, builds on the "Strategy for EuroGOOS". The projects are designed to demonstrate the potential of collaboration between agencies for creating operational services in European coastal and ocean areas. The Plan was approved by the first EuroGOOS Conference which was organised in The Hague, the Netherlands, in October 1996. The proceedings of the Conference were published in December 1997 by Elsevier, in its Oceanography Series. EuroGOOS published a series of special reports on its Science Base (1998), Atlantic Workshop (1998), Technology Survey (1998), Mediterranean Forecasting System (1998) and Data and Information Requirements (1999). The Second EuroGOOS Conference was held in March 1999 in Rome, Italy. It was a success and demonstrated the major steps taken forwards to in realising EuroGOOS.

Dr Jan Stel also introduced the Sea Watch System which offers one potential aid to capacity building in relation to GOOS. Sea Watch is an on-line, off-the-shelf environmental monitoring and surveillance system developed to provide an operational information system for the management of regional seas. It consists of the following modules: data acquisition; data storage; analysis and presentation; environmental modelling and forecasting; distribution of data; forecasts and user relevant information.

The data acquisition module includes a network of moored marine environmental data collection buoys. All data and results from the various models, are collected in a processing centre where the results are quality checked, and then used for monitoring and forecasting purposes. This centre could be compared with a processing centre in a weather bureau. Sea watch forecasts and environmental data are distributed to clients such as: public authorities, aquaculture/fish farming, commercial fishing, tourist industry, research institutes, navy and coast guards. A cost-benefit analysis of the Sea Watch System performed by the Organization for Economic Cooperation and Development (OECD) (1996) demonstrated that the system provides recognisable benefits. Sea Watch systems have been deployed in a variety of geographical regions from tropical (Thailand, Indonesia, India, Vietnam) to temperate (Spain, Greece, North Sea, Latvia) and arctic (Barent Sea) environments.

### 3.6 OFFER AND DEMAND FOR IOC SERVICES AND PRODUCTS (Amparo Ramos)

Nowadays information is the basis of any daily activity. Public and private areas and communities are influenced by large amounts of information obtained from special interest groups. Giving information effectively and efficiently is one of the objectives that is yet to be achieved for the

development of an efficient strategy in the sustainable use of the natural resources of the marine and coastal environment.

Even though information is a pre-requisite for the decision-making processes, it is not easily obtained by everybody. Much of the information produced by science can be found in scientific papers, which are not widely used by the public. In addition, the production of new knowledge and the urgent need for making decisions about the ocean and the coastal zones have not coincided in time so far. Conscious of this deficiency, the two big circles of action, the Area of Knowledge (investigators) and the Area of Management (decision makers, managers and planners) need to establish a mechanism of interaction (dialogue) that permits integrating knowledge with action, in other words, that permits the socialisation of information for action.

The information for making decisions is the result of a strategic process of Investigation-Interaction-Participation because it involves a process of change or transformation in the social appropriation of knowledge, which is vital for the development of a country and particularly for the coastal zones. It produces a real impact on decisions and the planning of actions regarding the marine environment and the coastal zones and focuses on the resolution of specific problems, in increasing the level of understanding of them and in the management of scientific information for making decisions. It involves all the players (passive and active, public and private) interested in the coastal zone in a space of communication and coordination, for the negotiation and transaction of the use of information produced. It considers training as an exchange process involving intellect-experience (co-training) from where understanding of the phenomenon and realities is broadened, and the use of tools is allowed, and also the process of planning is made possible.

For this reason, when offering information, it is important that the organizations offering information services develop a capacity for commercialization of their services, a capacity for offering adequate services in quality, opportunity, flexibility and a capacity to maintain a permanent dialogue with information users so as to meet their needs and match supply and demand, based on the users' needs, whether they are from the public or private sectors, whether they are investors, planners, governments etc.

For this purpose and in order to guarantee that information, besides being available is actually used, it is necessary to:

- i) have a viable platform that develops the flow and transactions between information supply and demand (Information Marketing);
- ii) facilitate and permanently maintain a channel and language of communication between the management and knowledge areas (scientific community) in order to establish mechanisms to use information in decision making and planning actions aimed at sustainable development of the oceans and the coastal zones;
- iii) develop a capacity of commercialization of the information services and a capacity of offering adequate services in quality, opportunity and flexibility for making supply and demand compatible;
- iv) identify mechanisms that allow to satisfy, in real time, the information needs of the decisions makers, planners, investors (users) for the analysis of the problems with a whole vision;
- v) identify the voids of information and research needs from the users in order to orient the information supply; and
- vi) train users for interpreting and applying technical-scientific information; otherwise this information probably will be wrongly used or will be left out during the process of strategy planning or decision making.

### 3.7 COUNTRY AND USER STATEMENTS ON NEEDS AND REQUIREMENTS, INTERESTS AND CAPABILITY

The reports presented by each participating country and that were handed in time for publication in this Report are given in Annex IV.

### 3.8 REPORTS ON ONGOING CARIBBEAN PROJECTS AND ACTIVITIES RELATED TO GOOS

#### 3.8.1 Inter-American Institute for Climate Research (IAI) (Armando Rabuffetti)

The Inter-American Institute for Climate Research (IAI) was founded in 1996 to facilitate capacity building in Latin America and the Caribbean mainly in what refers to projects related to climate change. It has completed the initial phase of capacity building and planning and has commenced a series of multi-year, multi-disciplinary, multi-national research studies on a variety of topics in hydrology, meteorology, terrestrial and marine ecology and physical oceanography.

IAI is interested in exploring partnerships with the regional GOOS activity for the Wider Caribbean.

#### 3.8.2 Land-Ocean Interactions in the Coastal Zone (LOICZ) (Hertwig Kremer)

As one of the eight core projects of International Geosphere-Biosphere Programme (IGBP), the Land-Oceans Interaction in the Coastal Zone (LOICZ) Project is providing science information describing the contribution and response of coastal systems to global change.

Central LOICZ objectives are the fluxes of CO<sub>2</sub> and nutrients through the coastal domain and their respective cycles; in particular, the question: "How will changes in land use, sea level and climate alter coastal ecosystems, and what are the wider consequences?"

The coastal zone is addressed as a three dimensional global compartment of the Earth's surface where land, sea and atmosphere meet and interact. Practical knowledge of the heterogeneous coastal zone depends on harnessing an array of research from natural and social sciences and recognising both anthropocentric and geocentric driving forces of change. The LOICZ programme is designed to encompass these elements in providing science information to the global community, which should also prove vital for decision-makers and managers.

In its first five years a global network of 2,400 scientists has been established and 250 projects are continuing to deliver scientific answers against the LOICZ questions on different spatial scales. Major topical LOICZ core projects include the whole European Land Ocean Interaction Studies (ELOISE), (30 EU funded scientific projects); a Coastal Typology database, Biogeochemical Modelling in particular addressing C-N-P fluxes and changes, Deltaic Processes, a Continental Margins Task Team and the South East Asia Project, which since the last four years is aimed at developing indicators and integrated modelling tools through bridging biogeochemistry and socio-economic aspects of nutrient flux changes. This may serve as a template for other regional approaches.

LOICZ work follows two major thrusts which are the development of horizontal and partly vertical material flux models and the scaling of the models from local via regional to global. Based upon 200 flux budgets, LOICZ is expecting to provide significant information on the role of the coastal zone in global change. Further efforts will concentrate on transboundary processes along the whole water continuum including catchments, estuaries etc. and how they affect the coastal system. Anthropogenic coastal changes and the response of society to those changes (the human dimension and human welfare) have become a major LOICZ objective, which is addressed through the

application of the Drivers, Pressure, States, Impact, Response (DPSIR) Scheme as outlined by the OECD, starting in the 1990s and developed further for LOICZ integrated modelling purposes.

LOICZ deliverables such as guidelines for biogeochemical budgeting and integrated socio-economic/natural science modelling are public domain and applicable tools open for a broad scientific use. The LOICZ coastal typology database is a standardised collection of scientific information on biogeochemical, climate, hydrographic and socio-economic coastal data as well a compendium of information on coastal basin dynamics. It is currently being used to process predictions and scenario simulations of future coastal change on various scales and seeks further processing by the scientific community.

Since 1998 IOC and LOICZ have strengthened their discussion on potential cooperation for the further development of databases, identification of key indicator variables for monitoring (particularly at local and regional scales) and the brokering process of science deliverables to coastal users. It has been acknowledged that especially the Coastal Module of GOOS and LOICZ are following common agendas and have mutual interests in pursuing joint efforts for scenario building and model valuation. Significant LOICZ contribution is expected to come from the typology database as well as from the application of the biogeochemical modelling tools including the human dimension, which may foster the monitoring networks GOOS is committed to. For LOICZ the wider application of its models, tools and guidelines will provide sound validation through a broad scientific community.

The Caribbean Sea covers a broad spectrum of characteristic geomorphological coastal settings including islands of various size dominated by well defined socio-economic drivers - pressure - response scenarios. Hence, LOICZ aims to support scientific synthesis in the region, which adds considerable regional information to the estimates of biogeochemical fluxes and functions to the overall goals of IGBP in understanding the total Earth system.

The application of the LOICZ modelling tools and data bases may also allow for higher order understanding of sensitivity and interactions between socio-economic drivers, coastal state change and society response than is normally requested for global synthesis. Especially if this is performed on the level of defined demonstration sites, for example based on the institutional network and scientific work of the CARICOMP sites in the Caribbean, the outcome will not only ultimately form a future legacy of LOICZ to coastal zone science and management, but also will be a major aid to regional applied science and the design of a regional monitoring scheme like CaribbeanGOOS.

### **3.8.3 Intra-Americas-Sea Initiative (IASI) (Kevin Leaman)**

The Intra-Americas Sea Initiative (IASI) is an international effort that initially developed out of the joint interests of the University of Miami Rosenstiel School of Marine and Atmospheric Science, the NOAA Atlantic Oceanographic and Meteorological Laboratory/CIMAS Joint Institute, and the Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC), a regional scientific organization with central offices in Panama, R.P.

IASI provides a broad framework to carry out research and education endeavours in the IAS (the Caribbean Sea, Gulf of Mexico, Straits of Florida and adjacent waters). Recent international scientific and planning meetings have identified three major scientific areas of focus, as well as emphasizing the need for a well-developed observing system (IAS-GOOS).

These primary research areas are:

- i) Improved understanding of basic physical processes. (These include the dynamics of the Western Hemisphere Warm Pool and its effect on landfalling hurricanes, the variability of

- mesoscale eddy fields in the Caribbean Sea and Gulf of Mexico and processes such as upwelling);
- ii) Improved understanding of biological-physical interactions in the Intra-Americas Sea (IAS), including the intercommunication of separated biological communities through downstream larval transport, and links between time variable circulation and life-cycle histories of various organisms;
  - iii) Improved understanding of coastal processes and the interconnections between coastal and offshore, remote environments.

All of these research problems carry broad implications for societal issues in the countries of Latin America and the Caribbean (LAC). A basic realisation in IASI is the intense "interconnectivity" of the whole LAC/Caribbean Sea environment. It is difficult to envision environmental problems occurring in one part of the IAS that could not potentially (and negatively) affect a much wider region. It is not difficult to identify the importance of societal problems in the IAS that could be ameliorated through the type of efforts envisioned for IASI because they form the basis of daily news stories, whether they are referring to dispersion of oil pollution, depletion of fisheries, destruction of coral reef habitats, or the disasters (and as yet difficult to predict), produced by intensification of landfalling and hurricanes.

The success of IASI (and of its IAS-GOOS component) requires that a broadly based communication network among scientists, policy makers and "end-users" be maintained and strengthened. Such success also depends on the existence of a well-trained cadre of professional research personnel in all LAC countries (as well as the US). As an example related to one component of IASI, "products" of an IAS-GOOS will be of little interest or value to the region unless all users can participate fully in the development and use process.

There has now been established, with a variety of funding sources, an IASI coordination office with the branch offices of CATHALAC at the Rosenstiel School of Marine and Atmospheric Science. The office is active in developing some of the goals outlined above. For example, it has helped to establish joint degree programmes in environmental science with one Central American university and is in the process of developing other such links. It has been involved in the development of GLOBE education programmes in Central and South America, as well as Web information resource to provide environmental and modelling information, library and other information resource products to LAC users. Work developed within IAS-GOOS component of IASI is also carried out through those facilities. IASI offer the resources of the office to support the overall goals of IAS-GOOS development in the IAS region.

#### **3.8.4 Caribbean Coastal Marine Productivity (CARICOMP) (John Ogden)**

The Caribbean Coastal Marine Productivity (CARICOMP) Network was established in 1990 with the support of UNESCO and to date has negotiated a Memorandum of Understanding with 28 sites in 19 countries to conduct a standardized, synoptic set of measurements of the structure, productivity, and associated physical variables of relatively undisturbed coral reefs, seagrasses, and mangroves.

Since 1993, approximately 12 sites have fully implemented the protocol, 7 sites are doing some part of it, and 9 sites are in the planning phase. The principal goals of the programme are to determine the dominant influences on coastal ecosystem structure and productivity and to discriminate human disturbance from long-term natural variation in coastal systems over the full regional range of their distribution. The CARICOMP programme provides an infrastructure to provide ground truth for the new generation of satellites which will greatly expand the utility and coverage of future monitoring and permit broadscale investigations of the interaction of coastal ecosystems with the open sea. Coordinated by a Data Management Centre at the University of the West Indies in Jamaica, the network provides a rapid response capability for regional phenomena such as coral bleaching, mass mortalities and diseases, and periodic oceanic phenomena. It also regularly



organizes capacity building workshops and training sessions. It is proposed to bring the CARICOMP programme into the Coastal Panel of GOOS (C-GOOS) with the cooperation of the IOCARIBE.

### **3.8.5 Strategic Background for Inter-Americas Sea - Global Ocean Observing System (IAS-GOOS) and Inter-Americas Sea - Regional Ocean Data Assimilation Experiment (IAS-RODAE) (Christopher Mooers)**

The Gulf Stream originates in the Inter-Americas Sea (IAS) and serves to connect the physical, chemical and biological systems of the IAS through physical transports. This connectivity has strong implications for coastal zone management on a regional scale. The circulation associated with the Gulf Stream System induces further mesoscale variability. This circulation variability needs to be estimated on a day-by-day basis in order to support regional environmental and ecological management, for example, to deal with transport pathways and rates associated with the dispersal of oil spills on one hand, and with the dispersal of fish eggs and larvae on the other, both in the context of their implications for the design and management of marine reserves. Numerical models of the IAS circulation have progressed to the point where credible simulations of the mesoscale variability exist and are now ready for quasi-operational prediction (*i.e.*, hindcasting, nowcasting and forecasting) given adequate observations on a regular basis in time with good spatial coverage.

Observing systems in the IAS have been developing relatively rapidly, but without any overall scientific design nor regional stewardship. For example, the various extant observational networks need to be made more accessible through Internet and Web linkages; *in situ* and remote sensing observations need to be integrated with numerical models; and research needs to be performed for determination of an optimal observing system.

In the interim, there are obvious steps to be taken to upgrade the observing system, *e.g.*, extending the Voluntary Observing Ship (VOS)-network. To create a prototype IAS information system (which includes system design, observations, models, information product creation and dissemination, user feedback mechanisms, and system assessment) for demonstration of capability in R&D mode, an IAS-RODAE (Regional Ocean Data Assimilation Experiment) should be initiated and conducted in association with the Global Observational Data Assimilation Experiment (GODAE). In summary, such a regional experiment (IAS-RODAE) will lead to the design of a fully operational regional GOOS (IAS-GOOS) that will provide the "downscaling" bridge from the global-scale GOOS to the coastal scale GOOS of individual IOCARIBE nations within a decade.

### **3.8.6 Regional Centres of excellence for Coastal Zone Management (Paul Geerders)**

The concept for such centres was developed in a close contact between Paul Geerders, Alan Duncan and Bruce Potter. Later it was presented with success during the meetings of Training, Education and Mutual Assistance (TEMA) in Concepción, Rio Grande and Cartagena, as a possible supporting initiative. A final decision on adopting this proposal will be made at a meeting later this year in Barcelona, Spain.

The proposed concept aims at fulfilling a number of needs and requirements related to the Integrated Coastal Zone Management (ICZM) in the region, including: hands-on training, information access through the Internet and direct access to remote sensing data. The Regional Centres of Excellence in ICZM would carry out tasks related to:

- i) training in fields related to ICZM;
- ii) production of data and information products;
- iii) operational access to satellite and other remote sensing data;
- iv) rapid access to Internet;
- v) assistance in solving ICZM problems in the region;
- vi) assistance and support related to environmental disasters; and

- vii) creating awareness at political level as well as with the general public.

The further development of a proposal and its implementation will depend on the availability of suitable partners and appropriate funding.

### **3.8.7 Planning for Adaptation to Global Change (CPACC) (Floyd Homer)**

The CPACC Project is funded by the Global Environment Facility (GEF), implemented by the World Bank and executed by the Organization of American States. The project is coordinated in the Caribbean through the Regional Project Implementation Unit (RPIU) in Barbados. Its overall objective is to support Caribbean countries in preparing to cope with the adverse effects of global climate change (GCC), particularly sea level rise, in coastal and marine areas, through vulnerability assessment, adaptation planning, and capacity building linked to adaptation planning. More specifically, the project will assist national governments and the University of the West Indies Centre for Environment and Development (UWICED) to: (i) strengthen the regional capability for monitoring and analyzing climate and sea level dynamics and trends, seeking to determine the immediate and potential impacts of GCC; (ii) identify areas particularly vulnerable to the adverse effects of climate change and sea level rise; (iii) develop an integrated management and planning framework for cost-effective response and adaptation to the impacts of GCC on coastal and marine areas; (iv) enhance regional and national capabilities for preparing for the advent of GCC through institutional strengthening and human resource development, and (v) identify and assess policy options and instruments that may help initiate the implementation of a long-term programme of adaptation to GCC in vulnerable coastal areas. It is executed through the cooperative effort of all twelve participating CARICOM countries and through a combination of national pilot/demonstration actions and regional training and technology transfer linked to adaptation planning. The project will execute a comprehensive programme of human resource development for upgrading the skills of technicians and officials from participating countries in areas relevant to GCC. Project execution will take four years and involve both regional and pilot-based components. The components include following:

- (a) Design and Establishment of Sea Level/Climate Monitoring Network. The network will be composed of 18 state-of-art gauges generating digitised data available in near real-time by satellite telemetry or telephone. Each participating country will be directly involved in the selection of sites, and designated national agencies, such as the National Weather Service, will manage their individual observatories. The Caribbean Meteorological Institute (CMI) will be the lead regional agency, and will take on the responsibility overseeing the network after project completion.
- (b) Establishment of Data bases and Information Systems. The data bases and information systems to be established under this component will form the backbone for the participating countries in their efforts to plan for adaptation to climate change. The information system will allow key regional and national institutions to acquire, analyse, store, and disseminate data on climate change and the impact on natural man-made systems;
- (c) Inventory of Coastal Resources and Uses. The inventory takes into consideration the widely varying coastal zone resources, existing inventories, and analysis capabilities in the region. Under this component, all twelve participating countries will acquire a Geographic Information System (GIS) capability in the form of hands-on and formal training, the establishment of data management procedures and standards; and gathering of existing data.
- (d) Formulation of a Policy Framework of Integrated Coastal and Marine Management. A draft framework will be presented at a regional meeting of CPACC representatives for review and training, and in-country consultations will be conducted to assist in adapting the framework to meet specific country needs. Countries requesting special support (zoning, building control etc.) will be offered direct assistance.

- (e) Coral Reef Monitoring for Climate Change. This component is designed to increase existing knowledge about the extend sources of coral reef degradation in three countries (the Commonwealth of the Bahamas, Belize, and Jamaica). Building upon ongoing work on coral reef monitoring throughout the region, this component will establish a long-term monitoring programme which over time will show the effects of global warming factors (temperature stress, sea level rise, and hurricanes) on coral reefs.
- (f) Coastal Vulnerability and Risk Assessment. Three countries (Barbados, Grenada, and Guyana) have agreed to participate in the development of vulnerability and risk assessments for their coastal areas. The component will begin with a review of coastal vulnerability assessment models and the application of the Intergovernmental Panel on Climate Change (IPCC) common methodology in these three countries and throughout the region.
- (g) Economic Valuation of Coastal and Marine Resources. This component will include the design and implementation of pilot studies in the Commonwealth of Dominica, Saint Lucia, and the Republic of Trinidad and Tobago on the economic valuation of resources in selected coastal ecosystems at risk from sea level rise. Each of the three pilot studies will focus on an ecosystem and associated economic activities.
- (h) Formulation of Economic/Regulatory Proposals. This component will implement two pilot studies in Antigua and Barbados, and Saint Kitts and Nevis to demonstrate the design and use economic and regulatory approaches to environmental protection in response to threats from sea level rise. The component will demonstrate how innovative approaches to environmental regulation, such as the use of economic incentives, can provide flexible, cost-effective alternatives to traditional "command and control" regulatory policies.
- (i) Enabling the preparation of national communications in response to commitments to the United Nations Framework Convention on Climate Change (UNFCCC). This component will enable St. Vincent and the Grenadines to prepare its initial national communication to (UNFCCC).

### **3.8.8 Harmful Algal Bloom (HAB) Regional Component** (Arturo Sierra)

Harmful Alga Blooms (HAB) are recognized as a serious threat to both human population and to the environment. During the last 15 years, a notorious increase of this kind of events has been registered worldwide, and specifically within the IOCARIBE Region. To date, there are no country safeguarded against the effects produced by the sudden blooms of toxic phytoplankton.

Within the IOCARIBE region, the relevance of HAB-related problems has already been recognized by countries and actions taken as a group by the setting up of the Harmful Algae in the Caribou Project (HACA), within the OSLR Programme. Also, additional efforts within the region led to IAI-AMERIHAB and ALFA-COSTA/Harmful Algae in Central America, all merging interests with the SCOR-IOC global project GEOHAB.

The ecological and oceanographic mechanisms underlying the population dynamics of harmful algae, through the integration of biological and ecological studies with chemical and physical oceanography, may be determined with the aid of an observing system such as GOOS.

Final envisaged products to this end may be an improved forecasting of timing, magnitude and effect of HABs'.

## **4. ORGANIZATION OF WORKING GROUPS**

### **4.1 ESTABLISHMENT OF THE WORKING GROUPS**

Two working groups were established. Working Group I was charged with examining the need for a regional GOOS, and, if the need was proven, what should it be called, what pilot projects would seem appropriate; what should be the membership; and what should be the priorities.

Guillermo García-Montero agreed to serve as Chair, and Hazel McShine as Rapporteur.

Working Group II was charged with defining the already identified and related projects and programmes in the region and the needs for, and approaches to, capacity building.

Anders Alm agreed to serve as Chair and Hartwig Kremer as Rapporteur.

### **4.2 WORKING GROUP TO ESTABLISH A REGIONAL GOOS FOR THE CARIBBEAN - CaribbeanGOOS**

The discussions of Working Group I centred around a number of questions to be answered by the participants. Points of discussion and decisions are set out below.

#### **4.2.1 Is there a need for a Regional GOOS?**

There was much discussion on this point. Discussion issues were:

- “Will the regional GOOS do anything that is not already being done in the region?”;
- “Can the "CaribbeanGOOS" be used to integrate the region with the global GOOS? The coastal GOOS best captures the interests of the Caribbean region”;
- “The regional need for regional meteorological products should indicate to the governments the need for regional oceanographic products”;
- “At the summit of the Heads of State of the Association of Caribbean States (ACS) held in Santo Domingo in April 1999, it was decided that sustainable tourism should be the first priority for ACS countries. This could be a vehicle for selling the regional GOOS to the Caribbean governments”.

The Working Group acknowledged the need for and recommended the creation of a regional GOOS, which should be called CaribbeanGOOS.

#### **4.2.2 Objectives of CaribbeanGOOS**

The aim of CaribbeanGOOS is to promote the technical implementation of GOOS in the Wider Caribbean Region on all the appropriate spatial and temporal scales, as required, to meet the specific economic, social and environmental needs of the Wider Caribbean coastal and island States.

It was thought that the general objectives for CaribbeanGOOS are likely to be the same as global GOOS, plus a set of specific objectives relevant to the region.

The above mentioned set of specific objectives shall satisfy the fundamental needs and priorities of sustainable development of the region.

The Working Group considered that the main priority areas to be taken into account when drafting the final proposal of regional specific objectives, are the following: tourism, fisheries, agriculture, coastal population, maritime safety, marine pollution, hurricanes and weather forecasting, tsunamis and storm surges, and marine biological diversity.

**It was recommended** that a temporary *Ad Hoc* Advisory Group to the Steering Committee, should draft the specific objectives of the CaribbeanGOOS, bearing in mind the priority areas already identified.

#### **4.2.3 Activities of CaribbeanGOOS**

General activities were defined for the CaribbeanGOOS, based on:

- a) an initial assessment to be made, including an examination of existing regional initiatives or activities, capabilities and needs;
- b) integrate existing efforts in the region into GOOS;
- c) disseminate information and data;
- d) develop a strategic plan; and
- e) develop an implementation plan.

#### **4.2.4 Steering Committee**

A Steering Committee shall be established with the following Terms of Reference:

- a) the Steering Committee should be the driving force behind the establishment of CaribbeanGOOS;
- b) identify the GOOS capacity building needs for participating countries;
- c) advise all the interested parties on the general development of CaribbeanGOOS;
- d) draft a CaribbeanGOOS strategy document;
- e) draft a CaribbeanGOOS implementation plan;
- f) recommend scientific and technical activities to support the implementation of CaribbeanGOOS;
- g) oversee the establishment of a CaribbeanGOOS network for data and information exchange;
- h) identify organizations and projects in the Wider Caribbean region that could contribute to CaribbeanGOOS and initiate contacts with them; and
- i) promote and disseminate the CaribbeanGOOS information to the public at large.

#### **4.2.5 Membership of the Steering Committee**

The Steering Committee should be open to all Member States of IOCARIBE. There should be a smaller temporary *Ad Hoc* Advisory Group to the Steering Committee, whose membership should consist of 5-7 persons from countries representing the geographic areas of IOCARIBE. Other selection criteria such as expertise may be used as well as that of country representation and available time to do the requested work. There should be two co-chairpersons. The *Ad Hoc* Advisory Group to the Steering Committee would need to be funded for attendance at meetings.

#### **4.2.6 Strategic Plan**

The Strategic Plan shall have a ten-year time span and should include plans for periodic revisions; its steps should include: integration, dissemination, definition of products, infrastructure required, and promotion.

The Strategic Plan should be drafted by the *Ad Hoc* Advisory Group to the Steering Committee rather than by consultants.

#### **4.2.7 Recommendations of the Working Group**

CaribbeanGOOS should promote the technical implementation of GOOS in the Wider Region on all the appropriate time and space scales, as required, to meet the economic, social and environmental needs of the Wider Caribbean coastal and island States.

The *Ad Hoc* Advisory Group to the Steering Committee should draft a Caribbean Strategy document which reflects the economic, social and environmental protection needs of the region and establishes the strategy for planning and implementing GOOS in the Wider Caribbean region.

### **4.3 WORKING GROUP TO DEFINE PROJECTS AND CAPACITY BUILDING NEEDS FOR CaribbeanGOOS**

#### **4.3.1 Introduction**

Working Group II was established to define projects and Capacity Building needs for the implementation of the regional GOOS Component. A number of ongoing projects were identified that may contribute towards the objectives of GOOS. Some of the major ones are for example:

- a) CARICOMP - Caribbean Coastal Marine Productivity
- b) CEPNET - Caribbean Environmental Programme - Information Management Network
- c) CFRAMP - CARICOM Fisheries Resource Assessment and Measurement Programme
- d) GLOSS - Global Ocean Sea Level Observing System
- e) HACA - Harmful Algae in the Caribbean
- f) IASI - the Intra-Americas Sea Initiative
- g) CPACC - Caribbean Planning for Adaptation to Global Climate Changes

In addition, several other national, regional and global programmes may contribute with data and information relevant to GOOS such as the Global Oceanographic Data Archaeology and Rescue Project (GODAR)-IOCARIBE, Regional Centre of Excellence in MIZC, Global Ocean Ecosystems Dynamics (GLOBEC), Joint Global Ocean Flux Study (JGOFS) and Land-Ocean Interactions in the Coastal Zone (LOICZ). The latter in particular due to its mutual agenda with the Coastal Module of GOOS on a global basis (GOOS Report No. 63), may also provide guidelines and tools for the identification of GOOS-relevant data and information sets in regional ongoing research, and function as a client for GOOS products. The Committee on Earth Observation Satellites (CEOS), ECOFRONT, MBRS, PORTALES, the Heavily Contaminated Bays Project of United Nations Development Programme (UNDP), World Wide Fund Nature (WWF) Eco-Regions Projects were also mentioned.

High importance was put on a detailed definition of the data required for GOOS and the potential contributions from existing programmes and projects. In addition to capturing existing information, the need for improvement should be identified. It should also be defined if the regional GOOS component should include other data which are of relevance for the Caribbean region. The inclusion of relevant biological and in particular socio-economic data should be ensured. This aspect received special attention because of the high relevance this information has for the non-scientific clients of GOOS, who seek scientific advice to address their issues.

The format for the database should be decided upon as well as the mechanisms for data exchange. Existing structures with good regional coverage, such as Water Centre for the Humid Tropics of Latin America and the Caribbean (CATHALAC), or the University of the West Indies may be used. Other options addressed were the databases which are operational through CARICOM.

#### **4.3.2 CaribbeanGOOS training and capacity building needs**

Training needs were discussed, taking into account two major components addressing human capacity as well as institutional and infra-structural capacity. It should be targeted towards the needs of the producers of scientific information and the users of those information, including the private sector, policy makers and coastal managers. Concerning researchers as a target group, and based upon enhanced data processing and model application, not only the improvement of synthesizing capacities but also the enhanced dissemination of scientific results as visible relevant products matching the client needs should be aimed at.

On the other hand, all sorts of users of GOOS deliverables should be properly enabled to exploit the outcomes of the observation system to their maximum benefit. In this context the point was made that a general feature of GOOS relevant operational capacity should be the employment of an appropriate communication strategy, which may use existing structures as provided through IOC but fill in detected gaps by taking appropriate action targeted to the needs of information exchange among the scientists but also with the relevant user groups.

Implementation of capacity building and training measures related to GOOS could consider involving existing mechanisms such as the Train Sea Coast programme, run through United Nations Division for Ocean Affairs and the Law of the Sea (UNDOALOS), or the activities of the International Ocean Institute (IOI) and Inter-American Institute for Global Change (IAI). The establishment of a Regional Centre of Excellence in MIZC was discussed as a possible basis for targeted capacity building measures as well as meeting the need for on the job training.

#### **4.3.3 Institutional and structural requirements for successful participation in CaribbeanGOOS**

Some structural and institutional improvements identified in this context mentioned enhancement of receiving and processing capacity for satellite imagery, improved and equally distributed measuring platforms for better real-time and near-real-time data delivery. Most attention was given to the enhancement of data and information exchange capacity. It was expected that GOOS will become a major thrust for improving the hardware and software availability in all participating countries with special emphasis to be put on establishing an operational coverage of Internet access among the contributing institutions.

#### **4.3.4 Data requirements for CaribbeanGOOS**

A GOOS-oriented review aimed at the identification of existing structures and deliverables for GOOS in national institutional capacities and projects which are currently underway was seen to be strongly dependent on a clear definition of the GOOS data and information requirements. This must be the first step before creating an inventory on which to build future action.

In principle it was recognized that other regional GOOS programmes could, at least in part, serve as a template for new regional approaches such as CaribbeanGOOS but this must definitely include tailoring the regional data and information requirements along the lines of the specific area needs. Not only the regional geomorphological, biological and meteorological settings should be taken into account but also strong reference should be made to the regional socio-economic specifics and related client needs.

However, it was also recognized that in the context of the global commitment of GOOS there is a strong rationale for a reasonable level of standardization when defining the data needs. It was explained that potential support for this exercise could evolve from consultation/linking with the IGBP/LOICZ project. Aimed at delivering answers to a well-defined set of coastal change questions on a global scale, this project is addressing all spatial steps of scaling from local to regional and to

global. Emphasis is being put on improving its coastal typology database and making it available for different sorts of syntheses purposes and integrated natural science and socio-economic modelling. GOOS and LOICZ have already identified its various fields of mutual interests and joint working accords are currently being established.

The project has come up with a set of modelling tools and guidelines on the related data needs, collection and processing which for GOOS (especially the coastal module), may serve as a sound basis on which to review the deliverables for GOOS in ongoing regional projects.

In principle the group expressed the view that the inclusion of historical data is crucial for GOOS. Based on decades of scientific data collection and following a proper description of data needs, GOOS would thus be enabled to start immediately. Furthermore, past time developments and the current status of the ocean system will thus become the scientific basis for the nowcasting and forecasting (*i.e.* prediction) work of GOOS. Reviewing historical data against the current and future requirements may also contribute to working out a clearer picture of the training and capacity building demands as outlined earlier. Finally, and as a general requirement applying to the involvement of all sorts of data, GOOS is expected to provide major impetus for those efforts taken to harmonise the data collection methodology and to allow for a scientifically sound regional coverage of collection sites.

#### **4.3.5 Users**

Users for GOOS products were identified to be governments, the private sector, which in the Caribbean could, for example, be the oil industry, the tourism industry, the sea transport and harbour business, and the academic research community.

Those clients like oil producers and processing industry, if properly approached, might even be able to provide logistic support in terms of sampling platforms. It was meant that they have a huge array of various sea bound platforms and transportation units which in terms of their regular use and sub-regional coverage may contribute significantly to the improvement of the GOOS data collection network. Furthermore, the global change science community (namely International Geosphere-Biosphere Programme - IGBP) was addressed as a client for GOOS. In particular, its maritime core projects like GLOBEC, JGOFS and LOICZ should benefit from GOOS outcomes, the latter especially when providing its coastal typology data, tools and guidelines into the monitoring efforts of GOOS and in reverse receiving large scale valuation exercises for LOICZ model application.

#### **4.3.6 Recommendations from the Working Group**

As an introductory remark there was common agreement on that a lot of work compiling relevant information for GOOS related inventories on available data, human and institutional capacity in the region has already been undertaken through IOCARIBE. The Working Group acknowledged those efforts and recommended to make use of the available information to facilitate proper design of the CaribbeanGOOS.

It was recognized that IAS-GOOS is to be considered a strong building block for Caribbean-GOOS, or rather its strongest scientific input to date, that will ultimately be operational in nature, when the whole ocean observing system is to be developed. The following recommendations therefore reflect the view to reinforce the efforts that are underway on this level, to identify information gaps and to provide the missing information needed for GOOS. No time frame was put to the recommendations yet but it was stressed that the *Ad Hoc* Advisory Group (see WG I) should be able to perform its duties in an overall period of 1-2 years, shall appropriate resources be provided to them.



It was therefore recommended:

1. That based on the GOOS data requirements, a detailed inventory of existing projects and programmes that could potentially contribute to GOOS should be carried out. The inventory should also define the mechanisms for exchange of data and information, and possible feedback to existing projects on a regular basis.
2. That based on GOOS requirements, an identification and recovery of relevant historic data and information should be carried out.
3. That a scientific workshop should be convened to establish requirements for the regional GOOS component with respect to data, information, training, institutional and infra-structural capacity building. This should be based upon a regular assessment of the current situation, and should lead to an identification of additional activities to be carried out by CaribbeanGOOS. These could be short tailored training courses on the specific issues identified.
4. That the potential for creating scientific links and working accords with regional and global organizations/projects should be considered in setting up the design and implementation plan for CaribbeanGOOS.
5. Data products should be tuned to user needs, and users should be trained to make best use of those products.
6. Establish and maintain a Web-page for the Regional GOOS Component, taking into account already existing Web-pages in GOOS-related fields. Additional means of information and data dissemination should be regularly considered (Newsletter), matching the capabilities of actors involved.

## **5. FINAL DISCUSSION OF WORKING GROUP REPORTS**

The draft reports of the working groups were discussed and approved.

Following consultations on the composition for the proposed *Ad Hoc* Advisory Group, and taking into account geographical and expertise balance, the Chairman presented the following membership to the Group, that has been duly accepted:

Co-Chairs:	Mr Guillermo García Montero (Cuba) Mr Douglas Wilson (USA)
Members:	Mr Yuri Chakalall (Barbados) Mr Alejandro Gutiérrez (Costa Rica) Mr Mauricio Gonzáles (Colombia) Mr Hazel McShine (Trinidad & Tobago) Mr Rubén Aparicio Castro (Venezuela)

The members of the permanent Steering Committee will be determined by the Member States as soon as possible. The *Ad Hoc* Advisory Group is charged with the following tasks:

- a) conduct assessment of present capabilities of needs and opportunities for CaribbeanGOOS;
- b) produce an initial strategic plan for CaribbeanGOOS; and
- c) recommend steps for initiating CaribbeanGOOS.

The *Ad Hoc* Advisory Group will require 1 to 2 years, (and 1 to 3 meetings) to complete its work, and then it should expire. The Steering Committee will then determine the appropriate follow-up organizational structure.

The Steering Committee will be invited to review the results of the work of the *Ad Hoc* Advisory Group and comment. Through a concerted action with the GOOS Project Office, IOCARIBE will support those activities.

Because of the existing protocols among IOCARIBE Member States, a Memorandum of Understanding (MOU) was deemed unnecessary for CaribbeanGOOS.

It was considered essential to actively promote awareness of CaribbeanGOOS at all societal levels, from the average citizen to the Heads of State, and to relate it to UNCED's Agenda 21. Finally, several specific suggestions were referred to the *Ad Hoc* Advisory Group for the strategic plan.

## **6. ADOPTION OF THE DRAFT REPORT**

All recommendations from the Working Groups were approved and forwarded to the VI Session of the IOCARIBE Sub-commission.

## **7. CLOSURE**

Before closing the meeting, the chairman gave the floor to Dr Patricio Bernal, Executive Secretary IOC. He manifested the Commission's strong support and interest on the development and implementation of GOOS projects in the Wider Caribbean region.

In his final remarks, the chairman thanked all participants for their active involvement in the discussions and support from their home countries towards the development of CaribbeanGOOS.

He thanked all the Secretariat, especially the excellent work performed by the translators and declared the meeting adjourned at 1300 hours.

ANNEX I

**AGENDA**

**THURSDAY 22 APRIL 1999**

- |      |     |  |
|------|-----|--|
| 0900 | 1.  | OPENING AND WELCOME REMARKS  |
|      | 2.  | ARRANGEMENTS   |
|      | 2.1 | Adoption of the Agenda   |
|      | 2.2 | Designate Rapporteur   |
|      | 2.3 | Logistics and Administration   |
| 0945 | 3.  | OVERVIEW AND BACKGROUND INFORMATION  |
|      | 3.1 | Workshop Objectives  |
| 1000 |     | COFFEE BREAK   |
| 1030 | 3.2 | GOOS Organization, Objectives and Principles                                   |
|      | 3.3 | GOOS Capacity Building Goals   |
|      | 3.4 | GOOS Benefits  |
| 1230 |     | LUNCH BREAK  |
| 1330 | 3.5 | Offer and Demand for IOC Services and Products                                 |
| 1400 | 3.6 | Country and Users statements on needs, requirements, interests and capability. |
| 1600 |     | COFFEE BREAK   |
| 1630 | 3.7 | Reports on Ongoing Caribbean Projects and Activities Related to GOOS           |
| 1830 |     | MEETING ADJOURN  |

**FRIDAY 23 APRIL 1999**

- |      |     |  |
|------|-----|--|
| 0830 | 3.8 | Summary of the results from the previously distributed questionnaire |
| 0900 | 4.  | ORGANIZATION OF WORKING GROUPS                                       |
|      | 4.1 | WG to establish IOCARIBE/GOOS  |
|      | 4.2 | WG to define projects and capacity building needs and requirements   |
|      | 4.3 | WG on user needs and requirements                                    |
| 1000 |     | COFFEE BREAK   |
| 1030 | 4.  | Working Groups continue  |
| 1230 |     | LUNCH BREAK  |
| 1330 | 4.  | Working Groups continue  |
| 1600 |     | COFFEE BREAK   |
| 1630 | 5.  | FINAL DISCUSSION OF RESULTS FROM WORKING GROUPS                      |
| 1700 | 6.  | RECOMMENDATIONS FROM WORKING GROUPS AND DRAFTING OF SUMMARY REPORT   |
| 1830 |     | ADJOURN  |

**SATURDAY 24 APRIL 1999**

- |      |     |   |
|------|-----|---|
| 0830 | 7.  | ADOPTION OF THE REPORT AND RECOMMENDATIONS          |
| 1000 |     | COFFEE BREAK  |
| 1030 | 7.  | ADOPTION OF THE REPORT AND RECOMMENDATIONS continue |
| 1130 | 8.  | FUTURE ACTIVITIES                                   |
|      | 9.  | OTHER BUSINESS                                      |
|      | 10. | CLOSURE   |
| 1230 |     | FAREWELL LUNCH                                      |

N.B. - It is intended to host an icebreaker reception in the first evening, pending confirmation



ANNEX II

LIST OF PARTICIPANTS

Mr Yuri Chakalall  
Coastal Zone Management Unit  
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### ANNEX III

#### **Speech from the Chairman**

by Jan H. Stel

There is a striking difference between the view of economists and ecologists towards the use of our home planet. In economy, one discounts. This is a system to make rational choices when resources are scarce. This selection criterion is also rational because it is based upon the experience that one can create increased productivity by applying efficient technology systems, economic models and management tools. The concept is, however, based upon the assumption of progress through the instruments. As a consequence economists 'discount' the future. By doing this they consider 'values' in the future less relevant than the ones of today.

Ecologists start from a different perspective. They consider the future as important as the present. They are sceptical about improvements of technology and human behaviour unless they are proven. In this respect their views have a totally different perspective than the ones of economists. They strive to harmonise economic development and sustainable development of natural resources for mankind. They invoke the precautionary principle in order to avoid decisions that society later may have to regret. In other words through the application of this principle credit is given to the fact that technology is at the very same time a solution for many environmental problems and threats, as well as it can be a threat in itself.

Based upon recent conventions such as the new Law of the Sea which came into force in 1994 and gives property rights of large marine areas to coastal states through the 200 mile Exclusive Economic Zone, and the outcome of conferences such as the ones in Rio (1992), Kyoto etc., there is a need for a new global governance. This new governance includes not only new forms of governmental cooperation and the development of new institutions but also the active involvement of the civil society. It will need a new symbiosis between government, business and civil society. Companies have to develop a keen eye upon other factors than making profit in their missions. Civil societies such as non-governmental organizations, connect people but have to look beyond the interest of their members. Some signals of change in this respect are:

- Unilever controlling some 20% of the world white fish market in Europe and Northern America, decided to buy only fish that has been caught and produced in a sustainable way.
- Volunteers in India and Ecuador replanting mangrove areas in order to repair the damage from shrimp farming.

The ocean has for a long time been seen as an area for fishing and an area you had to cross to meet different countries and cultures. Now, on the threshold of a new millennium the oceans are declared as the 'common heritage of mankind'. Oceans are not dividing societies and cultures; they are linking them. We are and have been aware of the beauty of the ocean, its bio-diversity, its richness to feed and cure us, its capacity to balance our climate etc. Mankind with its fast growing numbers lives and concentrates its activities at the interface ocean - land. From space this interface is, however, just a thin dividing line between land and water. Yet, because of our land-based mind we see the sea from the perspective of the continents, the islands in the ocean we live upon. Most of our economic activities are concentrated at this interface and an increasingly proportion of our species is living near the ocean. Through this our activities are becoming a threat to one of the main components of the life supporting system of our Planet.

In the early days of European exploration we learned about the blessings of the Gulf Stream, transporting heat from the Caribbean tropical area to the European shores. In this, the Gulf Stream functions as a gigantic central heating system for Western Europe. Nowadays scientists start to understand the North Atlantic Oscillation, which might allow for forecasting the European winters

some years ahead. Last year's El Niño and La Niña, clearly demonstrated the possible positive economic feedback of a reliable forecast of large scale interactions between the ocean and the atmosphere. The estimated economic loss of the 'disasters' related to last year's El Niño is an estimated 20-75 billion US\$. The devastating effects of Hurricane Mitch, a storm with a record breaking power, left deep scars in this region.

Development and environment have to become twins. Good governance means investing in capacity to govern. Rightfully UNCLOS and UNCED indicate that capacity building is a prerequisite for a successful sustainable development of the coastal area and the EEZ. Although capacity building has to take place at a national and regional level, it is a global responsibility which can be achieved by raising awareness and new approaches in the cooperation between the government, the private sector and the civil society. The revenues of a tax of one tenth of a percent on global industrial and recreational activities would result in a budget of some 500 million US\$; five times the present budget of the IMO and FAO together. The oceans of the future have to become our oceans. Oceans are about people; They are about you and me; they are about our children and about the future of the life supporting system of our sparkling blue planet.

## ANNEX IV

### COUNTRY REPORTS

#### A. BELIZE

Belize is not very active in the collection of oceanographic data. Data are being collected primarily for meteorological purposes. These include data relating to tide, temperature, current, wind, sea level, and rainfall.

The meteorological data are collected from two offshore marine stations.

Belize is also participating in the CPACC Project that currently has two automated marine stations in Belize collecting tide, temperature, current, wind, sea level and rainfall. One of the stations is offshore and the other is coastal.

There is also an ongoing water quality monitoring programme. This programme basically looks at nutrient influx, pesticide residues, aromatic carbons, heavy metals, salinity and dissolved oxygen concentrations along the coast.

Lastly, Belize is also carrying out data collection for its fisheries. These include catch and effort data and biological data on its major fisheries, such as conch, lobster, and some finfish.

#### B. BRAZIL

##### **Pilot Programme: Implementation of GOOS in Brazil (GOOS/Brazil)**

The Brazilian programme devoted to GOOS is structured in five modules, in view of the activities of the potential users: Climate Monitoring, Assessment and Prediction, Living Marine Resources, Health of the Oceans, The Coastal Environment and Marine Meteorological and Oceanographic Services.

In 1995, the GOOS Executive Committee was created, under the coordination of the Directory of Hydrography and Navigation. This Committee has the following composition: Ministry of Science and Technology, Ministry of Education, Ministry of the Environment, Ministry of Mines and Energy, Interministerial Commission for the Resources of the Sea and representatives of the scientific community, for each one of the modules. This Committee holds regular meetings, with the purpose to elaborate and implement pilot programmes associated with or as part of GOOS.

In 1997, the GOOS/Brazil Pilot Programme was approved by the Interministerial Commission for the Resources of the Sea, together with the National Buoy Programme (PNBOIA), whose implementation is coordinated as a GOOS component.

The GOOS/Brazil Programme does not constitute a national monitoring network yet, although it works in the shape of a meta-data bank, to compile the basic information and links for the institutions with products associated with the objectives of the Programme, at a global scale. The University of Sao Paulo (IO-USP) is building a network to monitor parameters of the sea surface in coastal waters of Rio de Janeiro and Sao Paulo, with the installation of several platforms to provide meteorological and oceanographic data in real-time.

Within the scope of the Climate module of GOOS/Brazil, the principal activity is the PIRATA Programme (Pilot Research Moored Array in the Tropical Atlantic), initiated by Brazil, France and the United States. Its purpose is to install and maintain a network of 14 moored buoys, with

transmission of data in real-time mode. The data are available in Internet at the site <http://aroeira.cmdc.inpe.br/pirata/display.html>. The data produced in the PIRATA Programme and others are assimilated in operational models at CPTEC/INPE, increasing the precision of weather and climate products.

The participation of Brazil in GODAE (Global Ocean Data Assimilation Experiment) is under consideration. The National Buoy Programme (PNBOIA) is working on the deployment of drifting buoys. Graphics of all of drifters, and a time series of sea surface temperature and zonal/meridional locations are available at: <http://www.atsme.inpebe/dsr/satboia/satboiap.htm#produtos>.

In the Coastal Module, monitoring and assessment of coastal erosion will start being implemented this year with the association of researchers from the Marine Geology and Geophysics Programme (PGGM). There is also a plan to process the available data of river discharge at the sea with the National Electric Energy Agency (ANEL).

### **C. COLOMBIA**

#### **Survey on Existing Marine Observing Methods and Services**

Number of institutions in the Caribbean: 13

Meteorological institution: IDEAM (Instituto de Hidrología Metereológica y Estudios Ambientales)

Oceanographically institution: CIOH (Centro de Investigaciones Oceanográficas e Hidrográficas)

There are no marine data from: - VOS  
- Moved buoys  
- XBT Lines  
- Moored buoys

There are 8 coastal marine stations, basically with meteorological data; variables observed: win speed and direction, ambient temperature, pressure and humidity. Three of those marine stations could measure sea level.

There are two operational oceanographic vessels.

Satellite facilities:	IDEAM:	AVHRR
	CIOH:	AVHRR
		ERS

Marine models:	CIOH:	. Caribbean Sea Wave models . Meteorological analysis . Coastal Zone circulation model . Diagnostic oil slicks transport models for the Coastal zone
	IDEAM:	. Meteorological analysis

Marine data base:	CIOH:	. Marine variables are sea temp, salinity and nitrogen. Extent of holdings from 1980
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Marine data base accessibility: on line and hard copy

User groups: Colombia maritime community in general (specifically: shipping & fisheries)

Comments: The CCO is actually developing networks and establishing a Marine Information Centre, according to the GOOS Principles.

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#### **D. COSTA RICA**

##### **Activities performed by Universidad Nacional, Heredia, Costa Rica:**

##### Laboratory of Oceanography and Coastal Management (LAOCOS).

This laboratory is responsible for four main projects:

SERMAR: Tidal and sea state service of Costa Rica. (A joint effort between Universidad Nacional, the National Meteorological Institute and the Universidad of Costa Rica)

Main tasks: sea state daily forecast.

Climate change and climate variability control through recording of sea level and SST data. This project is in charge of the Costa Rica tidal network: 4 automatic real time transmission stations on the Pacific coast and one on the Caribbean, sending data on a regular basis to international data banks. The stations record the main oceanic and meteorological variables.

Contact: Alejandro Gutiérrez.

SERIO: Regional Oceanographic Information Service (a project supported by PRADEPESCA supported by the European Union).

Main tasks: hydrological and oceanographical data collection from regional cruises and distribution of data among the Central American countries, mainly supporting the fishing activities. A good follow up and research on the El Niño and La Niña impacts on the region.

Contact: Carlos L. Brenes.

Marine Chemistry Lab: This laboratory has been responsible for the local coastal and estuarine chemistry research that has been developed at Universidad Nacional. Among the main projects recently developed are: the Ecological Evaluation of Gulf of Nicoya (including a pollutant dispersion model application together with the Oceanographic Institute of Israel) and the determination of the heavy metals impact on the Gulf of Nicoya, supported by the Government of The Netherlands.

Contact: Sandra León.

Remote Sensing Programme: Supported by a high resolution Sea Space device and a reliable communication system, this programme, through download and analysis of satellite imagery, keeps

track of the climate change and climate variability, as well as the location of fishing spots supporting local and regional fishing activities. At present, together with staff from Universidad of Costa Rica and CICESE (Mexico), this programme is involved with a wave modelling and coastal processes project for the Wider Caribbean, supported by the European Union.

Contacts: Enrique Coen. - Daniel Ballesterio.

International Ocean Institute (IOI-Costa Rica).

This is an interdisciplinary operational centre for Latin America and the Caribbean of the International Ocean Institute, with Headquarters in Malta.

Its main task is the training of all-level decision makers involved with coastal and ocean management; from politicians to community leaders, in order to establish a bridge between the scientific community and the decision making, favoring the formulation and the implementation of ICZM plans.

From 1995 to 1998, it has been supported by UNDP GEF I funds. From then on, IOI work is being supported by different international institutions, as for instance the Government of Japan, the IDRC (Canada), the AVINA Foundation (Switzerland), the UNDP GEF II (proposal in progress), the Costa Rica National Council of Science and Technology, among others and the headquarters itself.

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**Activities performed by Universidad de Costa Rica**

Centro de Investigacion en Ciencias del Mar y Limnologia (CIMAR). Research Centre in Marine Science and Limnology.

CIMAR is located at the UCR Main Campus and two hours away by car from either coast (Pacific and Caribbean). The Centre conducts research oriented towards the management of the coastal ecosystems of Costa Rica, and provides the facilities for the training of graduate students from the region. A new M.Sc. Regional Programme in Integrated Coastal Area Management is scheduled to begin in year 2000, with the participation of institutions from the Caribbean, Latin America, USA, and Europe. A total of 308 scientific publications in international journals have been produced since 1979 by CIMAR scientists (including visiting personnel from more than 30 institutions worldwide). In 1999, a total of 10 Research Programs, (*e.g.* Marine Biodiversity, Pollution Monitoring, Plankton ) are being developed in the Pacific and Caribbean coasts, in addition to the study of freshwater ecosystems. Sample collection is conducted mainly using two small research boats (8 m long each), and a fleet of rubber inflatables.

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**E. CUBA**

**A summary of Cuban Activities of Relevance to GOOS:**

- VOS

The Institute of Meteorology coordinates five VOS routes, on a regular basis, from Havana to - Europe, which are reported to the international VOS System.

- Coastal Marine Stations

A CARICOMP station has been installed on the North coast of Cuba, in 1994, to monitor the coral reef health.

- Data Buoys

There are no buoys currently installed by Cuba. The PORTALES project (USA-Cuba-Mexico) is planning to deploy a buoy on each side of the Yucatan Channel for Real Time transmission of oceanographic and meteorological data. The IOCARIBE-GOOS will be an appropriate framework for the implementation of this project.

- Ships

The Cuban marine institutions own several small and midsize research ships. The biggest R/V is the *Ulises*, a 2149 ton ship (26 crew and 23 scientists).

- XBT Lines

There are no XBT lines charged by Cuba.

- Satellite Facilities

There are several facilities and personnel for processing SST and Sea Color images in Cuba.

- Marine Models

Limited circulation and flood models are produced by some Cuban institutions.

A detailed list of Cuban contributions and operational services can be found in the Executive Summary of the Cuban IOCARIBE-GOOS Workshop (Havana, 18-19 April 1999) distributed during this workshop.

## **F. FRANCE/MARTINIQUE**

The following description of French activities in the Caribbean region is concentrated on physical oceanography, in relation with Météo-France. It is complemented by activities of IFREMER, IRD and University of Antilles-Guyana.

The main project of recent years is Oceantilles, dealing with ocean consequences of cyclones and hurricanes. The results are two meteorological buoys for measurement of Atlantic swell and operational use of two models, one for storm surge and one for swell induced by storms.

On a daily basis, Météo-France makes two coastal forecasts for Martinique and Guadeloupe and two forecasts for the Lesser Antilles. The French models used are a wave model "Vagatla", an oceanographic tropical model "Opra" and a model for oil pollution. New products expected for the next years are a model for swell, the use of a forecast database of meteorological features "Espadom", and global ocean model "Mercator". A Web server for diffusion of operational products ([www.meteo.gf](http://www.meteo.gf)) has been developed.

The needs of users are large and include, for instance, the influence of El Niño on fisheries, impact of coastal currents on localized pollution, and coastal erosion in French Guyana.

## **G. GUATEMALA**

In Guatemala, the available information about oceanographic reference terms is still scarce in spite of the fact that there are Public, Private & Academic Institutes within the area to establish the technical scientific basis required for the formation of a professional cadre or subject. Among them, the University of San Carlos de Guatemala created a University Centre oriented to study Marine Science and Aquaculture (CEMA) which has as objectives the study of biotic and abiotic marine factors and the sustainability of aquaculture activities. Also, the Faculty of Veterinary Science put efforts into the study of natural phenomena that affect the next production of hydrobiological species.

The current information collected by the Army and Navy is not available in general, but slowly becomes accessible to the scientific community and governmental authorities that need to take directions related to natural disasters (hurricanes, red tides etc.).

There are presently efforts to create a national oceanographic data base.

#### **H. PUERTO RICO (USA)**

In Puerto Rico, meteorological services are provided by NOAA's National Weather Service. There are no ocean buoys. The University of Puerto Rico has no meteorologist, and offers no degree in such a discipline. But the University sponsoring the Puerto Rico Climate Office. NOAA has two tide stations, on the north and south coasts. Marine-related research is carried on basically by the U.S. Geological Survey (Division of Marine Geology) and the Department of Marine Sciences at the University. At the University degrees are offered in Biological Chemical Geological and Physical Oceanography (M.Sc. and Ph.D.). There is also a strong aquaculture component. At present there is an ocean-going research vessel (RN *Magueys*), and in a couple of months it will be joined by the RN *Chapman*. Presently on-going research projects include: remote sensing applied to coastal and deep waters; a NASA sponsored Tropical Atmosphere Sciences Centre with three components (air-sea exchange of gases, land-atmosphere interaction, and upper troposphere research, this last are performed with the Arecibo radiotelescope); a 5-year long monthly XBT time series and other chemical parameters at a station 30 miles south of Puerto Rico; 1 ½-year long measurements by two ADCP's of the Atlantic-Caribbean exchange of water through the Marea Passage (between Puerto Rico and Hispaniola); coastal erosion studies; coastal hazards studies (storm surge and tsunami inundation mapping); the effect of the Amazon and Orinoco rivers plumes on Caribbean waters; coral reefs and coastal habitats mapping; ocean circulation modelling applied to the Caribbean and surrounding waters, with application to air/sea exchange of nitrous oxide and larval dispersal. In addition the Sea Grant College Programme of the University is sponsoring a diversity of research topics and through its extension agents it helps in establishing links between the research community, the general public and fishermen.

#### **I. TRINIDAD AND TOBAGO**

Trinidad and Tobago, like many of the Caribbean countries, is carrying out research programs and projects which fit in to the HOTO Module rather than the larger GOOS.

The Institute of Marine Affairs (IMA) was established in 1976 by the Government of Trinidad and Tobago, with initial founding and technical assistance from the UNDP. The IMA was set up to do research to provide data and information which could be used to advise the government on natural resource use; environmental management; pollution control; development planning; and policy formulation.

Research at IMA is carried out mainly through multi-disciplinary projects such as:

- contamination/pollution studies
- natural resource management studies
- environmental management studies
- environmental impact assessments (EIA)

The research in each discipline subsequently feeds into the multi-disciplinary projects which are summarized below.



## **Physical Oceanography**

Nearshore circulation and hydrographic data are collected. A circulation model of the Gulf of Paria was developed. It is a depth averaged model with a one-kilometer grid. This means it can be used to predict the paths of the larger oil spills.

There are no buoys in place at present, but the Ministry of Energy has initiated talks with the offshore oil and gas companies to fund the placement of six buoys offshore around Trinidad. The buoys will collect real time data which will be processed and interpreted by the IMA.

## **Chemical Oceanography**

Nearshore data are obtained on water and sediment quality. Data will be collected on biota quality (*i.e.* contamination of commercially important finfish and shellfish) in 1999.

Water and sediment samples are analyzed for nutrients; heavy metals (associated with petroleum hydrocarbon exploration, exploitation and production and the downstream petrochemical industries); pesticides; PCBs; and petroleum hydrocarbons.

Thirty-two stations are being monitored in the Gulf of Paria.

## **Fisheries**

Fish stock assessment studies are carried out at the IMA. The research includes fish age and growth assessments using otoliths. IMA's Fish Age and Growth laboratory is partially funded by CFRAMP since it services the CARICOM countries.

Turtle nesting and conservation studies are carried out in collaboration with studies being carried out by WIDECAST.

## **Ecosystems**

Monitoring of ecosystems include coral reefs, seagrass beds and mangroves around Trinidad and Tobago. In addition specific sites are monitored as part of the CARICOMP regional project.

Benthic studies are also carried out on the soft bottom macrofauna of the nearshore areas.

## **Sedimentology and Coastal Processes**

Long-term monitoring of littoral processes and beach profiles is carried out at beaches around Trinidad and Tobago.

Textural analyses are performed on sediments from nearshore areas to support contamination studies.

## **Remote Sensing and GIS Capabilities**

Remote sensing and GIS capabilities are being developed to support the multi-disciplinary projects. Data is not downloaded directly from the satellites. Instead Landsat and Radarsat images are purchased. At IMA they are enhanced, processed and interpreted for natural resource studies, for example of coral reefs and mangroves.

## **Legal Research**

Legal research is carried out by the IMA as part of the environmental and natural resource management projects; and to inform the control of shipping activities.

IMA also undertakes research into the legal aspects of the requirements necessary for the implementation of international and regional Conventions and Protocols.

## **J. UNITED KINGDOM**

The Delegate of the United Kingdom (UK) noted that its geographical presence in the IOCARIBE region consisted of the six UK Overseas Territories of Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Montserrat, and the Turks and Caicos Islands. He regretted that none of these territories was represented in the UK delegation to this meeting and that, therefore, it would not be possible to present individual country statements. He was unable to confirm whether or not copies of the questionnaire sent out by the IOCARIBE Secretariat, in advance of the meeting, had reached the respective governments or what action, if any, had subsequently been taken.

The UK Delegate informed the meeting that the UK Government had recently published a White Paper on its Overseas Territories setting out a number of new policies concerning certain aspects of their relationship with the UK. He noted that environmental issues had been given significant emphasis in this paper and that work was currently being undertaken to explore ways in which the territories could participate more effectively in the activities of regional bodies, if it was their wish to do so. He explained that his presence at this meeting formed part of that process.

The UK Delegate noted that he had had useful discussions in the margins of the meeting with its Chairman, and with the Regional Secretary of IOCARIBE, on procedures relating to the participation of the six Caribbean Overseas Territories in IOCARIBE meetings and in activities implemented under its auspices, should they wish to do so.

He cited, as an example, the possibility that some or all of the territories might wish to become more closely involved in the regional activities of the Global Coral Reef Monitoring Network. Coral reefs were important both economically and socially to all of the territories, and particularly to those poorer sections of the community who relied on coastal resources for their livelihoods. He noted that individual territories could bid for funds from a new environmental budget line established specifically to enable them to participate in this type of activity.

In the interest of improving communication, the UK Delegate undertook to arrange for the IOCARIBE Secretariat to be provided with an up-to-date list of the appropriate technical contact points in each of the Caribbean UK Overseas Territories and, if necessary, to ensure that copies of the IOCARIBE questionnaire were distributed to them.

## **K. VENEZUELA**

### **A Summary of its Capability in Marine Topics of Relevance to GOOS:**

#### **I. VOS Data**

So far, Venezuela has not taken advantage of the certainly considerable number of national vessels circulating in its marine territory for obtaining critical sea information. A proposal for involving the marine traffic related to activities of the national oil industry (PDVSA) and the transportation sector (CONFERRYS and the Navy) is being developed.

## II. Coastal Marine Stations

### a) Sea Level Network (In operation since 1955)

Locations: Maracaibo  
Amuay  
La Guaira<sup>1</sup>  
Carupano  
Cumana  
Punta de Piedras (Isla de Margarita)

Type: Conventional tide gauges (analog signal converted to digital signal since 1998).

Communication: Land line.

State of the information: Hard copy

Agency responsible for the operation of the network:

Ministerio del Ambiente de los Recursos Naturales Renovables

Servicio Autónomo de Geografía y Cartografía Nacional

División de Geodesia

Esquina Camejo Edif. Camejo segundo piso

CARACAS, VENEZUELA

### b) Sea Surface Temperature and Surface Salinity

On most of the locations that actually have stations of the sea level network, an ancient dependence named MINISTERIO DE OBRAS PUBLICAS that disappeared at the beginning of the seventies, collected sea surface temperature and surface salinity on beaches by following the standard methods recommended at that time. The length of those records probably covers 20 or 25 years of information on a daily basis (1950-1970, 1975). The rescue of that set of historical data will be a hard but not an impossible task.

During the period 1992-1994, an effort for obtaining SST records with a national coastal area coverage was made by the INSTITUTO OCEANOGRAFICO DE VENEZUELA (UDO) with financial support from the CONICIT. The sensor used was an automatic recorder, usually installed 3m below the sea surface.

### c) Hydrographical and Bio-Geochemical Parameters

Since Nov. 1995, the CARIACO PROJECT (an initiative of scientists from USA and Venezuela that receives financial support from the USA National Science Foundation (NSF) and the CONICIT, under a bilateral agreement) has been collecting physical, chemical, and biological data, under the standard protocols required by JGOFS (the Joint Global Ocean Flux Studies), a component of the IGBP (the International Geosphere and Biosphere Programme). CARIACO generates information to be used in studying the carbon budget and the role of the ocean in it. CARIACO integrates two of the three institutions in Venezuela with capability for the acquisition of oceanographic data (Fundación La Salle and Universidad de Oriente). The collection of data is made in a water column 1300m deep, on a monthly basis, on the eastern end of the CARIACO Basin at the northeastern section of Venezuela. Remote sensing facilities with application to marine space have been a reality in Venezuela since CARIACO included this tool as a crucial component of its data acquisition programme. Actually, an antenna (QUORUM) installed in the CPDI (Centro de Procesamiento Digital de Imágenes, Universidad Simón Bolívar) allows capture of data and generation of SST and ocean color images coming from NOAA 12 and 14, and SEAWIF satellites.

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• <sup>1</sup> La Guaira is a GLOSS station and also a Station reporting data to the TOGA Sea Level Network.

### III. Data Buoys

No buoys are actually operating under a permanent programme of oceanographic data acquisition in the Venezuelan Marine territory. In fact, only the national oil industry (PDVSA) in the past has made use of this instrumentation for collecting data at particular places of extreme importance for its activities. Actually, since the second part of 1998, a buoy has been in operation for PDVSA in a very shallow water zone (no more than 25m depth), part of the coastal area occupied by PDVSA in the Anzoategui state (Costa de José) at the southern boundary of the CARIACO Basin. That buoy provides data about the coastal wind, sea surface temperature, sea level, and wave pattern.

### IV. XBT Lines

A very short transect from Margarita Island (coastal boundary of the CARIACO Basin) to the hydrographical station occupied monthly in the CARIACO Project, has been covered during the last two years (1997 and 1998) as part of the hydrographical component of that programme.

A very old proposal for the implementation of a XBT line, taking advantage of the periodical transect made by the Venezuelan Navy at the time of giving logistical support to the people they have on the Isla de Aves (15° N) where they installed a meteorological station since 1980, has not yet received attention. That transect is covered every 40 days connecting the coast line in the central area of the coastal margin of the country with Isla de Aves, almost 600 km away. The GOOS requirements will bring again that proposal to the debate in our National Committee of Oceanology.

#### Research Vessels

Number and Type:

NAME	AGENCY	RANGE OF ACTION	CAPACITY
Punta Brava	Venezuelan Navy	Open waters	15 scientists
Hermano Gines	Fundación La Salle	Coastal waters	6 scientists
Guaikeri II	UDO	Coastal waters	9 scientists
Bergantín	ICLAM	Lake Maracaibo	6 scientists

#### Main observational programmes

\* The CARIACO Project has been developing its seawork by using the Hermano Gines.

\* The Punta Brava is actually used by the Venezuelan Navy in a programme of data acquisition of bathymetric character with national coverage.

\* The Guaikeri II has been out of operation during the last 4 years. However, this vessel is being repaired since the second part of 1998 and the UDO hopes to put it in operation by the end of this next summer August 1999.

\* The Bergantín is being used for the ICLAM (Instituto para la Conservación del Lago de Maracaibo) to collect water quality information in Lake Maracaibo on a bi-monthly basis since 1992.

### VI. Satellites Facilities

As a component of the CARIACO Project.

### VII. Other Instrumentation

#### Coastal Radars

- The national oil industry (PDVSA), in conjunction with the national agency dealing with marine traffic affairs (the Ministerio de Transporte y Comunicaciones), will operate

before the end of this year a local system of warning for the purpose of penalizing marine traffic for undesirable activities of PDVSA.

- As a result of a loan obtained from the CORPORATION ANDINA DE FOMENTO, financial system of the COMUNIDAD ANDINA in South America (Colombia, Ecuador, Peru, Bolivia and Venezuela), Venezuela will install several radars and automatic weather stations on its coastal margin during 1999, with the purpose of actualizing its national infrastructure for meteorological and hydrological forecasting. This new programme is named VENEHMET. The responsibility of organizing and operating this data acquisition system has been given to the Ministerio del Ambiente y de los Recursos Naturales Renovables (MARNR). The location of the radars and new stations will be discussed by the academic sector (CONICIT), the Air Force and the national electricity company (EDELCA).

### VIII. Marine Services

All the services dealing with safety, bathymetry, navigation signals, operations in ports etc., are under the responsibility of the Venezuelan Navy, that carries out those activities through the Dirección de Hidrografía y Navegación (DHN) and the Servicio de Guardacostas, with an operational infrastructure covering the entire coastal area of the country. The information is generally available depending on the purpose of the requester. National agencies and research centres receive priority in this matter. Delivery of any dataset is made by specific media (fax, radio, hard copy, charts etc.) depending on the request. The DHN actually is the focal point in Venezuela of the IODE programme.

### IX. Marine Models

Models of the wind and wave patterns and pollution transport have been used by the national oil industry in specific coastal locations of interest for its activities (Lake Maracaibo, the coastal area of JOSE, the Orinoco River Delta etc.). Cooperation between research centres and the INTEVEP (technical research centre of PDVSA) could be an important element in favor of enhancing the Venezuelan contribution to GOOS in the Caribbean area.

### X. Users

A list of the main users of marine information in Venezuela could be larger than that presented here, but at least it must include:

- a) Official agencies:
  1. MARNR (Environment and EEZ)
  2. MTC (Shipping and ports management)
  3. MRE (Foreign affairs related to marine delimitation)
  4. Navy (Marine Services, forecasting etc.)
  5. Fisheries
  6. Tourism (Health of beaches, water quality etc.)
  7. Oil industry
  8. Research centers (Public universities)
  9. MSAS (Health of the coastal zone)
- b) Private interests
  1. Transportation industry
  2. Tourism
  3. Environmental ONG
  4. Commercial Shipping

## XI. General Conclusion

The lack of integration of national efforts is recognized as the main deficit that prevents Venezuela from actually showing a better prospect for offering a good contribution to GOOS and any other global programme related to marine affairs. It is believed that the scientific sector (CONICIT) should organize a vigorous plan of action with the purpose of bringing together potentialities from the oil industry (PDVSA), the Navy, and private investment (tourism, fisheries and aquaculture, marine transportation etc.). Only under that strategy is it possible to make a really positive contribution by Venezuela to the goals of GOOS in the Wider Caribbean zone.

## ANNEX V

### LIST OF ACRONYMS

ACS	Association of Caribbean States
CaribbeanGOOS	GOOS for Caribbean Region
CARICOM	Caribbean Community
CARICOMP	Caribbean Coastal Marine Productivity
CATHALAC	Water Centre for the Humid Tropics of Latin America and the Caribbean
CB	Capacity Building
CDB	Association of Caribbean Development Bank
CEOS	Committee on Earth Observation Satellites
CEPNET	Caribbean Environmental Programme - Information Management Network
CFRAMP	CARICOM Fisheries Resource Assessment and Measurement Programme
CMI	Caribbean Meteorological Institute
CPACC	Planning for Adaptation to Global Change
DPSIR	Drivers, Pressure, States, Impact, Response
EEZ	Exclusive Economic Zone
ELOISE	European Land Ocean Interaction Studies
ENSO	<i>El-Niño</i> - Southern Oscillation
EuroGOOS	GOOS for Europe
FAO	Food and Agriculture Organization ( <a href="#">UN</a> )
GCC	Global climate change
GEF	Global Environment Facility
GIS	Geographic Information System
GLOBEC	Global Ocean Ecosystem Dynamics ( <a href="#">SCOR-IOC</a> )
GLOSS	Global Sea Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Oceanographic Data Archaeology and Rescue Project
GOOS	Global Ocean Observing System
HACA	Harmful Algae in the Caribbean
IAI	Inter-American Institute for Global Change
IAS	Intra-Americas Sea
IASI	Intra-Americas Sea Initiative
ICSU	International Council for Science [previously: International Council of Scientific Unions]
ICZM	Integrated Coastal Zone Management
IGBP	International Geosphere-Biosphere Programme ( <a href="#">ICSU</a> )
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission
IOCARIBE	<a href="#">IOC</a> Sub-commission for the Caribbean and Adjacent Regions
IOI	International Ocean Institute
IPCC	Intergovernmental Panel on Climate Change
JGOFS	Joint Global Ocean Flux Study ( <a href="#">IGBP</a> )
LAC	Latin America and the Caribbean
LOICZ	Land-Ocean Interaction in the Coastal Zone
MedGOOS	GOOS for the Mediterranean Sea
MIZC	Manejo Integrado de la Zona Costera (Coastal Zone Integrated Monitoring)
MOU	Memorandum of Understanding
NEAR-GOOS	GOOS for the Northeast Asian Region of WESTPAC
NERC	National Environmental Research Council (UK)
NOAA	National Oceanic and Atmospheric Administration (USA)
ODA	Overseas Development Agency
OECD	Organization for Economic Cooperation and Development
PIRATA	Pilot Research Moored Array in the Tropical Atlantic

RODAE	Regional Ocean Data Assimilation Experiment
RPIU	Regional Project Implementation Unit
SCOR	Scientific Committee on Oceanic Research
SIDA-SAREC	Swedish International Development Authority - Swedish Agency for Research Cooperation with Developing Countries
TAO	Tropical Atmosphere Ocean Array
TEMA	Training, Education and Mutual Assistance ( <a href="#">IOC</a> )
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDOALOS	United Nations Division for Ocean Affairs and the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UWICED	University of the West Indies Centre for Environment and Development
VOS	Voluntary Observing Ship ( <a href="#">WMO</a> )
WESTPAC	<a href="#">IOC</a> Sub-commission for the Western Pacific
WMO	World Meteorological Organization ( <a href="#">UN</a> )
WWF	World Wide Fund for Nature



## IOC Workshop Reports

The Scientific Workshops of the Intergovernmental Oceanographic Commission are sometimes jointly sponsored with other intergovernmental or non-governmental bodies. In most cases, IOC assures responsibility for printing, and copies may be requested from:

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No.	Title	Languages	No.	Title	Languages	No.	Title	Languages
1	CCOP-IOC, 1974, Metallogensis, Hydrocarbons and Tectonic Patterns in Eastern Asia (Report of the IDOE Workshop on); Bangkok, Thailand, 24-29 September 1973 UNDP (CCOP).	E (out of stock)	17	IGOSS Data Processing and Services System (IDPSS); Moscow, 9-11 April 1979.	E	17	Papers submitted to the Joint IOC/WMO Seminar on Oceanographic Products and the IGOS Data Processing and Services System; Moscow, 2-6 April 1979.	E
2	CICAR Ichthyoplankton Workshop, Mexico City, 16-27 July 1974 (UNESCO Technical Paper in Marine Sciences, No. 20).	E (out of stock) S (out of stock)	18	IOC/UNESCO Workshop on Syllabus for Training Marine Technicians; Miami, U.S.A., 22-26 May 1978 (UNESCO reports in marine sciences, No. 4 published by the Division of Marine Sciences, UNESCO).	E (out of stock), F, S (out of stock), R	18	IOC/UNESCO Workshop on Syllabus for Training Marine Technicians; Miami, U.S.A., 22-26 May 1978 (UNESCO reports in marine sciences, No. 4 published by the Division of Marine Sciences, UNESCO).	E (out of stock), F, S (out of stock), R
3	Report of the IOC/GFCM/ICSEM International Workshop on Marine Pollution in the Mediterranean; Monte Carlo, 9-14 September 1974.	E, F E (out of stock)	19	IOC Workshop on Marine Science Syllabus for Secondary Schools; Llantwit Major, Wales, U.K., 5-9 June 1978 (UNESCO reports in marine sciences, No. 5, published by the Division of Marine Sciences, UNESCO).	E (out of stock), S, R, Ar	19	IOC Workshop on Marine Science Syllabus for Secondary Schools; Llantwit Major, Wales, U.K., 5-9 June 1978 (UNESCO reports in marine sciences, No. 5, published by the Division of Marine Sciences, UNESCO).	E (out of stock), S, R, Ar
4	Report of the Workshop on the Phenomenon known as 'El Niño'; Guayaquil, Ecuador, 4-12 December 1974.	E (out of stock) S	20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources; Bandung, Indonesia, 17-21 October 1978	E	20	Second CCOP-IOC Workshop on IDOE Studies of East Asia Tectonics and Resources; Bandung, Indonesia, 17-21 October 1978	E
5	IDOE International Workshop on Marine Geology and Geophysics of the Caribbean Region and its Resources; Kingston, Jamaica, 17-22 February 1975	E	21	Second IDOE Symposium on Turbulence in the Ocean; Liège, Belgium, 7-18 May 1979.	E, F, S, R	21	Second IDOE Symposium on Turbulence in the Ocean; Liège, Belgium, 7-18 May 1979.	E, F, S, R
6	Report of the CCOP/SOPAC-IOC IDOE International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific; Suva, Fiji, 1-6 September 1975.	E, F, S, R	22	Third IOC/WMO Workshop on Marine Pollution Monitoring; New Delhi, 11-15 February 1980.	E, F, S, R	22	Third IOC/WMO Workshop on Marine Pollution Monitoring; New Delhi, 11-15 February 1980.	E, F, S, R
7	Report of the Scientific Workshop to Initiate Planning for a Co-operative Investigation in the North and Central Western Indian Ocean, organized within the IDOE under the sponsorship of IOC/FAO (IOFC)/UNESCO/EAC; Nairobi, Kenya, 25 March-2 April 1976.	E (out of stock)	23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific; Tokyo, 27-31 March 1980.	E, R	23	WESTPAC Workshop on the Marine Geology and Geophysics of the North-West Pacific; Tokyo, 27-31 March 1980.	E, R
8	Joint IOC/FAO (IPFC)/UNEP International Workshop on Marine Pollution in East Asian Waters; Penang, 7-13 April 1976	E (out of stock)	24	Workshop on the Inter-calibration of Sampling Procedures of the IOC/ WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters; Bermuda, 11-26 January 1980.	E (Superseded by IOC Technical Series No.22)	24	Workshop on the Inter-calibration of Sampling Procedures of the IOC/ WMO UNEP Pilot Project on Monitoring Background Levels of Selected Pollutants in Open-Ocean Waters; Bermuda, 11-26 January 1980.	E (Superseded by IOC Technical Series No.22)
9	IOC/CMG/SCOR Second International Workshop on Marine Geoscience; Mauritius 9-13 August 1976.	E, F, S, R	25	IOC Workshop on Coastal Area Management in the Caribbean Region; Mexico City, 24 September- 5 October 1979.	E, S	25	IOC Workshop on Coastal Area Management in the Caribbean Region; Mexico City, 24 September- 5 October 1979.	E, S
10	IOC/WMO Second Workshop on Marine Pollution (Petroleum) Monitoring; Monaco, 14-18 June 1976	E, F E (out of stock) R	26	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific; Nouméa, New Caledonia, 9-15 October 1980.	E	26	CCOP/SOPAC-IOC Second International Workshop on Geology, Mineral Resources and Geophysics of the South Pacific; Nouméa, New Caledonia, 9-15 October 1980.	E
11	Report of the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions; Port of Spain, Trinidad, 13-17 December 1976.	E, S (out of stock)	27	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes. Lima, 20 April-5 May 1980.	E	27	FAO/IOC Workshop on the effects of environmental variation on the survival of larval pelagic fishes. Lima, 20 April-5 May 1980.	E
11 Suppl.	Collected contributions of invited lecturers and authors to the IOC/FAO/UNEP International Workshop on Marine Pollution in the Caribbean and Adjacent Regions; Port of Spain, Trinidad, 13-17 December 1976	E (out of stock), S	28	WESTPAC Workshop on Marine Biological Methodology; Tokyo, 9-14 February 1981.	E	28	WESTPAC Workshop on Marine Biological Methodology; Tokyo, 9-14 February 1981.	E
12	Report of the IOC/FAO/UNEP Interdisciplinary Workshop on Scientific Programmes in Support of Fisheries Projects; Fort-de-France, Martinique, 28 November-2 December 1977.	E, F, S	29	International Workshop on Marine Pollution in the South-West Atlantic; Montevideo, 10-14 November 1980.	E (out of stock) S	29	International Workshop on Marine Pollution in the South-West Atlantic; Montevideo, 10-14 November 1980.	E (out of stock) S
13	Report of the IOC/FAO/UNEP Workshop on Environmental Geology of the Caribbean Coastal Area; Port of Spain, Trinidad, 16-18 January 1978.	E, S	30	Third International Workshop on Marine Geoscience; Heidelberg, 19-24 July 1982.	E, F, S	30	Third International Workshop on Marine Geoscience; Heidelberg, 19-24 July 1982.	E, F, S
14	IOC/FAO/WHO/UNEP International Workshop on Marine Pollution in the Gulf of Guinea and Adjacent Areas; Abidjan, Côte d'Ivoire, 2-9 May 1978	E, F	31	UNU/IOC/UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime; Paris, France, 27 September-1 October 1982.	E, F, S	31	UNU/IOC/UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the context of the New Ocean Regime; Paris, France, 27 September-1 October 1982.	E, F, S
15	CPPS/FAO/IOC/UNEP International Workshop on Marine Pollution in the South-East Pacific; Santiago de Chile, 6-10 November 1978.	E (out of stock)	32	Papers submitted to the UNU/IOC/ UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime; Paris, France, 27 September-1 October 1982.	E	32	Papers submitted to the UNU/IOC/ UNESCO Workshop on International Co-operation in the Development of Marine Science and the Transfer of Technology in the Context of the New Ocean Regime; Paris, France, 27 September-1 October 1982.	E
16	Workshop on the Western Pacific, Tokyo, 19-20 February 1979.	E, F, R	32 Suppl.	Joint IOC/WMO Workshop on Oceanographic Products and the	E	32 Suppl.	Joint IOC/WMO Workshop on Oceanographic Products and the	E
17	Joint IOC/WMO Workshop on Oceanographic Products and the	E						

No.	Title	Languages	No.	Title	Languages	No.	Title	Languages
33	Workshop on the IREP Component of the IOC Programme on Ocean Science in Relation to Living Resources (OSLR); Halifax, 26-30 September 1963.	E	52	South Pacific Island Nations; Lae, Papua-New Guinea, 1-8 October 1987.	E	52	SCOR-IOC-UNESCO Symposium on Vertical Motion in the Equatorial Upper Ocean and its Effects upon Living Resources and the Atmosphere; Paris, France, 6-10 May 1985.	E
34	IOC Workshop on Regional Co-operation in Marine Science in the Central Eastern Atlantic (Western Africa); Tenerife, 12-17 December 1963.	E, F, S	53	IOC Workshop on the Biological Effects of Pollutants; Oslo, 11-29 August 1986.	E	53	IOC Workshop on the Biological Effects of Pollutants; Oslo, 11-29 August 1986.	E
35	CCOP/SOPAC-IOC-UNU Workshop on Basic Geo-scientific Marine Research Required for Assessment of Minerals and Hydrocarbons in the South Pacific; Suva, Fiji, 3-7 October 1983.	E	54	Workshop on Sea-Level Measurements in Hostile Conditions; Bidston, UK, 28-31 March 1988.	E	54	Workshop on Sea-Level Measurements in Hostile Conditions; Bidston, UK, 28-31 March 1988.	E
36	IOC/FAO Workshop on the Improved Uses of Research Vessels; Lisbon, Portugal, 28 May-2 June 1984.	E	55	IBCCA Workshop on Data Sources and Compilation, Boulder, Colorado, 18-19 July 1988.	E	55	IBCCA Workshop on Data Sources and Compilation, Boulder, Colorado, 18-19 July 1988.	E
36 Suppl.	Papers submitted to the IOC/FAO Workshop on the Improved Uses of Research Vessels; Lisbon, 28 May-2 June 1984	E	56	IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP); Cleveland, Australia, 24-30 July 1988.	E	56	IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP); Cleveland, Australia, 24-30 July 1988.	E
37	IOC/UNESCO Workshop on Regional Co-operation in Marine Science in the Central Indian Ocean and Adjacent Seas and Gulfs; Colombo, 8-13 July 1985.	E	57	IOC Workshop on International Co-operation in the Study of Red Tides and Ocean Blooms; Takamatsu, Japan, 16-17 November 1987.	E	57	IOC Workshop on International Co-operation in the Study of Red Tides and Ocean Blooms; Takamatsu, Japan, 16-17 November 1987.	E
38	IOC/ROPME/UNEP Symposium on Fate and Fluxes of Oil Pollutants in the Kuwait Action Plan Region; Basrah, Iraq, 8-12 January 1984.	E	58	International Workshop on the Technical Aspects of the Tsunami Warning System; Novosibirsk, USSR, 4-5 August 1989.	E	58	International Workshop on the Technical Aspects of the Tsunami Warning System; Novosibirsk, USSR, 4-5 August 1989.	E
39	CCOP (SOPAC)-IOC-IFREMER-ORSTOM Workshop on the Uses of Submersibles and Remotely Operated Vehicles in the South Pacific; Suva, Fiji, 24-29 September 1985.	E	58 Suppl.	Second International Workshop on the Technical Aspects of Tsunami Warning Systems, Tsunami Analysis, Preparedness, Observation and Instrumentation. Submitted Papers; Novosibirsk, USSR, 4-5 August 1989.	E	58 Suppl.	Second International Workshop on the Technical Aspects of Tsunami Warning Systems, Tsunami Analysis, Preparedness, Observation and Instrumentation. Submitted Papers; Novosibirsk, USSR, 4-5 August 1989.	E
40	IOC Workshop on the Technical Aspects of Tsunami Analysis, Prediction and Communications; Sidney, B.C., Canada, 29-31 July 1985.	E	59	IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring Research, Control and Abatement in the Wider Caribbean; San José, Costa Rica, 24-30 August 1989.	E, F, S	59	IOC-UNEP Regional Workshop to Review Priorities for Marine Pollution Monitoring Research, Control and Abatement in the Wider Caribbean; San José, Costa Rica, 24-30 August 1989.	E, F, S
40 Suppl.	First International Tsunami Workshop on Tsunami Analysis, Prediction and Communications. Submitted Papers; Sidney, B.C., Canada, 29 July-1 August 1985.	E	60	IOC Workshop to Define IOCARIBE-TRODERP proposals; Caracas, Venezuela, 12-16 September 1989.	E	60	IOC Workshop to Define IOCARIBE-TRODERP proposals; Caracas, Venezuela, 12-16 September 1989.	E
41	First Workshop of Participants in the Joint FAO/IOC/WHO/IAEA/UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region (WACAF2); Dakar, Senegal, 28 October-1 November 1985.	E	61	Second IOC Workshop on the Biological Effects of Pollutants; Bermuda, 10 September-2 October 1988.	E	61	Second IOC Workshop on the Biological Effects of Pollutants; Bermuda, 10 September-2 October 1988.	E
43	IOC Workshop on the Results of MEDALPEX and Future Oceanographic Programmes in the Western Mediterranean; Venice, Italy, 23-25 October 1985.	E	62	Second Workshop of Participants in the Joint FAO-IOC-WHO-IAEA-UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region; Accra, Ghana, 13-17 June 1988.	E	62	Second Workshop of Participants in the Joint FAO-IOC-WHO-IAEA-UNEP Project on Monitoring of Pollution in the Marine Environment of the West and Central African Region; Accra, Ghana, 13-17 June 1988.	E
44	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities; Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986.	E (out of stock) S	63	IOC/WESTPAC Workshop on Co-operative Study of the Continental Shelf Circulation in the Western Pacific; Bangkok, Thailand, 31 October-3 November 1989.	E	63	IOC/WESTPAC Workshop on Co-operative Study of the Continental Shelf Circulation in the Western Pacific; Bangkok, Thailand, 31 October-3 November 1989.	E
44 Suppl.	IOC-FAO Workshop on Recruitment in Tropical Coastal Demersal Communities, Submitted Papers; Ciudad del Carmen, Campeche, Mexico, 21-25 April 1986.	E	64	Second IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP); Phuket, Thailand, 25-31 September 1989.	E	64	Second IOC-FAO Workshop on Recruitment of Penaeid Prawns in the Indo-West Pacific Region (PREP); Phuket, Thailand, 25-31 September 1989.	E
45	IOCARIBE Workshop on Physical Oceanography and Climate; Cartagena, Colombia, 19-22 August 1986.	E	65	Second IOC Workshop on Sardine/Anchovy Recruitment Project (SARP) in the Southwest Atlantic; Montevideo, Uruguay, 21-23 August 1989.	E	65	Second IOC Workshop on Sardine/Anchovy Recruitment Project (SARP) in the Southwest Atlantic; Montevideo, Uruguay, 21-23 August 1989.	E
46	Reunión de Trabajo para Desarrollo del Programa "Ciencia Oceánica en Relación a los Recursos No Vivos en la Región del Atlántico Sud-occidental"; Porto Alegre, Brasil, 7-11 de abril de 1986.	S	66	IOC ad hoc Expert Consultation on Sardine/ Anchovy Recruitment Programme; La Jolla, California, U.S.A., 1989	E	66	IOC ad hoc Expert Consultation on Sardine/ Anchovy Recruitment Programme; La Jolla, California, U.S.A., 1989	E
47	IOC Symposium on Marine Science in the Western Pacific: The Indo-Pacific Convergence; Townsville, 1-6 December 1966	E	67	Interdisciplinary Seminar on Research Problems in the IOCARIBE Region; Caracas, Venezuela, 28 November-1 December 1989.	E (out of stock)	67	Interdisciplinary Seminar on Research Problems in the IOCARIBE Region; Caracas, Venezuela, 28 November-1 December 1989.	E (out of stock)
48	IOCARIBE Mini-Symposium for the Regional Development of the IOC-UN (OETB) Programme on Ocean Science in Relation to Non-Living Resources (OSNLR); Havana, Cuba, 4-7 December 1986.	E, S	68	International Workshop on Marine Acoustics; Beijing, China, 26-30 March 1990.	E	68	International Workshop on Marine Acoustics; Beijing, China, 26-30 March 1990.	E
49	AGU-IOC-WMO-CPPS Chapman Conference: An International Symposium on 'El Niño'; Guayaquil, Ecuador, 27-31 October 1986.	E	69	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Leningrad, USSR, 28-31 May 1990.	E	69	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Leningrad, USSR, 28-31 May 1990.	E
50	CCALR-IOC Scientific Seminar on Antarctic Ocean Variability and its Influence on Marine Living Resources, particularly Krill (organized in collaboration with SCAR and SCOR); Paris, France, 2-6 June 1987.	E	69 Suppl.	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Submitted Papers; Leningrad, USSR, 28-31 May 1990.	E	69 Suppl.	IOC-SCAR Workshop on Sea-Level Measurements in the Antarctica; Submitted Papers; Leningrad, USSR, 28-31 May 1990.	E
51	CCOP/SOPAC-IOC Workshop on Coastal Processes in the	E	70	IOC-SAREC-UNEP-FAO-IAEA-WHO Workshop on Regional Aspects of Marine Pollution; Mauritius, 29 October - 9 November 1990.	E	70	IOC-SAREC-UNEP-FAO-IAEA-WHO Workshop on Regional Aspects of Marine Pollution; Mauritius, 29 October - 9 November 1990.	E
			71	IOC-FAO Workshop on the Identification of Penaeid Prawn Larvae and Postlarvae; Cleveland, Australia, 23-28 September 1990.	E	71	IOC-FAO Workshop on the Identification of Penaeid Prawn Larvae and Postlarvae; Cleveland, Australia, 23-28 September 1990.	E
			72	IOC/WESTPAC Scientific Steering Group Meeting on Co-Operative Study of the Continental Shelf Circulation in the Western Pacific; Kuala Lumpur; Malaysia, 9-11 October 1990.	E	72	IOC/WESTPAC Scientific Steering Group Meeting on Co-Operative Study of the Continental Shelf Circulation in the Western Pacific; Kuala Lumpur; Malaysia, 9-11 October 1990.	E

No.	Title	Languages	No.	Title	Languages	No.	Title	Languages
73	Expert Consultation for the IOC Programme on Coastal Ocean Advanced Science and Technology Study; Liège, Belgium, 11-13 May 1991.	E	95	SAREC-IOC Workshop on Donor Collaboration in the Development of Marine Scientific Research Capabilities in the Western Indian Ocean Region; Brussels, Belgium, 23-25 November 1993.	E	112	22-26 January 1995. IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials (GESREM) Workshop; Miami, U.S.A., 7-8 December 1993.	E
74	IOC-UNEP Review Meeting on Oceanographic Processes of Transport and Distribution of Pollutants in the Sea; Zagreb, Yugoslavia, 15-18 May 1989.	E	96	IOC-UNEP-WMO-SAREC Planning Workshop on an Integrated Approach to Coastal Erosion, Sea Level Changes and their Impacts; Zanzibar, United Republic of Tanzania, 17-21 January 1994.	E	113	IOC Regional Workshop on Marine Debris and Waste Management in the Gulf of Guinea; Lagos, Nigeria, 14-16 December 1994.	E
75	IOC-SCOR Workshop on Global Ocean Ecosystem Dynamics; Solomons, Maryland, U.S.A., 29 April-2 May 1991.	E	96	IOC-UNEP-WMO-SAREC Planning Workshop on an Integrated Approach to Coastal Erosion, Sea Level Changes and their Impacts; Submitted Papers	E	114	International Workshop on Integrated Coastal Zone Management (ICZM) Karachi, Pakistan; 10-14 October 1994.	E
76	IOC/WESTPAC Scientific Symposium on Marine Science and Management of Marine Areas of the Western Pacific; Penang, Malaysia, 2-6 December 1991.	E	Suppl.	1. Coastal Erosion; Zanzibar, United Republic of Tanzania 17-21 January 1994.	E	115	IOC/GLOSS-IAPSO Workshop on Sea Level Variability and Southern Ocean Dynamics; Bordeaux, France, 31 January 1995.	E
77	IOC-SAREC-KMFRI Regional Workshop on Causes and Consequences of Sea-Level Changes on the Western Indian Ocean Coasts and Islands; Mombasa, Kenya, 24-28 June 1991.	E	96	Submitted Papers	E	116	IOC/WESTPAC International Scientific Symposium on Sustainability of Marine Environment: Review of the WESTPAC Programme, with Particular Reference to ICAM, Bali, Indonesia, 22-26 November 1994.	E
78	IOC-CEC-ICES-WMO-ICSU Ocean Climate Data Workshop Goddard Space Flight Center; Greenbelt, Maryland, U.S.A., 18-21 February 1992.	E	Suppl.	2. Sea Level; Zanzibar, United Republic of Tanzania 17-21 January 1994.	E	117	Joint IOC-CIDA-Sida (SAREC) Workshop on the Benefits of Improved Relationships between International Development Agencies, the IOC and other Multilateral Inter-governmental Organizations in the Delivery of Ocean, Marine Affairs and Fisheries Programmes; Sidney B.C., Canada, 26-28 September 1995.	E
79	IOC/WESTPAC Workshop on River Inputs of Nutrients to the Marine Environment in the WESTPAC Region; Penang, Malaysia, 26-29 November 1991.	E	97	IOC Workshop on Small Island Oceanography in Relation to Sustainable Economic Development and Coastal Area Management of Small Island Development States; Fort-de-France, Martinique, 8-10 November, 1993.	E	118	IOC-UNEP-NOAA-Sea Grant Fourth Caribbean Marine Debris Workshop; La Romana, Santo Domingo, 21-24 August 1995.	E
80	IOC-SCOR Workshop on Programme Development for Harmful Algae Blooms; Newport, U.S.A., 2-3 November 1991.	E	98	CoMSBlack '92A Physical and Chemical Inter-calibration Workshop; Erdemli, Turkey, 15-29 January 1993.	E	119	IOC Workshop on Ocean Colour Data Requirements and Utilization; Sydney B.C., Canada, 21-22 September 1995.	E
81	Joint IAPSO-IOC Workshop on Sea Level Measurements and Quality Control; Paris, France, 12-13 October 1992.	E	99	IOC-SAREC Field Study Exercise on Nutrients in Tropical Marine Waters; Mombasa, Kenya, 5-15 April 1994.	E	120	International Training Workshop on Integrated Coastal Management; Tampa, Florida, U.S.A., 15-17 July 1995.	E
82	BORDOMER 92: International Convention on Rational Use of Coastal Zones. A Preparatory Meeting for the Organization of an International Conference on Coastal Change; Bordeaux, France, 30 September-2 October 1992.	E	100	IOC-SOA-NOAA Regional Workshop for Member States of the Western Pacific - GODAR-II (Global Oceanographic Data Archeology and Rescue Project); Tianjin, China, 8-11 March 1994.	E	121	IOC-EU-BSH-NOAA-(WDC-A) International Workshop on Oceanographic Biological and Chemical Data Management, Hamburg, Germany, 20-23 May 1996.	E
83	IOC Workshop on Donor Collaboration in the Development of Marine Scientific Research Capabilities in the Western Indian Ocean Region; Brussels, Belgium, 12-13 October 1992.	E	101	IOC Regional Science Planning Workshop on Harmful Algal Blooms; Montevideo, Uruguay, 15-17 June 1994.	E	122	IOC-EU-BSH-NOAA-(WDC-A) International Workshop on Oceanographic Biological and Chemical Data Management, Hamburg, Germany, 20-23 May 1996.	E
84	Workshop on Atlantic Ocean Climate Variability; Moscow, Russian Federation, 13-17 July 1992.	E	102	First IOC Workshop on Coastal Ocean Advanced Science and Technology Study (COASTS); Liège, Belgium, 5-9 May 1994.	E	123	Second IOC Regional Science Planning Workshop on Harmful Algal Blooms in South America; Mar del Plata, Argentina, 30 October - 1 November 1995.	E, S
85	IOC Workshop on Coastal Oceanography in Relation to Integrated Coastal Zone Management; Kona, Hawaii, 1-5 June 1992.	E	103	IOC Workshop on GIS Applications in the Coastal Zone Management of Small Island Developing States; Barbados, 20-22 April 1994.	E	124	GLOBEC-IOC-SAHFOS-MBA Workshop on the Analysis of Time Series with Particular Reference to the Continuous Plankton Recorder Survey; Plymouth, U.K., 4-7 May 1993.	E
86	International Workshop on the Black Sea; Varna, Bulgaria, 30 September - 4 October 1991.	E	104	Workshop on Integrated Coastal Management; Dartmouth, Canada, 19-20 September 1994.	E	125	Atelier sous-régional de la COI sur les ressources marines vivantes du Golfe de Guinée ; Cotonou, Bénin, 1-4 juillet 1996.	E
87	Taller de trabajo sobre efectos biológicos del fenómeno «El Niño» en ecosistemas costeros del Pacífico Sudeste; Santa Cruz, Galápagos, Ecuador, 5-14 de octubre de 1989.	S only (summary in E, F, S)	105	BORDOMER 95: Conference on Coastal Change; Bordeaux, France, 6-10 February 1995.	E	126	IOC-UNEP-PERSGA-ACOPS-IUCN Workshop on Oceanographic Input to Integrated Coastal Zone Management in the Red Sea and Gulf of Aden. Jeddah, Saudi Arabia, 8 October 1995.	E
88	IOC-CEC-ICSU-ICES Regional Workshop for Member States of Eastern and Northern Europe (GODAR Project); Obninsk, Russia, 17-20 May 1993.	E	Suppl.	Conference on Coastal Change: Proceedings; Bordeaux, France, 6-10 February 1995	E	127	IOC Regional Workshop for Member States of the Caribbean and South America GODAR-V (Global Oceanographic Data Archeology and Rescue Project); Cartagena de Indias, Colombia, 8-11 October 1996.	E
89	IOC-ICSEM Workshop on Ocean Sciences in Non-Living Resources; Perpignan, France, 15-20 October 1990.	E	106	IOC/WESTPAC Workshop on the Paleographic Map; Bali, Indonesia, 20-21 October 1994.	E	128	Atelier IOC-Banque Mondiale-Sida/SAREC-ONE sur la Gestion Intégrée des Zones Côtères ; Nosy Bé, Madagascar, 14-18 octobre 1996.	E
90	IOC Seminar on Integrated Coastal Management; New Orleans, U.S.A., 17-18 July 1993.	E	107	IOC-ICSU-NIO-NOAA Regional Workshop for Member States of the Indian Ocean - GODAR-III; Dona Paula, Goa, India, 6-9 December 1994.	E	129	Gas and Fluids in Marine Sediments, Amsterdam, the Netherlands; 27-29 January 1997.	E
91	Hydroblack '91 CTD Inter-calibration Workshop; Woods Hole, U.S.A., 1-10 December 1991.	E	108	UNESCO-IHP-IOC-IAEA Workshop on Sea-Level Rise and the Multidisciplinary Studies of Environmental Processes in the Caspian Sea Region; Paris, France, 9-12 May 1995.	E	130	Atelier régional de la COI sur l'océanographie côtière et la gestion de la zone côtière ; Moroni, RFI des Comores, 16-19 décembre 1996.	E
92	Réunion de travail IOCEA-OSNLR sur le Projet « Budgets sédimentaires le long de la côte occidentale d'Afrique » Abidjan, côte d'Ivoire, 26-28 juin 1991.	E	Suppl.	Workshop on Sea-Level Rise and the Multidisciplinary Studies of Environmental Processes in the Caspian Sea Region; Submitted Papers; Paris, France, 9-12 May 1995.	E	131	GOOS Coastal Module Planning Workshop; Miami, USA, 24-28 February 1997	E
93	IOC-UNEP Workshop on Impacts of Sea-Level Rise due to Global Warming. Dhaka, Bangladesh, 16-19 November 1992.	E	109	First IOC-UNEP CEPOL Symposium; San José, Costa Rica, 14-15 April 1993.	E			
94	BMTC-IOC-POLARMAR International Workshop on Training Requirements in the Field of Eutrophication in Semi-enclosed Seas and Harmful Algal Blooms, Bremerhaven, Germany, 29 September-3 October 1992.	E	110	IOC-ICSU-CEC regional Workshop for Member States of the Mediterranean - GODAR-IV (Global Oceanographic Data Archeology and Rescue Project) Foundation for International Studies, University of Malta, Valletta, Malta, 25-28 April 1995.	E			
			111	Chapman Conference on the Circulation of the Intra-Americas Sea; La Parguera, Puerto Rico,	E			

No.	Title	Languages			
132	Third IOC-FANSA Workshop; Punta-Arenas, Chile, 28-30 July 1997	S/E	146	Living Marine Resources Panel Meeting, Paris, France, 23-25 March 1998.	E
133	Joint IOC-CIESM Training Workshop on Sea-level Observations and Analysis for the Countries of the Mediterranean and Black Seas; Birkenhead, U.K., 16-27 June 1997.	E	147	IOC-SOA International Training Workshop on the Intregation of Marine Sciences into the Process of Integrated Coastal Management, Dalian, China, 19-24 May 1997.	E
134	IOC/WESTPAC-CCOP Workshop on Paleogeographic Mapping (Holocene Optimum); Shanghai, China, 27-29 May 1997.	E	148	IOC/WESTPAC International Scientific Symposium – Role of Ocean Sciences for Sustainable Development Okinawa, Japan, 2-7 February 1998.	E
135	Regional Workshop on Integrated Coastal Zone Management; Chabahar, Iran; February 1996.	E	149	Workshops on Marine Debris & Waste Management in the Gulf of Guinea, 1995-97.	E
136	IOC Regional Workshop for Member States of Western Africa (GODAR-VI); Accra, Ghana, 22-25 April 1997.	E	150	First IOCARIBE-ANCA Workshop Havana, Cuba, 29 June-1 July 1998.	E
137	GOOS Planning Workshop for Living Marine Resources, Dartmouth, USA; 1-5 March 1996.	E	151	Taller Pluridisciplinario TEMA sobre Redes del Gran Caribe en Gestión Integrada de Areas Costeras Cartagena de Indias, Colombia, 7-12 de septiembre de 1998.	S
138	Gestión de Sistemas Oceanográficos del Pacífico Oriental; Concepción, Chile, 9-16 de abril de 1996.	S	152	Workshop on Data for Sustainable Integrated Coastal Management (SICOM) Maputo, Mozambique, 18-22 July 1998	E
139	Sistemas Oceanográficos del Atlántico Sudoccidental, Taller, TEMA; Furg, Rio Grande, Brasil, 3-11 de noviembre de 1997	S	153	IOC/WESTPAC-Sida (SAREC) Workshop on Atmospheric Inputs of Pollutants to the Marine Environment Qingdao, China, 24-26 June 1998	E
140	IOC Workshop on GOOS Capacity Building for the Mediterranean Region; Valletta, Malta, 26-29 November 1997.	E	154	IOC-Sida-Flanders-SFRI Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA project) Capetown, South Africa, 30 November-11 December 1998.	E
141	IOC/WESTPAC Workshop on Co-operative Study in the Gulf of Thailand: A Science Plan; Bangkok, Thailand, 25-28 February 1997.	E	155	Science of the Mediterranean Sea and its applications UNESCO, Paris 29-31 July 1997	E
142	Pelagic Biogeography ICoPB II. Proceedings of the 2nd International Conference, Final Report of SCOR/IOC Working Group 93; Noordwijkerhout, The Netherlands, 9-14 July 1995.	E	156	IOC-LUC-KMFRI Workshop on RECOSCIX-WIO in the Year 2000 and Beyond, Mombasa, Kenya, 12-16 April 1999	E
143	Geosphere-biosphere coupling: Carbonate Mud Mounds and Cold Water Reefs; Gent, Belgium, 7-11 February 1998.	E	157	'98 IOC-KMI International Workshop on Integrated Coastal Management (ICM), Seoul, Republic of Korea 16-18 April 1998	E
144	IOC-SOPAC Workshop Report on Pacific Regional Global Ocean Observing Systems; Suva, Fiji, 13-17 February 1998.	E	158	The IOCARIBE Users and the Global Ocean Observing System (GOOS) Capacity Building Workshop, San José, Costa Rica, 22-24 April 1999	E
145	IOC-Black Sea Regional Committee Workshop: 'Black Sea Fluxes' Istanbul, Turkey, 10-12 June 1997.	E			