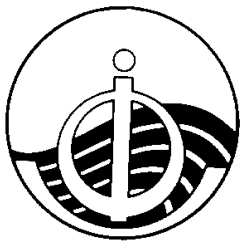
Intergovernmental Oceanographic Commission

Annual Reports Series



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Annual Report 1999

UNESCO

IOC Annual Reports Series No. 6
Annual Report 1999
English only

The Intergovernmental Oceanographic Commission (IOC) of UNESCO was established in 1960 as a specific mechanism of the United Nations system, to coordinate Ocean Science Research and Ocean services worldwide. The commitment of its member States has allowed UNESCO to maintain for 40 years a high level forum in support of a strong focus on ocean science. UNESCO through its Intergovernmental Oceanographic Commission, has played and will continue to play a leadership role in the development of the knowledge necessary to manage ocean resources.

"The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services and capacity building, in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making process of its Member States (Art.2.1.)"

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OF THE INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

On 21 September 1999, Dominica became the 127th Member State of the Commission.

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The Intergovernmental Oceanographic Commission was established by resolution 2.31 adopted by the General Conference of UNESCO at its eleventh session (Nov.-Dec. 1960), and in conformity with the recommendation of the Intergovernmental Conference on Oceanic Research (Copenhagen, 11-16 July 1960). Drafted in 1960, the Statutes of the Commission were revised in 1970 and 1987. In 1999, new proposed amendments to these Statutes were adopted by the IOC Assembly at its twentieth session and were approved in the same terms by the General Conference of UNESCO at its thirtieth session. The present statutes of the Commission entered into force through adoption of 30 C/Resolution 22 on 16 November 1999.

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* Members of the Executive Council elected during the 21st Session of the IOC Assembly (July 1999)

OFFICERS ***Elected in July 1999***

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Prof. Su Jilan (China)
Advisor to the Administrator
Second Institute of Oceanography
State Oceanic Administration

Past-chairperson
1995 - 1999
Mr. Geoffrey L. Holland (Canada)
Special Advisor, Oceans
Department of Fisheries & Oceans
(No longer Officer of the Commission)

1st Vice-chairperson

Dr. David Pugh (United Kingdom)
Southampton Oceanography Centre

2nd Vice-chairperson

Vice-admiral Marcos Leal de Azevedo (Brazil)
Director
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3rd Vice-chairperson

Dr. Sergey Khodkin (Russian Federation)
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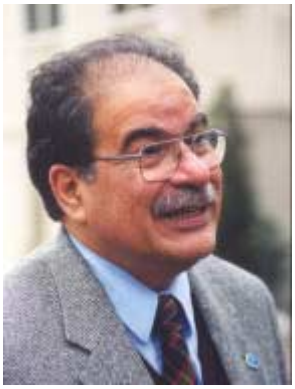
Federal Service for Hydrometeorology and Environmental Monitoring

4th Vice-chairperson

Dr. Thomas Olatunde Ajayi (Nigeria)
Director
Nigerian Institute for Oceanography and Marine Research

1999 A YEAR OF CHANGE FOR THE IOC AND UNESCO



At the 20th Assembly in July, the IOC elected a new Chairman, Professor Su Jilan from China who is accompanied by the four new Vice-Chairmen: Dr. David Pugh (United Kingdom), Vice-admiral Marcos Leal de Azevedo (Brazil), Dr. Sergey Khodkin (Russian Federation) and Dr. Thomas Olatunde Ajayi (Nigeria). In UNESCO, after being elected by the General Conference in November, Mr. Koichiro Matsuura from Japan, succeeded Dr. Federico Mayor as Director-General, who served as the CEO of the organization for 12 years. It is fair to say that through these combined events, 1999 presented itself as a year of change and therefore of opportunities.

In 1999, the IOC underwent an external review, and very early on after his election, our new Chairman had to play a key role in the discussions leading to the approval the new statutes of the Commission by the General Conference of UNESCO. The new statutes, contained in Annex II, reaffirm that Ocean Science is at the core of IOC's Mission. In its 40 years, the IOC has successfully coordinated the major ocean science programmes responsible for generating the knowledge and collecting the data needed to:

- Understand the role of the Ocean in bio-geochemical cycling, drawing attention to the process of Climate and Global Change;
- Understand Ocean circulation and its relationship with the atmosphere, increasing the range of weather and climate forecasting;
- Asses the role of marine ecosystems in the cycling of CO_2 in the marine environment;
- Establish the baseline reference and conduct regular assessments of the major ocean basins, to ascertain the impact of man-made activities and pollution.

The recent mandates to assess the Ocean Science for Living Resources Programme and the overall review of the science Programmes, also highlights this clear priority.

However, reflecting the major changes taking place after UNCED and the coming into force of UNCLOS in 1994, the delivery of *Ocean Services* has evolved as an unifying theme for all IOC programmes, in particular in two major areas: Coastal Area Management and Operational Oceanography.

IOC is responsible for maintaining and coordinating a series of monitoring systems (autonomous floats, tide-gauges, buoys, ships of opportunity, etc.) that provide data about the ocean practically on a daily basis. These data are freely available and distributed to partners all over the world. These are the *Ocean Services* referred above. Today IOC is the organization that provides the Global Observing Sea-level System, the Ships of Opportunity Programme (SOOP), the Data Buoy Cooperation Panel. Some 14,000 XBT profiles were made during the first six months of 1999 by SOOP operators from Australia, France, Germany, India, Japan, and USA, including about 8,500 profiles in the Pacific Ocean, 3,200 in the Indian Ocean, and 2,300 in the Atlantic Ocean.

The development of *Operational Oceanography*, a concept pioneered by IOC, will bring this daily acquired information about the Ocean to new groups of users, providing real-time services that were not available one or two decades ago. These products will enable member states of the UN to implement sustainable development strategies for their Coastal zones and Oceans, and to improve their response to the new Global Conventions. For example the *Argo Pilot Project*, will seed the ocean with 3,000 profiling floats that will rise from about 2,000 m to the surface every 14 days, each one collecting 100 CTD profiles over a 4-year period. At maximum capacity *Argo* should provide 300,000 profiles that together give full global coverage of the ocean interior for the first time.

WMO and the IOC formed JCOMM, the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology, to help to implement the Global Ocean Observing System and other marine operations.

In this context it is relevant that the first Recommendation by the External Evaluation Team calls: *"UNESCO and its Member [States to] seize the opportunity to build on their initial investment in the scientific study of the oceans in the second half of the twentieth century to provide the urgently needed global leadership in the development of operational oceanographic services for the benefit of all humanity through the twenty-first century."*

Indeed this is a major opportunity and challenge. After 40 years the IOC has maintained its focus as a specialized mechanism of the UN system, to coordinate Ocean Scientific research and Ocean services worldwide. UNESCO through its IOC has played and will continue to play a leadership role in the development of the knowledge necessary to manage ocean resources in a sustainable way.

Convened every two years in UNESCO Headquarters, Paris, the IOC Assembly held its 20th ordinary session from 29 June to 9 July . The event also provides an international forum for representatives of 127 Member States, observers and many IGOs and NGOs. The implementation of resolutions adopted during the session appear in an addendum to this report. This document and the report of the session can be requested to the IOC Secretariat.

CONTENTS

Ocean Sciences 1

OVERVIEW 1999 was the first year the Ocean Sciences Section of IOC operated as a unit that is responsible for coordination of the efforts of the Commission in diverse areas in marine scientific research and related activities.

Within the **Oceans and Climate** sub-programme, the IOC-JGOFS Panel on Ocean CO_2 successfully completed its main task of overseeing the acquisition of a coherent and high quality global data set on ocean CO_2 from WOCE and JGOFS ships. A new Panel is emerging to advise SCOR/JGOFS, GOOS and OOPC on CO_2 observations, data management and modelling for continuing studies of the global carbon cycle. WOCE researchers continued to produce new scientific insights as the analysis phase gained momentum. CLIVAR planners incorporated national statements of intent in accelerating the transition from planning to implementation at international levels. OCEANOBS99, convened jointly by the OOPC and the UOP, was a key step towards strengthening the partnership between CLIVAR, GOOS and GCOS. This is central to ensuring the climate observing system will meet the needs of both the operational and research communities.

Under **OSLR**, the IOC/UNEP/IUCN/World Bank co-sponsored GCRMN became active in all oceans with substantial funding being provided by the Governments of United States, Australia, France, and the United Kingdom. The UK Department for International Development provided funding for a second phase for the GCRMN South Asia Node. Significant headway was made on the 'Status of the Coral Reefs of the World: 2000' report which will provide a full global perspective on coral reef status. Nine training courses and workshops were implemented and 94 scientists were trained under the HAB Programme. The draft science plan for the IOC/SCOR Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) was completed.

GIPME intensified its HOTO related activities on the development of rapid assessment techniques for anthropogenic stresses and took on two new initiatives concerned with indicators for ocean and human health. One of these initiatives involves the development of indicators for assessing the health of marine benthic communities. The other is concerned with the increasing risk to human health posed by the anthropogenic mobilization of artificial and natural toxic agents in the environment.

In September 1999, a major international workshop on coastal mega-cities was co-sponsored by **IOC's ICAM** programme and the State Oceanic Administration (SOA) of China, in collaboration with the IOI, and IGU. IOC/ICAM and the LOICZ programme of IGBP agreed to start joint pilot studies in the Caribbean region, and the Indian Ocean/Pacific Island States, involving a synthesis of physical, biogeochemical and human interaction processes relevant to the coastal zone stakeholders and the global-change scientific community. ICAM, in cooperation with PRE-COI and IFREMER, undertook the preparation of a concise methodological guide on zoning and mapping of coastal areas. A three year workplan for *Oceans 21*, a joint IOC/ICAM and IGU project, was developed.

Within the activities initiated under ONSLR associated with **UNCLOS**, an IHO/IOC multi-authored volume *"Continental Shelf Limits: the Scientific and Legal Interface"*, was finalized and sent to Oxford University Press, for publication in 2000.

1.1 Ocean and Climate[1]

The World Climate Research Programme (WCRP)

The WMO, IOC and ICSU are co-sponsors of the WCRP, which oversees a number of major global climate activities including the World Ocean Circulation Experiment (WOCE) and the Climate Variability and Predictability (CLIVAR) programme. The WCRP is also an active co-sponsor along with GOOS and GCOS of the Ocean Observations Panel for Climate (OOPC).

The Joint Scientific Committee (JSC) of the World Climate Research Programme (WCRP) held its 20th session 15-19 March in Kiel. Continuing effort to develop improved coordination with IGBP programmes and produced a proposal to IGBP to jointly organize several workshops. Noteworthy from the IOC point of view, was one on the carbon cycle. That workshop, to be held in 2000 would consider the required observation programmes to support model development and validation.

Ocean CO_2 (Joint Global Ocean Flux Study)

With the approval of the IOC Assembly, the IOC Secretariat negotiated with SCOR a set of revised Terms of Reference to establish a new Panel with new membership with expertise consistent with a new focus for the Ocean CO_2 Panel. Its new Panel interests center on assistance to GOOS in establishing ocean CO_2 observational requirements and having a ready source of expertise on issues that are of increasing concern such as the sequestering of CO_2 in the deep ocean and the ocean processes involved in the exchange with the atmosphere of other (non- CO_2) green house gases.

Pending issues to be addressed by this panel are:

- the lack of a long-term, reliable source of reference materials for measuring ^{13}C and ^{14}C and other components of the ocean carbon chemistry,
- the closing of the global carbon budget,
- determination of a set of universally accepted dissociation constants, and reduced error bars on global net uptake of CO_2 by the ocean.

[1] See also Ocean Observations Panel for Climate (OOPC) and Global Ocean Data Assimilation Experiment (GODAE) under section 3.

World Ocean Circulation Experiment/Climate Variability & Predictability

The WOCE Programme continued to progress through its phase of Analysis, Interpretation, Modelling and Synthesis (AIMS). Part of this effort will result in the production of a second set of CD-ROMs of WOCE data in 2000

WOCE is producing new scientific insights into the role of the ocean in climate. This is clearly demonstrated by the rapidly increasing number of papers (standing at 964 in December 1999) in the refereed literature that are based on WOCE observations or WOCE funded research.

As WOCE approaches its end in 2002, the WCRP's CLIVAR study is rapidly developing. In CLIVAR as with WOCE, modelling is a key element. The development of coupled models is driven by the needs of the Intergovernmental Panel on Climate Change (IPCC) as well as the requirements of CLIVAR. For achieving these objectives, data sets for both the atmosphere and the ocean will be required and, at a global scale, these will depend on the development of strong partnerships between CLIVAR and. the global climate and ocean observing systems (GOOS and GCOS) and the operational meteorological services of WMO.

The OCEANOBS99 Conference, convened jointly by the OOPC and UOP was a key step in partnership building. The agreement adopted by WMO and IOC to establish the Joint Commission for Oceanography and Marine Meteorology was another. These evolving partnerships are essential to ensure that all relevant observations, whether in the atmosphere or the ocean, are made available to CLIVAR researchers in a timely and user-friendly manner.

1.2 Ocean Science in Relation to Living Marine Resources (OSLR)

After two decades of development, the Ocean Science in Relation to Living Resources Programme includes a number of significant programmes and research activities. These include the Living Marine Resources Module of GOOS, the Global Coral Reef Monitoring Network and its South Asia node, the Global Ocean Ecosystem Dynamics Programme (GLOBEC), the Large Marine Ecosystems initiative (LMEs), the Sir Alister Hardy Foundation for Ocean Science's Continuous Plankton Recorder Programme, the Harmful Algal Bloom (HAB) Programme and the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) programme.

Harmful Algal Bloom Programme (HABP)

The HAB Programme is monitored and guided by the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB). At its Fifth Session in November 1999, IPHAB reviewed results for 1997-99, and agreed to a 2000-2001 workplan for the HAB Programme.

The HABP continued to work closely with SCOR and ICES in the development of the scientific elements of the Programme. With respect to SCOR this work focused on the new research programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB).

In order to develop mechanisms to minimize the impacts of harmful algae and their toxins on human health, commerce, fisheries resources, and the marine ecosystems, the IOC jointly with the Asia-Pacific Economic Cooperation Forum (APEC) organized the First International Conference on Harmful Algae Management and Mitigation (HAMM). The HAMM Proceedings and the HAB Management Guidelines are expected to appear in the IOC Publications Series.

See http://vm.cfsan.fda.gov/~frf/sfhamm.html

Highlight on GEOHAB

In 1998, the IOC and SCOR developed a plan for coordinated international scientific research and cooperation to develop capabilities for assessment, prediction and mitigation of harmful algae. The resulting programme is called Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB).

Figure 1. GEOHAB Scientific Steering Committee Nov. 1999; *front row (from left to right)* Grant Pitcher (South Africa), John Cullen (Canada), Yasuwo Fukuyo (Japan), Nestor Lagos (Chile), Susan Blackburn (Australia), Liz Gross (SCOR), Patricia Glibert (USA), Marta Estrada (Spain), Arturo Sierra-Beltran (Mexico), Zhang Jing (China); *second row*: Allan Cembella (Canada), Don Anderson (USA), Patrick Gentien (France), Thomas Osborn (USA); *back row*: Manuel Barange (GLOBEC-IPO), Henrik Enevoldsen (IOC), Wolfgang Fennel (Germany), Malte Elbraechter (Germany); *not present on picture*: Adriana Zingone (Italy), Richard Geider (UK) and Steve Thorpe (UK), Kaisa Kononen (Finland).

Despite the large body of knowledge available on harmful algae, very little is known about the mechanisms controlling the dynamics of individual species or the hydrographic or ecological conditions resulting in massive blooms. Such blooms consist of toxic species that may kill fish and shellfish or contaminate seafood, with adverse effects on human health. Blooms may also be due to non-toxic species that disrupt the ecosystem by depleting oxygen during bloom decay or that degrade recreation areas by producing foams or mucilage.

Although monitoring procedures based on proper taxonomic identification and toxin determinations improve the protection of seafood consumers throughout the world, prediction of toxic events is still not possible. Establishment of predictive capacity depends on a detailed knowledge of the ecology and the interactions between the species of interest and the oceanographic climate at different scales.

GEOHAB is essentially an oceanography programme, and this is reflected in the membership of the GEOHAB Scientific Steering Committee (SSC). For example, the SSC includes three physical oceanographers whose expertise is crucial for understanding the physical field in which the toxic events occur and for guiding investigations on physical-biological interactions at small scale. The SSC also includes general phytoplankton ecologists in addition to HAB specialists. The first meeting of the SSC was held in Brest, France in November 1999.

GEOHAB is not an isolated initiative. It is part of IOC HAB Programme and specifically addresses a significant part of the scientific objectives identified in the IOC HAB Programme Plan. GEOHAB is designed to complement the other activities under the IOC HAB Programme. It is monitored and guided by the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB). It is also recognized by the SSC that GEOHAB development requires collaboration with other programmes, e.g. GLOBEC, C-GOOS and LOICZ.

Beside training and capacity building (see table 1), International networking among scientists and managers working with HAB continued to be another main priority for the HAB Programme. Harmful Algae News, the IOC newsletter on harmful algae and algal blooms, has more than 2,000 subscribers. Subscriptions can be made at http://ioc.unesco.org/hab/news.htm. The IOC Directory of HAB Experts is available at http://ioc.unesco.org/hab/data1.htm#1

The HAB programme and its centres in Copenhagen and Vigo develop a number of Internet accessible services and products. The IOC-ICES Harmful Algal Event Data Base (HAE-DAT) is a meta-data-base developed to provide a structure for storage of data on harmful algae events in different countries, and allow for easy integration of data, efficient search tools, and the possibility of data analysis. HAE-DAT will come closer to global coverage during 2000. HAE-DAT is available at http://ioc.unesco.org/hab/data3.htm#1

The IOC-ICES Metadata-base on Design and Implementation of HAB Monitoring Programmes (MON-DAT) contains information on the design and implementation of harmful algae monitoring and management systems from all over the world. The data-base can be found at http://ioc.unesco.org/hab/data2.htm#1. A specific HAB -version (HAB-BIB) of the FAO-IOC-UNEP Aquatic Science and Fisheries Abstracts (ASFA) has been prepared. HAB-BIB will be available at http://ioc.unesco.org/hab.

Table 1. *HAB summary of training, workshops and training in 1999*

Title	***Place & dates***	***Nbr. of attendants***	***Nbr. of Countries***	***Budget*** [2]	***US$***
Training Courses					
IOC Training Course on the Biology and Taxonomy of Harmful Marine Microplankton	Copenhagen, Denmark, 10-18 January	12	10	EX	40,000
IOC-SAREC-DANIDA Training Workshop on the Taxonomy of Harmful Marine Microplankton	Zanzibar, 8-13 February	10	5	EX	15,000
IOC-UNEP Training Course on Qualitative and Quantitative Determination of Algal Toxins	Jena, Germany, 2-12 March	12	10	EX RP	30,000 10,000
IOC/WESTPAC-Chinese Taipei: Red Tide Seminar Workshop	Chinese Taipei, 3-7 April	13		EX	55,000
IOC-IEO-AECI Training Course on Toxic Microalgae and Marine Phycotoxins	Vigo, Spain, 1-17 June	12	5	EX	40,000
IOC-Danida Training Courses on the Taxonomy and Biology of Harmful Marine Microplankton	Copenhagen, Denmark, 26 July-7 August	15	13	EX RP	40,000 10,000
FANSA International Seminar on Red Tides	Puerto Varas, Chile, 3-5 August			RP EX	10,000
FANSA Regional Course on HAB: Methodologies for marine biotoxins	Santiago, Chile, 8-12 November			RP EX	10,000
IOC/WESTPAC-Hong Kong: Red Tide Seminar and Training Course	Hong Kong, 6-10 December	20	2	EX	55,000
Conferences & Meetings					
ICES-IOC Working Group on Harmful Algal Bloom Dynamics	Jena, Germany, 16-20 March	21	12	EX	40,000
ICES-IOC-IMO Study Group on Ballast Water and Sediments	Llandado, UK, 12-13 April	49	18	EX	-
IOC-APEC Conference on Harmful Algal Management and Mitigation (HAMM)	Subic Bay, Philippines, 9-14 May	104	25	EX RP	140,000 10,000
IOC-SCOR Scientific Steering Committee for GEOHAB	Brest, France, 3-6 November	21	16	EX	40,000

[2] EX: extra-budgetary sources; RP: regular budget

Global Coral Reef Monitoring Network

Co-sponsored by the IOC, UNEP, IUCN and The World Bank, the Global Coral Reef Monitoring Network continued to expand during 1999 and is now active in all oceans. Funding is provided by the U.S. Department of State and NOAA, and the governments of Australia, France and the UK, and coordination is provided by IOC/UNESCO in collaboration with UNEP, IUCN, ICLARM and the World Bank.

The UK Department for International Development (DFID) has extended funding through IOC for the GCRMN South Asia Node (India, Sri Lanka, and the Maldives) for a second 30-month phase, with coordination provided by IOC/UNESCO. A new regional coordinator for the project, Emma Whittingham, has been appointed and is located at the project headquarters at IUCN in Colombo, Sri Lanka. India, the Maldives and Sri Lanka have prepared Coral Reef Monitoring Action Plans, which will be available in early 2000.

Coral monitoring is also now in planning or underway in the Western Indian Ocean, East African States, Micronesia and the Caribbean Sea.

The major activity now underway under GCRMN is the preparation of a report for GOOS, 'Status of the Coral Reefs of the World: 2000', which will provide a global perspective on coral reef status and monitoring. All coral reef nations are being asked to provide country reports by May 2000. The preparation of the report is under the guidance of Dr Clive Wilkinson, coordinator of the GCRMN

Global Ocean Ecosystem Dynamics: GLOBEC

In 1999, GLOBEC held its Scientific Steering Committee meeting in conjunction with the IGBP Congress (Yokohama, Japan, May) and published its Implementation Plan. The plan describes the major activities to be undertaken in GLOBEC's four research foci, and indicates how the observations and results from GLOBEC's diverse global research programme will be drawn together into a global synthesis describing how global change may affect the abundance, diversity and productivity of important marine populations.

As one of the co-sponsor of GLOBEC, IOC participated in consultations to renew the Programme scientific steering group. Furthermore, OSLR officers are in close contact with the GLOBEC project office in order to coordinate support to some of GLOBEC's programmes of particular interest to OSLR, such as SPACC.

Large Marine Ecosystems

The Large Marine Ecosystem programme continued to expand rapidly in 1999 under sponsorship from the Global Environment Facility (GEF). A new programme for the Yellow Sea LME, which includes the People's Republic of China, the Republic of Korea and the Democratic People's Republic of Korea, was provided support in the form of a GEF planning grant.

The Benguela Current LME project (Angola, Namibia and South Africa) continues planning with the development in 1999 of a Transboundary Diagnostic Analysis and a Strategic Action Programme. The first phase of the Gulf of Guinea LME was completed and plans are underway to begin a second phase, which will include additional countries bordering the LME.

In a recent consultation on LME's (Paris, early 2000), further progress was reported. The Benguela project has been initially approved at a level close to 15 million USD, and new proposal are under development for the Humboldt Current (Peru and Chile) and for the Canary Current (Morocco, Mauritania, Senegal and Spain).

Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

Co-operation between IOC and SAHFOS continued in 1999. In July of 1999 a new project began with SAHFOS as the main partner, supported by the UK Department of the Environment, Transport and the Regions, to further develop the U-Tow into an operational instrument for Ship of Opportunity (SOOP) use.

This project involves polling the ships that currently deploy the CPR to obtain comments and identification of potential problems from their perspective with deploying the U-Tow. Further trials on SOOPs will also be undertaken and comparisons made between the sampling characteristics of the U-Tow and the CPR.

At present the U-Tow has proved reliable and capable of undulating to depths of approximately 60 m at speeds of up to 16 knots but it has not yet been towed unaccompanied. This project will move towards that goal.

A proposal was submitted, and funding received, during 1999 for a two-year programme of CPR tows in the NE Pacific. This project was proposed by the MONITOR Task Team of the PICES Climate Change and Carrying Capacity programme. Sampling will start in the spring of 2000 and the project will be considered a pilot project of GOOS.

1.3 Ocean Science in Relation to Non-living Resources

Marine Science Inputs to Integrated Coastal Area Management (ICAM)

Foreword by Biliana Cicin Sain and Robert Knecht, Co-Directors, Center for the Study of Marine Policy, University of Delaware

ICAM has emerged as a key tool in the quest for sustainable development of the world's ocean and coastal areas. In Rio in 1992, nations committed themselves to adopting a more integrated approach to the planning and management of their coastal and ocean resources and since that time they have found ICAM to be a useful methodology for achieving that goal.

Since 1992, international guidelines for ICAM have been developed, training forces have been designed and constructed, and specialised handbooks have been prepared and disseminated. IOC has been one of the leading intergovernmental organizations in this capacity building effort. But the ICAM work is far from finished. The initiative must shift to the national and subnational level as the principles of ICAM are applied to the specific coastal context of each nation. Organizations like IOC must find new ways to assist nations in their implementation efforts. IOC, for example, can help ensure that ICAM is being implemented at the national level in scientifically sound ways. IOC's broad scientific base and, especially, its global monitoring programmes such as GOOS and coastal GOOS, should be focused on these needs. More specifically, many nations will need data and information on the erosion rates along their shorelines, especially as they prepare to deal with the threats associated with sea level rise. Nations will also need data on coastal pollution levels and their changes over time and on sediment outflows from rivers and estuaries. ICAM programmes will also benefit from data on coastal current systems, on the wave climates influencing coastal zones, and on the intensity and location of coastal storms. Just how much of this information can be provided by monitoring systems such as coastal GOOS remains yet to be determined.

IOC is well positioned to take the lead in ensuring that the needs of coastal managers are well understood and carry appropriately in the design and operation of GOOS and its modules.

It would be most fitting if the tenth anniversary of the Rio UNCED conference in 2002 found the majority of the world's coastal nations in the process of implementing scientifically sound ICAM programmes.

In 1999, the IOC/ICAM has continued its expansion through the development of intersectorial activities structured around the five core components:

- Inter-disciplinary Approaches to Coastal Processes;
- Marine Scientific and Technological information systems;
- Methodology development;
- Coastal Monitoring systems; and
- Training and Education in ICAM.

The ICAM team in the Secretariat increased with a new junior staff hired in February 1999 to assist with the implementation of the programme. In the framework of the US-EU Consortium on Marine Policy and Education in Integrated Coastal Management, IOC also benefited from receiving two Graduate Students interns, in June 1999 and in May 2000.

Inter-disciplinary Approaches to Coastal Processes and Management. 1999 marked the beginning of a strong co-operation between IOC/ICAM and LOICZ of IGBP in the development of the interdisciplinary science needed to link the physical, biogeochemical and human dimensions of coastal processes and changes.

IOC joined the LOICZ Workshop on Global Island States and the Caribbean (held during the LOICZ, Open Science Meeting, Bahia Blanca, Argentina, 15-18 November 1999). This meeting recommended undertaking pilot studies for the Caribbean, and Indian Ocean-Pacific regions, which would contain a synthesis of physical, biogeochemical and human interaction processes relevant to global change studies.

The story of a Success: The International Workshop on Coastal Mega-cities

Focusing on the theme *"Challenges of Growing Urbanisation of the World's Coastal Areas"* this Workshop was the major event of this year for the IOC/ICAM programme. Held in Hangzhou, China (27-30 September 1999) and co-organized by IOC, the State Oceanic Administration (SOA) of China, and with the collaboration of the International Ocean Institute (IOI), and the International Geographical Union (IGU), was attended by more than 60 participants. Among these were representatives from coastal mega-cities such as Shanghai, Tianjin, Jakarta, Manila, Bombay, Buenos Aires, Lagos, and Los Angeles, tens of scientists and social-economists and representatives from UNEP, the World Bank, and IOC discussed the challenges that coastal megacities face.

At the end of the Workshop, the *Hangzhou Declaration on Coastal Megacities* was adopted. The results of this important event are being disseminated through different channels, i.e. the internet, newsletter, IOC reports and through the publication of a Special Issue devoted to Coastal Megacities in the *Ocean and Coastal Management Journal.*

Marine scientific and Technological Information System for ICAM. The website created in October 1998 as a collaborative effort between IOC, US-NOAA's National Ocean Service and the University of Delaware's Centre for the Study of Marine Policy (CSMP) has become a real clearinghouse for ICAM worldwide. In addition to welcoming the World Bank as a full new partner sponsoring the website, several new areas have been added. These include a NEWS section, GLOBAL AND REGIONAL INFORMATION, covering organizations and issues taking place at the global and regional level. Recently a comprehensive section on coastal management in the European Union was added. The NATIONAL INFORMATION section, which includes general country and ICAM-specific information on the country level, has been expanded to include 17 countries.

Product oriented sections have also been added on INTERNATIONAL GUIDELINES on ICAM (downloadable) as well as on INTERNATIONAL PRESCRIPTIONS on ICAM contained in international treaties. The success of the website makes possible to consider transforming into the official clearinghouse component of ICAM for the GPA.process and to have it jointly sponsored by GPA office of UNEP.

Since March 1999, IOC/ICAM has established its own web pages, which can be found at: http://ioc.unesco.org/icam/default.htm It contains information on the current activities undertaken by the programme, publications, a link to the *Oceans 21* web page and other links.

ICAM homepage: http://ioc.unesco.org/icam

Methodologies in support of ICAM. One of the goal of the IOC/ICAM programme is to develop manuals, procedures, and guidelines, which would provide guidance to coastal scientists and managers, and enable them to build scientific research, investigation and operation techniques into the ICAM process.

As a result of the interest on the methodology used in the production in 1998 of the *Sensitivity Atlas of the shallow water of Mahé (Seychelles),* presented by UNESCO to the CSD-7 meeting in New York, IOC together with PRE-COI and IFREMER (France) initiated the production of a concise methodological guide of coastal areas. This Guide will be illustrated by case studies from the Indian Ocean, and will describe a methodology readily available for the zoning of coastal areas, which is cost-effective and transferable to other coastal regions. The Guide is being published in 2000.

In 1998 a joint project *"Oceans 21"* was established between IOC/ICAM and the International Geographical Union (IGU). The first meeting of the Steering Committee identified the priority areas for the programme. Special attention will be given to the development of ICAM related guides and manuals, with emphasis on the methodological inputs originating in the social sciences, and in particular geography. A call for contributions has been circulated using the IGU and IOC networks, and should result in the elaboration and ulterior publication of a series of *'Oceans 21 Dossiers', which* should be practical and educational for coastal managers. To steer this process, an Advisory Committee for the IOC inputs to Oceans 21 was appointed in December 1999, made up of 6 renowned scientists.

A Regional Workshop on Data and Information for Integrated Coastal Area Management was organized in Cape Town, South Africa, 13-15 December 1999. *(See also the IODE section under Regional Approach).*

Training and Education in the field of ICAM. The majority of personnel responsible for coastal zone management and environmental impact analysis are drawn mainly from traditional fields of physical, biological and engineering sciences. Many of them are not exposed to specialised training in problems of coastal marine waters, natural and man made hazards and marine policy issues which are of major concern in most developing countries.

In November 1999 with the active support of IOC, the Indian Institute of Technology, Delhi organized a comprehensive training programme on Integrated Coastal Management (MAMCOMP), to train manpower in the problems of coastal marine environment, coastal hazards as well as integrated coastal management. It was attended by 20 participants from India, representing 17 Faculties. MAMCOMP is meant for scientists/engineers, research workers, and policy makers/managers of the government/non-governmental agencies who are involved in the issues related to coastal marine problems.

IOC together with NOAA, USAID, and University of Rhode Island co-sponsored the International Training Workshop on the Role of Stakeholders in Marine Protected Areas and Integrated Coastal Management (24-26 July, San Diego), just prior the Coastal Zone '99 Conference. The workshop focused on how to consider the role of Marine Protected Areas (MPA) in Integrated Coastal Management (ICM) with an emphasis on stakeholder involvement. The Workshop was attended by 120 participants from 50 countries. The workshop report is being published by IOC. A similar initiative is being considered for the year 2001.

***Table 2**. ICAM meetings and training courses in brief*

Type of Meeting	*Nbr. of attendants*	*Nbr. of Countries*	*Region*	*Budget US$*
Meetings				
IOC-SOA Workshop on Coastal Megacities Hangzhou, China, 27-30 September	60	20	Global	50.000 from EX
Oceans 21 f^{t} Steering Committee, Paris, France, 20 May	8	7	Global	6.000 from RP
MAMCOMP, Delhi, India, 15-26 November	20	2	India	15.000 from EX
IOC-SIDA-FLANDERS on Data and Information for Integrated Coastal Area Management, Cape Town, South Africa, 13-15 December	25	8	East Africa	20.000 from RP
Travel Grants				
Coastal Zone 99 (26-30 July) and Training workshop on the Role of Stakeholders, San Diego, USA, 24-26 July	700 (10 sponsored participants by IOC)	70	Global (Africa, Brazil, Caribbean)	15.000 from EX
WIOMSA Training Workshop for ICAM Practitioners, 1-13 March	20	7	East Africa	10.000 from EX
LOICZ Open Science, Bahia Blanca, Argentina 15-18 November	170 (5 sponsored participants by IOC)	60	Global	12.000 from EX

1.4 Marine Pollution Research and Monitoring

Global Investigation of the Pollution in the Marine Environment (GIPME)

Restructuring GIPME. Further action on the restructuring of GIPME was deferred until late 1999 waiting for input from UNEP after its internal reorganization. Accordingly, the restructuring process has now been resumed with a revised GIPME framework being prepared by March 31st, 2000. This will be followed, subject to the agreement and participation of the Co-sponsoring Agencies, by a GESAG meeting to complete revisions to the framework for GIPME that will subsequently be presented to the 21st IOC Assembly (July 2001).

GIPME and the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). Through GIPME, IOC continued in 1999 to contribute to the GESAMP activities, most particularly to the activities of the GESAMP Working Group on Marine Environmental Assessments (MEA) [See Section 6.1.]

Rapid Assessment of Marine Pollution (RAMP). One of the tasks of the GIPME, in relation to the implementation of the GOOS Health of the Ocean (HOTO) Module, is to assist in development of methods for rapid assessment of anthropogenic stresses in the marine environment through techniques that are simple to use, robust and inexpensive, while providing a basis for prioritising among sites so that the limited resources available can be used most efficiently and effectively.

A RAMP pilot project was launched successfully in Brazil during 97-98. This activity was followed in 1999 by a RAMP Regional Training Course held at the Centro de Investigacion en Ciencias del Mar y Limnologia (CIMAR), University of Costa Rica (September). A video of the course is available at the BBSR website (http://www.bbsr.edu/). It is planned to follow

the RAMP Costa Rica Training Workshop with a series of activities in the year 2000 that are expected to lead to the implementation of a RAMP network for the entire Caribbean.

The sediment Quality Guidelines (SQG) Project. The SQG Project is being carried out jointly by the IOC, UNEP and IMO under the auspices of GIPME. The second GIPME Sediment Quality Guidelines Workshop held at IMO Headquarters (London, October) concluded that numerical sediment quality criteria are not achievable for general (i.e., large-scale or global) application and that the applicability of single numerical values as surrogates for sediment quality is limited. It further noted that the scientific basis for assessing sediment quality incorporates biological and chemical as well as physical considerations. Therefore, while currently there are no chemical measurements that can be used to reliably predict sediment toxicity, it was possible to outline procedures for identifying cases in which sediment quality did justify management concern. The report of the workshop contains a screening mechanism to discriminate between sediments of little environmental management concern and those warranting more detailed consideration in the context of marine environmental damage and threat.

Indicators of Ocean and Human Health. One of the issues addressed by GIPME in 1999 was the increasing risk to human health posed by the anthropogenic mobilization of artificial and natural toxic agents in the environment. These associations between the ocean and human health are important to design and implementation of the GOOS HOTO module.

The IOC and the National Institutes of Environmental Health Sciences jointly sponsored a meeting that was hosted by the International Center of Ocean and Human Health at the Bermuda Biological Station for Research, (16-19 October 1999). A diverse group of experts, including physicians, public health officers, marine and environmental scientists reviewed the current state-of-the-art science regarding the use of indicators to link environmental changes, their effects on marine organisms and, ultimately, their effects on human health. The research gaps in the use of indicators of ocean and human health and ways of establishing collaboration between national and international governmental and private sectors were identified. The group determined that the main variables of interest are POPs (DDT, PCBs), metals (e.g., methyl mercury, cadmium), algal toxins, cholera and other pathogens, pharmaceuticals and possibly genetically modified organisms. Another major international meeting, to develop this programme outline further, is planned during the next 18 months.

Indicators for Assessing Health in the Marine Benthos. A new initiative has been incorporated into the GIPME Programme during 1999 to develop indicators for assessing the condition (or "health") of marine benthic communities in support of HOTO. The goal of this initiative is to develop indicators that are:

- reliable in their ability to detect stress;
- powerful in their ability to discriminate between anthropogenic versus natural sources of stress;
- easy to use; and
- broadly applicable to different marine areas.

An initial planning meeting with a small group of experts was held to identify approaches and milestones for this new initiative (Paris, 6-9 December 1999). A preliminary list of potential indicators was developed at the meeting and the group agreed to examine initially relationships between organic carbon content in sediments and simple infaunal community variables that might serve as useful indicators. A second meeting of the group took place in the first quarter of 2000, to review a joint working paper to be published in the scientific literature, and to plan further steps in the planning of this initiative.

GIPME and MED POL. Two new projects initiated in 1999 as part of the continuing cooperation between IOC and UNEP in the context of the MED POL Programme studied long-term variability at lower trophic levels in the Northern Levantine basin in relation to the influence of anthropogenic forcing and the indicators for benthic communities in the Ionian and Aegean seas. In addition, IOC participated in the meetings of MED POL National Co-ordinators, MAP National Focal Points and the Contracting Parties to the Barcelona Convention during 1999. The MED POL National Coordinators meeting held in Calabria, Italy, 20-23 June 1999, decided that, starting in the year 2000, the MED POL research component will be restructured to address emerging issues relating to pollution to be identified by a group of experts and carried out by Mediterranean research institutes.

Table 3. *GIPME meetings and training courses in brief*

Title	***Place & Dates***	***Nbr. of Attendants***	***Nbr. of Countries***	***Budget***	***US$***
ICES-IMO-IOC Study Group on Ballast Water and sediment	Wales, UK, 11-13 April	12	8	RP	3,000
GESAMP/MEA	London, UK, 23-26 August	18	13	RP	
Costa Rica Workshop	San José, Costa Rica 20-24 Sept.	34	12	RP EX	46,000
Sediment Quality Guidelines	London, UK, 11-15 October	11	12	RP	8,000
Indicators for Ocean and Human Health	Bermuda, 16-19 Nov.	33	9	RP	10,000
Indicators for Benthic Health	Paris, France, 6-9 December	5	5	RP	10,000
Marine Debris 4th Workshop	Abidjan, Côte d'Ivoire, 19-21 April	20	6	EX	4,000
Marine Debris Public Awareness Campaign	Accra, Ghana, 29 Sept.- 2 Oct.	40	6	EX	15,000

Ocean Services 2

OVERVIEW by Ben Searle [1]

The year 1999 has been one of consolidation for the IODE programme. The planned activities such as training courses have proceeded smoothly and effectively, supporting a growing need for knowledge of marine data management processes. The on-going programmes such as the Joint IODE/JCOMM Global Temperature and Salinity Profile Programme continue to make valuable contributions to international marine data management and exchange activities and indicate the truly cooperative nature of the IODE business.

With the close of the millennium, IODE has begun to think of the future in a rapidly changing world. We are faced with massive changes in technologies for both the collection and management of marine data. We are faced with the growing national and international realization of the significance of the oceans and its importance to our social, economic and environmental well-being. The issues we are now required to address are greater than the resources of one country or one programme can resolve. There is an increasing recognition of the interdependence of all aspects of the environment and as a consequence, the increasing interdependence of the intergovernmental and global scientific programmes working on environmental issues.

IODE must face the next decade with a view to improving its ability to manage and exchange data but within a context of cooperation and collaboration with a wider range of partner organizations. To this end, the IODE community needs to look carefully at its role, its strengths and weaknesses and look towards forging linkages with the increasing number of programmes relevant to marine data exchange and management.

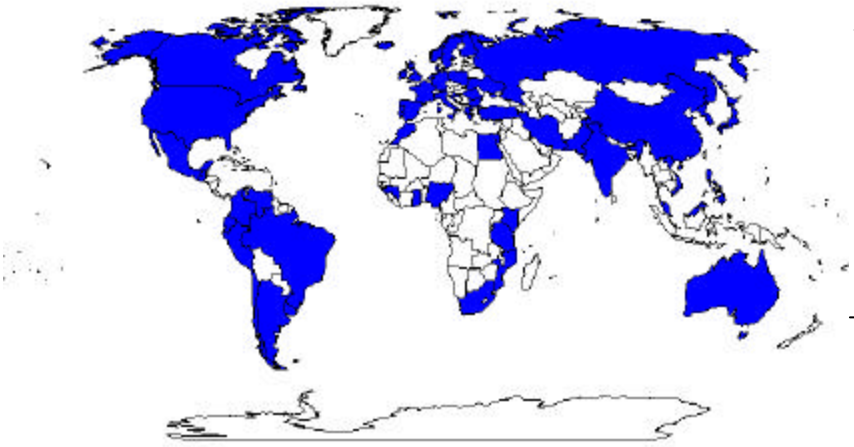
The activities of IODE fall into a small but vital niche area and the IODE programmes need to reflect this. In addition to the development of cooperative activities IODE needs to play a role in the creation of standards and protocols for data management and exchange within the age of the Internet. This is a testing challenge, but the 'corporate knowledge' of the IODE members provides an excellent basis for this effort. The approach taken in the development of the IODE Resource Kit and its future potential together with the innovation in the field of metadata by the MEDI Pilot Project provide a solid platform for future efforts in the information technology field.

The IODE community can be proud of its past achievements but must now demonstrate its flexibility to adapt to new paradigms resulting from increasing awareness of ocean issues and the rapid changes in technologies used to collect and manage data, generate information, create knowledge and understanding. IODE needs to take the lead in the development of a marine data and information technology framework to support the broad community's future needs.

[1] Chair of the International Oceanographic Data and Information Exchange programme.

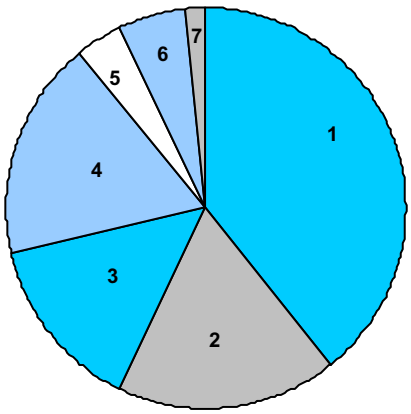
2.1 International Oceanographic Data and Information Exchange (IODE)

The IODE System was established in 1961 to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products. A detailed description of the IODE rules of procedure is given in the IOC/ICSU Manual on IODE *(IOC Manuals and Guides No. 9, Revised edition, 1991).* The IODE system forms a worldwide service-oriented network consisting of DNAs (Designated National Agencies), NODCs (National Oceanographic Data Centres), RNODCs (Responsible National Oceanographic Data Centres) and WDCs (World Data Centres – Oceanography).



In 1999, Mauritius joined the IODE System, bringing the total number of DNAs and NODCs to 57. IODE operates a number of programmes and projects such as GTSPP, GODAR, MIM, OceanPC/IODE ResourceKit, IODE website, MEDI Pilot Project, GLODIR.

Figure 1. IODE Data Centres around the World. Countries marked in dark have established a DNA or NODC.



1. Europe	22/33
2. Asia	10/30
3. S-America	8/9
4. N-America	2/2
5. C-America	3/16
6. Africa	10/32
7. Australia & Pacific Isl.	1/5
Total…....57/127	

Figure 2. IODE Data Centres/Member States distribution

The IODE System gives worldwide access to literally millions of measurements and observations. Many more are added each year. The largest data banks are available in the World Data Centres (WDC-A, USA; WDC-B1, Russian Federation; WDC-D, China). Users can approach the data centres of the IODE System with requests for data and/or information or advice regarding data or information management. The data and services are provided either in exchange or at a cost not to exceed that of processing and shipping. Increasingly the data centres provide their data and information services on-line over the World Wide Web.

IODE homepage: http://ioc.unesco.org/iode

Global Oceanographic Data Archaeology and Rescue Project (GODAR). The First Phase of the Global Oceanographic Data Archeology and Rescue Project (GODAR) culminated with the organization of the International GODAR Review Conference which took place in Silver Spring, MD, USA from 12 to 15 July 1999. Several countries have declassified naval data, which has made an important contribution to the historical ocean profile archives. The World Ocean Atlas 1998 series were published by US NODC/WDC-A, containing products based on WOD98. This series includes objectively analyzed fields of temperature, salinity, nutrients and chlorophyll. Statistics of standard level values for climatological compositing periods (seasons and months) are presented for both one-degree and five-degree gridboxes. The series include more than 41,000 color figures (GIF images) which are available on CD-ROM and online via the US NODC/WDC-A home page http://www.nodc.noaa.gov

A number of regional activities have been initiated and shaped during 1999 in Africa, IOCARIBE, the Mediterranean and Black Sea Regions.

MEDAR/MEDATLAS-2: Mediterranean Data Archaeology and Rescue, & Mediterranean Atlas

The first meeting of the MEDAR / MEDATLAS programme partners was held at the Institut Oceanographique in Paris on March 22-24, 1999. Following this first organizational meeting, two workshops on data quality control, assessment, and formatting procedures were held; one in Brest, France, 22 November – 3 December, for the Western and Central Mediterranean region, and one in Athens, Greece, 29 November – 10 December, for the Black Sea and Eastern Mediterranean region. The result of the workshops was the agreement on common quality control procedures and standard formats. A number of value-added data products are already available on the MEDAR / MEDATLAS web-site:
http://www.ifremer.fr/sismer/program/medatlas/gb/gb_medat.htm#table_matiere
http://www.ifremer.fr:582/sismer/program/medar/
http://ioc.unesco.org/medar

OceanPC / IODE Resource Kit. A second, more comprehensive version of the 'IODE Resource Kit', has been prepared in 1999. The kit is now composed of 2 CD-ROMs: Part I: Training module; Part II: Data module. Whereas Part I will be a standard module, Part II will be customized by region. The Kit was demonstrated during the ODINEA 99 Workshop and participants were given the opportunity to test-run the product. During the year 2000 the Kit will be finalized and distributed to the IODE National Coordinators for comments and suggestions, prior to submission to the IODE-XVI. Session in Lisbon in October 2000.

Marine Information Management (MIM). The 6th Session of the IODE Group of Experts on Marine Information Management was held from 31 May to 3 June 1999 in Silver Spring, Maryland, USA. The Group identified 4 major lines of action for the period 1999-2002:

- development of information centres and/or regional information networks, building on the RECOSCIX model;
- development of training tools and products;
- support for skills training and education; and
- products and services, such as GLODIR, IDALIC and other directories; IOC Publications catalogue; info-bases; development of integrated data and information products; identification of Integrated Library Management system (ILMS), with special attention to developing countries.

This report is available in the IOC e-Library's 'Report of Meetings of Experts and Equivalent Bodies', http://ioc.unesco.org/iocweb/IOCpub/elibexp.htm

MEDI Pilot Project. The Marine Environmental Data Information Referral Service Pilot Project, a meta-database development tool, was reviewed by the Group of experts on MIM and modifications were made accordingly. The tool was provided to data centres in the IOCINCWIO region within the framework of the ODINEA project.

Global Directory of Marine (and Freshwater) Professionals (GLODIR). 1999 was a most successful year for GLODIR. Entries in the database more than doubled from 4593 in December 1998 to 10426 in December 1999. This was mainly due to the cooperation of dedicated GLODIR input centres. GLODIR now has input centres for the Black Sea region, the IOCEA region, the IOCINCWIO region, the IOCARIBE region, the WESTPAC region, Chile, China, Spain, Greece, India, Norway, Saudi Arabia. The 'IOC Science and Communication Centre on Harmful Algae' provides GLODIR with records from its HABDIR expert database http://ioc.unesco.org/habdir

Additionally arrangements have been made with NOAA, MBNMS, and Hopkins Marine Station (USA). GLODIR has received recognition by various service providers in the web as a leading source of information on marine science human resources. Due to this success, the GLODIR database is being considered by other organizations of the UN-system (FAO in particular) to be used in their own developments. GLODIR can be accessed through URL http://ioc.unesco.org/glodir

EURASLIC and IAMSLIC Directories of Aquatic Science Libraries and Information Centres.. The EURASLIC and IAMSLIC directories continued to be hosted by the IOC. During the 1999 IAMSLIC Conference (Woods Hole, MA, USA) the success of the EURASLIC Directory was acknowledged and it was decided by IAMSLIC to actively publicize the Directory among the Membership. The EURASLIC Directory can be accessed through http://ioc.unesco.org/euraslic The IAMSLIC Directory can be accessed through http://ioc.unesco.org/iamslic

UN Ocean Atlas: a partnership. The UN Atlas of the Oceans is a digital, CD-ROM and web-based interactive information tool focusing on policy-oriented issues and the sustainable use of the ocean resources. The project is being implemented in the context of ACC-SOCA by a core group of UN Agencies (FAO, UNESCO/IOC, IMO, UNEP, UNDP, IAEA, and WMO) under the coordination of FAO, and in collaboration with prominent academic organizations and research institutions. The Atlas is to be built from existing documents available from programmes of the UN Agencies and participating organizations, and will be regularly updated in cooperation with a private publisher. A meeting of the partner organizations was held in London in August 1999 to discuss policy issues to be included in the Atlas. The first meeting of the technical staff from the six UN core agencies was held in Rome in December 1999 to discuss the information and policy contributions of each agency. At both meetings, the IOC staff were represented and contributed to discussions. IOC will be contributing to Atlas articles and information on Large Marine Ecosystems; Oil, Gas and Mineral Resources; Pollution; Ocean CO_2 sinks and sources; Harmful Algal Blooms; Storm Surges and Tsunamis; Coastal Area Management.

The Regional Approach

In Africa and the Indian Ocean, support to data centres was continued through the ODINEA and RECOSCIX-WIO projects within the framework of the Ocean Data and Information Network for Africa (ODINAFRICA) project, with support from the Government of Flanders (Belgium), SAREC of Sida and UNESCO/IOC.

The North and Central Indian Ocean. The main thrust of ODINAFRICA-I in the Western Indian Ocean region in 1999 was aimed at the further strengthening of the National Oceanographic Data Centres (or Designated National Agencies). We are pleased to report that, out of the seven cooperating countries, six have now established a data centre: (1) Kenya; (2) Mauritius; (3) Mozambique; (4) Seychelles; (5) South Africa; and (6) Tanzania. Madagascar is expected to establish its Centre in the year 2000. Thanks to the continued support from SIDA/SAREC and the Government of Flanders, substantial support could be provided for the further development of data management capacity in the IOCINCWIO region through the ODINEA project. The main achievements in 1999 can be summarized as follows: (i)

Updating of equipment; (ii) Provision of operational support for data centres; (iii) Internship support; (iv) ODINEA '99 Workshop; (v) 'Data for ICAM' workshop; (vi) Continued support for Internet access; (vii) Participation in International GODAR conference; (viii) Development of ODINEA Resource Kit.

A series of workshops was organized in 1999 to develop capacity building and to set to up priorities to answer future needs in the region:

- IOC-LUC-KMFRI Workshop on *RECOSCIX-WIO in the year 2000 and beyond* was held between 12 and 17 April in Mombasa, Kenya, co-sponsored by SAREC of Sida and hosted by the Kenya Marine and Fisheries Research Institute. Recognizing that the next phase of the project should strongly address the agenda of sustainability, future activities must be tailored into a transition phase that would entail the development of a regional information and data exchange network utilizing mainly the Internet. The participants recommended that ways should be explored to either develop a freshwater component of the project, or formally incorporate freshwater into the project. Support was furthermore provided for subscriptions to scientific journals, subscriptions to the ASFA database, participation in the IAMSLIC conference, and for the operation of the RECOSCIX-WIO Regional Dispatch Centre (RDC) in Mombasa, Kenya. A training course for librarians was held together to the workshop.
- The third regional workshop on Ocean Data Management for the IOCINCWIO region was held at the Marine and Coastal Management department (former Sea Fisheries Research Institute) in Cape Town, South Africa from 29 November to 10 December. The objectives of the workshop, were (i) review the progress made in development of NODCs and DNAs in the IOCINCWIO region, (ii) provide in-depth data management training, and (iii) develop workplans for ODINEA for the year 2000.
- For any data or information management facility, especially in developing countries, it is essential that the data and information services and products serve the needs of the target users. As Integrated Coastal Zone Management (ICZM) has quickly become a core component of national development programmes, the ODINEA and IOC/ICAM programmes decided to jointly organize the *'Workshop on Ocean Data and Information for Integrated Coastal Area Management*', Cape town, South Africa (13 - 15 December), to help NODC's to adapt to this new demand.

The Central Eastern Atlantic Region. Support to the RECOSCIX-CEA project of which the Regional Dispatch Centre is based at the Centre de Recherches Océanologiques, Abidjan, Côte d'Ivoire, has continued in 1999. Computer equipment, as well as support for document delivery in the region was provided. Additional support was also provided for the development of the CEADIR (Central Eastern Atlantic Directory of Marine Professionals), which was merged with the GLODIR.

The Western Pacific. The International Conference on the International Oceanographic Data and Information Exchange in the Western Pacific (IODE-WESTPAC –1999) took place in the Pelangi Beach Resort, Langkawi, Malaysia from 1 to 4 November, with the financial support of Japan, Malaysia and the IOC. The objective of the Conference was to bring together scientists and data managers to discuss the new challenges facing the IODE system in the region and to identify measures for increasing the effectiveness of the System. The Conference brought together more than 200 participants.

The Central and South American Region. Responding to the need for training on the management and exchange of oceanographic data and information, a course for the Spanish-speaking countries of Central and South America ('Taller Regional de la COI para la Gestion de Datos Marinos y Costeros en Latinoamerica y el Caribe') was held on 20 - 29 September, 1999, at the Fundacion Universidad de Rio Grande, Rio Grande do Sul, Brasil. In the course

participated 15 trainees from 8 countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, and Uruguay.

2.2 International Tsunami Warning System (ITSU) and other IDNDR-related Activities

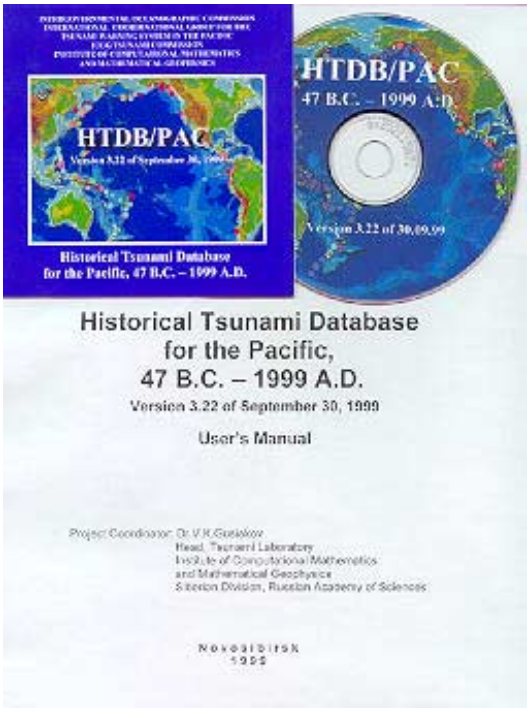
Tsunamis are a threat to life and property to all coastal residents living near the ocean. Since the establishment of the Tsunami Warning System in the Pacific, dozens of destructive tsunamis took place in the Pacific and its adjacent seas resulting in significant casualties and/or property damage. Only since 1992, major local tsunamis have claimed more than 4,200 lives and caused billions of dollars in property damage. The IOC efforts in natural disaster warnings are based on the principle of disaster prevention through utilizing modern technology in collecting seismological and hydrological data and disseminating it rapidly to the most remote places, increasing public awareness and managing potential risks.

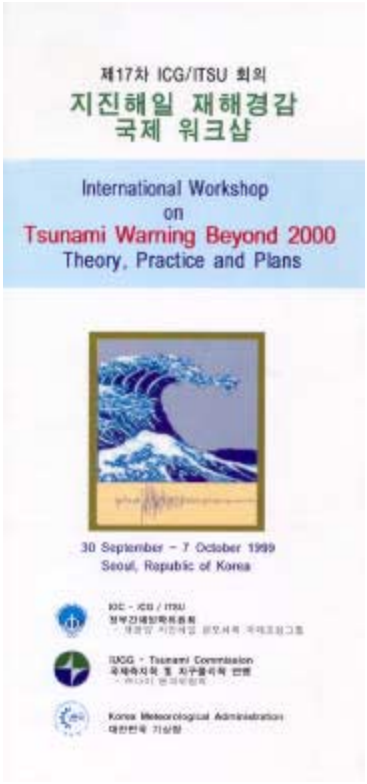
The International Decade for Natural Disaster Reduction came to an end in December 1999. The Decade was successful in achieving substantial progress in natural disaster reduction at all levels. IOC made contributed to this success through demonstrating to a wide range of audiences its experience with the tsunami warning system programme and formulating jointly with WMO and IHP of UNESCO, a project proposal on storm surge disaster reduction for the northern part of the Indian Ocean.

The Seventeenth Session of the ICG/ITSU took place in Seoul, Republic of Korea from the 4 to the 7 of October. The development of a real-time, deep ocean tsunami detector is almost complete in the United States. Four systems were deployed in 1999 and data return rates are in excess of 90%. The concept of this system was adopted by ITSU-XVII and it is planned to consider a project proposal for the Pacific wide tsunami detection system in 2001. One of the main achievements of the ICG/ITSU in 1999 was the publication of the TWS Master Plan, designed as a long-term guide for improvement of the TWS based on the analysis of existing components of the system. In addressing the technological innovations and progress in tsunami modelling, the plan is targeted for the benefit of the Member States, as it helps to identify ways for further improvement of national systems and extension of collaboration amongst Member States.

There was in 1999 a further expansion of TREMORS (Tsunami Risk Evaluation through Seismic Moment from a Real-time System) with the installation of two new stations, one in the Republic of Korea and one in Peru. The TREMORS software has been adapted to the IRIS real-time format with the cooperation of France, USA (PTWC) and IRIS, on the basis of the 1999 upgrade of the IRIS format. Within the framework of the Rapid Focal Mechanism Determination (RDFU) some interesting and promising results have been achieved with large and moderate earthquakes of several and different tectonic areas in the Pacific and Mediterranean regions.

Jointly with the IUGG Tsunami Commission, a meeting was organized on digital bathymetry from the 23 to the 30 of July in Birmingham, UK, in conjunction with the IUGG General Assembly and a workshop on Tsunami Observation, Modelling and Hazard Reduction in Seoul, 30 September - 2 October. ⇒





The **HTDB/PAC** is an interactive PC-based database management system developed in Russia intended for visualization and handling of historical tsunami data for the Pacific region. The list of basic functions of the system is extensive and includes among others, construction of a raster and/or vector background maps, search and retrieval seismic and tsunami data, calculation of statistical characterization of run-ups of heights and tsunami intensity, and also procedures for processing of seismic and tsunami data, calculation of distance and azimuth between two geographical points and some others parameters.

The milestone in thestorm surge project development was the organization in October in New Delhi, India of a joint IOC-WMO-UNESCO meeting with the participation of 8 Member States of the northern part of the Indian Ocean, 4 international organizations and other regional bodies. The participants discussed at length the mechanism for implementation of the regional project and approved and undersigned the plan of action. They identified a pre-project manager and requested Member States and regional organizations to identify focal points for the project coordination. The next step will be negotiation with funding agencies in order to find support for the project.

2.2 Ocean Mapping

The main goal of the Ocean Mapping Programme (OMP) is to cover the world ocean with bathymetric and geological/geophysical charts in order to provide decision-makers, scientists and a wide range of users with information about bottom relief and geological parameters of the open part of the World Ocean and in exclusive economical zones. OMP products provide a useful framework for many IOC programmes.

General Bathymetric Chart of the Oceans (GEBCO). The main GEBCO activities during 1999 were centred around the constitution of a 2.5-minute grid to be introduced with the Third Release of the CD ROM *GEBCO Digital Atlas (GDA)* in the Fall of 2000. Additionally, work continued on numerous bathymetric compilations, notably in the Indian Ocean. Many geographical names of undersea features were approved by the Sub-Committee on Undersea Feature Names (SCUFN). Plans were laid for the GEBCO Centenary Conference to be held in 2003.

International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series (IBCM). The 8th Session of the IOC Editorial Board for IBCM took place in Kaliningrad (Russia) from 1 to 4 September on board R/V *Vitiaz*. The colour proof of the magnetic anomalies map - the last in the Geological/Geophysical Series - was presented and approved by the Editorial Board. The explanatory volumes for all maps are planned to be achieved in 2001

International Bathymetric Chart of the Western Indian Ocean (IBCWIO). Sheets 04 and 07 were printed in 1999 in the German Hydrographic Office and made available to users. Sheet 19 will be printed in the beginning of 2000 as well as the colour proof for Sheets 06 and 09. This material will be presented to the 5th Session of the IOC Editorial Board for IBCWIO, which is planned to be hosted by the Meteorological Service of Mauritius in July 2000.

International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA). Sheets 1.04 and 1.09 have been printed in paper. Sheets 1.01, 1.02, 1.03, 1.08, 1.15, 1.16 and 1.17 have been digitized and printed in CD-ROM; all of them are now available for users. The 8th Session of the IOC Editorial Board for the IBCCA, combined with training in bathymetry, is planned to take place in November 2000 in Boulder, Colorado, USA.

International Bathymetric Chart of the Arctic Ocean (IBCAO). The 2nd Meeting of the IOC Editorial Board for IBCAO took place in Monaco in November 1999. The available data sets and the various compilations were re-assessed, and future activities considered. During 1999, a bathymetric grid had been established. In addition a new map "Bottom Relief of the Arctic Ocean" was published by the Russian Head Department of Navigation and Oceanography (HDNO), in cooperation with VNIIOCEANGEOLOGIA (VNIIO).

International Bathymetric Chart for the Central Eastern Atlantic (IBCEA). Sheet 8: was published in June 1999. Digitized curves will be communicated to the British Oceanographic Data Centre (BODC) for inclusion into the GEBCO Digital Atlas (GDA).

International Bathymetric Chart for the Western Pacific (IBCWP). The IBCWP database, data catalogue, standardization and data quality control have been established. All countries submitted their data catalogues to the Chief Editor, who transmitted them to the GEBCO Permanent Secretariat. SOPAC proposed IOC to publish jointly a map entitled "Bathymetry map of the Pacific Region" in cooperation with SIDA. It will be available for users at the end of 2000.

Operational Observing Systems 3

OVERVIEW
by Colin Summerhayes and Ralph Rayner[1]

Over the next 20 years, safe and sustainable navigation, the exploitation of marine resources and the safeguarding of both local and global marine environments will increasingly depend upon a greatly enhanced capacity to understand and forecast seas and oceans on time-scales that permit relevant and effective management decision making. This capacity will be met through the growth of the new field of operational oceanography, which will provide operationally useful information about the present state of the sea, and about its future states for as far ahead as possible, for a wide range of users and customers. Operational observations are required to be systematic, routine, cost-effective, high quality, sustained for the long term, available in a timely manner, and relevant to users' needs.

Operational oceanography has developed to meet needs expressed by the end-user community. Much of it is carried out in the public sector. In addition, an oceanographic and marine meteorological services sector is growing to meet any of the needs of the offshore and coastal industries and other users for environmental information affecting efficiency, safety, and environmental health. Observing systems are growing. Rates of capture of data from both satellites and *in situ* instruments are rapidly increasing. Value is being added to these data by storing, retrieving, managing and manipulating them digitally to derive products tailored to the needs of different customers including policy makers.

At the global level, meeting the increasing demand for operational oceanographic information will require coordinated efforts for systematic observations of the oceans, which will be met through the agency of the Global Ocean Observing System (GOOS).

End uses and users

The user community is rather broad, because ocean data are essential not only for offshore and coastal activities, but also to underpin weather and climate forecasts used by people on land, eg to plan supplies of water, food and energy. In analyzing the operational oceanographic requirements of a

[1] Respectively Director of the GOOS Project Office and Member of the GOOS Steering Committee (photo).

broad community of users in several countries in Europe, the EuroGOOS Association (Fischer, J., and Flemming, N.C., Operational Oceanography: Data Requirements Survey. EuroGOOS Pub. No. 12, Southampton Oceanography Centre, UK, 59 pp.), found that there was considerable interest in the parameters below:

Main Parameters of Interest to Users of Oceanographic Data	***Broad Classes of Users and Customers***
• surface fields (e.g. of temperature, salinity, wind, currents, waves, etc.) • sea surface topography (including tides) • upper layer fields (related to the fluxes of heat, salt and fresh water transport, and to currents, eddies, jets, and fronts, etc.) • ice (including the extent and character of sea-ice, ice shelves) and • the deep ocean (including temperature, salinity, storage of heat, salt, freshwater and carbon, boundary currents, etc.) • the seabed (depth, shape and character) • the coast and shelf (coastline, stratification, river runoff, sediment transport, etc.) • biogeochemistry (chlorophyll, nutrients, oxygen, silicate, iron, pigments, pathogens, synthetic organics, artificial radionuclides, petroleum hydrocarbons, pesticides, herbicides, phytoplankton, zooplankton, etc.) • optics (transmissivity; bioluminescence, light spectrum, etc.) • Acoustics (sound transmission, acoustic scattering, ambient noise, etc.)	• Government agencies, regulators, public health, certification agencies; • Environmental management, wildlife protection, amenities, marine parks; • Operating agencies, services, safety, navigation, ports, pilotage, search, rescue; • Small companies; fish farming; trawler skippers, hotel owners, recreation managers; • Large companies, offshore oil and gas, survey companies, shipping lines, fisheries, dredging, construction; • The single user, tourist, yachtsman, surfer, fisherman, scuba diver. *(Courtesy of the Director of EuroGOOS)*

Their analyses show the kinds of products required by the surveyed users, along with the preferred accuracy, spatial resolution, vertical resolution, temporal resolution and forecast period. Relatively few users (20%) need raw data; the rest prefer it processed or in the form of forecasts. Most users focus on coastal or shelf seas rather than the open ocean. Most users prefer accuracy of 1% or less for most variables. Preferred spatial resolutions are less than 10km, with vertical resolutions less than 10m, and temporal resolutions of hours to a few days. There is a demand for forecast periods ranging from around 10 days to 20 years. This information helps improve the design of the observing system.

This work is supported by similar work elsewhere, showing that aside from traditional fisheries observations, there is considerable interest in obtaining physical data about the state and behaviour of the sea. There is also growing interest in obtaining chemical data, especially nutrients and dissolved oxygen, and biological data especially relating to primary productivity. Operational systems for physical measurements have been around for some time. Chemical and biological monitoring (except for fisheries) has developed more slowly for technological reasons, and until recently it was not possible to collect much chemical and biological data on the same time and space scales as physical data. Now certain sorts of chemical and biological data can be collected on these scales, making chemical and biological monitoring systems a reality for some parameters.

The Manager's toolkit includes operational numerical models

For both developing and developed countries alike, numerical models can add enormous amounts of information to data. The rapid advances in operational oceanography in recent years have been made possible largely through rapid increases in computer power that have made possible the development and application even at the desk top PC level of numerical ocean models that can simulate the way the ocean works and be used to forecast how it may change in response to external forcing. The

application of numerical models is now (or should be) an essential part of the toolkit of the manager of ocean or coastal zone operations. As John Woods observed in the 1999 Bruun Memorial Lecture, there is considerable scope for improving the performance of local operational oceanographic services by switching to model-based generation of products; this normally involves a redesign of the sampling strategy for observations, and may turn out to require fewer observations than were being taken originally – thus saving costs.

For example, for developing countries, in the context of sustainable coastal zone management, even where the present observing network is sparse, the combination in a numerical model of (i) historical *in situ* ocean data sets with (ii) usually readily available remotely sensed data from satellites, and (iii) usually readily available meteorological data, will produce quite a realistic synoptic representation of ocean circulation on regional or local scales. Local ocean data, meteorological data and satellite data can be assimilated into such models to provide continual updates and projections. Where the observing network is inadequate, observing system simulation experiments can be applied to a numerical model to determine what observations are most desirable and where they should be made, thus guiding the development of a cost-effective observational network capable of providing new *in situ* data to feed to the model to improve regional or local forecasts. The design of the observing array should meet the requirements of the model to provide output meaningful to the user community. All too often we find that observing arrays designed without the aid of models are measuring the right things in the wrong places. Modelling can help to rectify that.

Many coastal zone managers are now becoming much more aware that open ocean information in the form of observational data and model output is essential to provide them with the boundary conditions they need for the operation of local and regional scale numerical models of shelf seas. It is no longer sufficient to collect information just from the local (usually coastal) area of interest if accurate forecasts of waves, tides, currents and other parameters are required. Instead, local-scale models with high resolution output, on say a 0.5 km grid, must be nested within regional models, operating on say a 5-10km grid, which are in turn nested in basin scale or global models with a much coarser grid, each model providing boundary conditions for the next level down. There are several possible sources for basin-scale or global model output for local or regional managers to use.

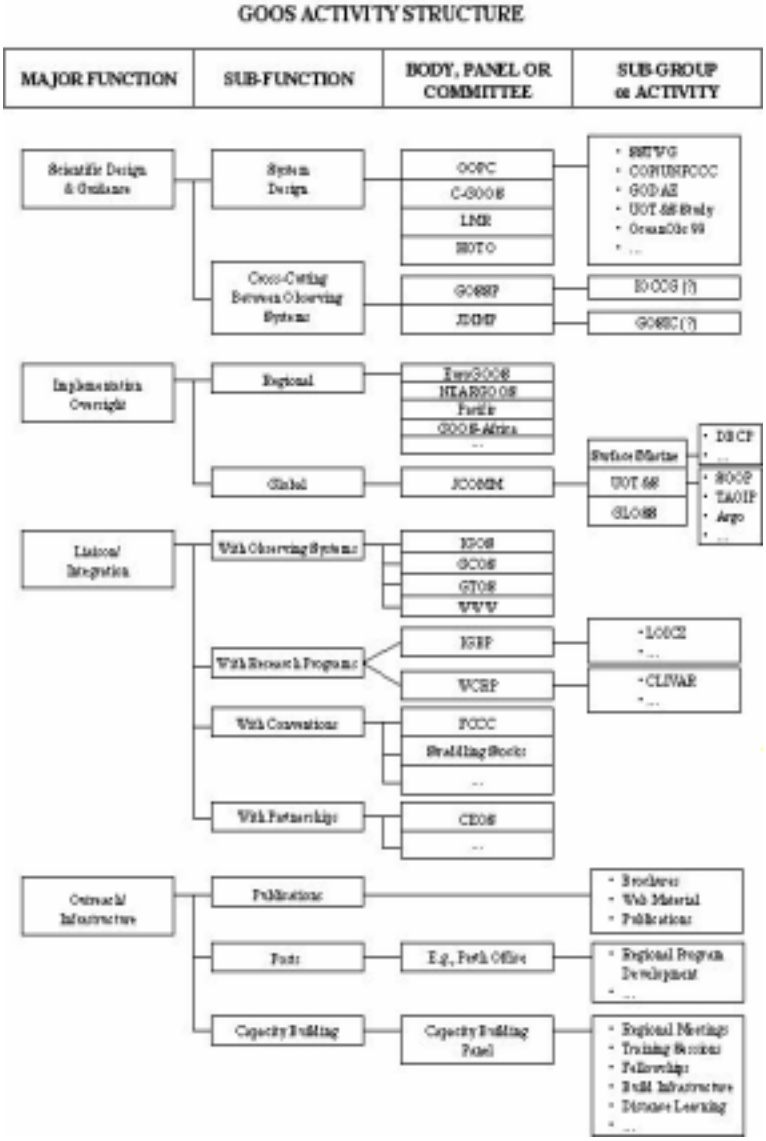
Access to data

So that maximum use can be made of publicly acquired data, to the benefit of all, widespread access will be needed to them. In any regional sea area bordered by two or more countries, neighbours have more to gain by making their data available than they do by keeping it to themselves, since the waters washing one coast today will wash another coast tomorrow. Without complete knowledge of the system, any one country's knowledge of it and forecasts of its behaviour will remain incomplete and so will be less useful to its own end-users. This principle is accepted throughout the countries that are Members of the WMO, where the motivation for exchange of meteorological data is accurate forecasts for aircraft take-off and landing. Free exchange of such data (at the cost of retrieval only) is encouraged by the WMO, through the World Weather Watch and through WMO Resolution 40. The same requirements exist for the exchange of oceanographic data, for example in support of (i) the Safety of Life At Sea (SOLAS) Convention, and (ii) the United Nations Framework Convention on Climate Change (UNFCCC), among others. Free exchange of data is required in order for the Global Ocean Observing System (GOOS), which is in a sense the marine equivalent of the World Weather Watch, to work for the benefit of all.

3.1 The Global Ocean Observing System (GOOS)

Operational oceanography is being developed at the global scale under the aegis of GOOS, which is sponsored by the IOC, WMO, UNEP and ICSU. GOOS is a response to the demands of UNCED's *Agenda 21*. It is designed to provide descriptions of the present state of the sea and its contents, and forecasts of these for as far ahead as possible, for a wide range of users, and to underpin forecasts of changes in climate. It is not solely operational, but includes work to convert research understanding into operational tools.

GOOS differs from most present observing systems (i) in having modelling and forecasting as part of its mandate, as well as the collection of data; (ii) in being holistic, integrated and interdisciplinary, rather than narrow and sectoral; and (iii) in being designed to deliver useful products for both decision makers and the scientific community.



In many respects, GOOS is like a spatially distributed large facility, and needs the same kind of international management as CERN or the ODP. If it is designed and managed well, GOOS should provide nations with the ability to convert research results into useful products to meet societal needs. One thing it will benefit from is a unified and integrated infrastructure for cost effective operations. That infrastructure is likely to be provided by the newly formed Joint WMO-IOC Technical Commission on Oceanography and Marine Meteorology (JCOMM), the operation of which is likely to change the face of oceanography over the next 10 years. JCOMM, formed by the recent merger of the WMO's Commission on Marine Meteorology WMO's Commission on Marine Meteorology (CMM) and the IOC/WMO Integrated Global Ocean Services System (IGOSS), will facilitate the collection of both marine meteorological and subsurface data through increasingly automatic systems from the same ships, the improved data gathering network and data flow leading to more efficient services.

At the time of writing, the work of advisory panels on the GOOS design was rapidly drawing to a conclusion. Finalised strategies for implementation are expected to emerge during 2000-2001.

Implementation will be incremental, and full implementation, following tests of the system through pilot projects, is expected to be achieved in the period 2010-2020. As part of the design and implementation exercise, Observing System Simulation Experiments (OSSEs) will be needed to discover what appears to be the most economical mix of observations capable of constraining models so that they yield desired products with appropriate accuracies.

At the detailed design level, it is anticipated that we will see an open ocean GOOS devoted mainly to weather climate forecasting and related issues, and a Coastal GOOS that has a much higher density of observations and addresses a wider variety of issues including pollution and living marine resources. The details of the design will vary from one area to another, depending on local concerns. For example, observational networks should be designed to take into account the variability of risk from one region to another for different kinds of natural hazards, such as hurricanes, or unusually high winds associated with storm surges.

GOOS Highlights for 1999

1. WMO and the IOC formed JCOMM (the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology), to help to implement GOOS and other marine operations.
2. The GOOS Initial Observing System (GOOS-IOS) was expanded by the inclusion of the Continuous Plankton Recorder Survey, the ICES International Bottom Trawl Survey, and selected time series stations ('S' and BRAVO).
3. Retrospective analyses published in 1999 confirmed that the first indications of the 1997-98 El Niño event appeared in subsurface data from the Tropical Atmosphere-Ocean (TAO) array of buoys in the tropical Pacific, which is part of the GOOS-IOS (Leetma et al., 1999; McPhaden et al., 1999). Reports published by Weiher (1999) indicate the benefits arising from investment in the ENSO forecasting system including the TAO buoys.
4. Further general advice on the GOOS design was published by Nowlin (1999), Nowlin et al., (1999), Woods (1997) and Woods (in press).
5. The spectacular performance of the TOPEX/POSEIDON altimeter, the vastly improved global wind fields provided by the NSCAT scatterometer, and the increased lifetimes and reliability of profiling floats forced a revisit of the original design for an observing system for ocean climate. The design was considered at an ocean observations conference, OCEANOBS99 at St Raphael, France, in October 1999. The key message for the space agencies from the Conference was the need for continuity of key observations (e.g. sea-surface height; surface winds; ocean colour; sea-ice). A gravity mission is essential to improve estimates of the geoid, so as to improve the accuracy of altimetric measurements.
6. The Conference gave high priority to deployment of profiling floats in the *Argo Project*. Over a 4-year period, *Argo* will provide some 300,000 profiles that together give full global coverage of the ocean interior for the first time. Added to satellite data from the ocean surface these profiles will underpin models of ocean behaviour and of climate.
7. The needs of Small Island Developing States (SIDS) and developing countries are addressed by the initiation of three new GOOS regional programmes: IOCARIBE-GOOS for Caribbean states; MedGOOS for Mediterranean states; and an Indian Ocean programme which is being developed through the new IOC (GOOS) Office in Perth, Western Australia.
8. Several major oceanographic institutions formed a Partnership for Observation of the Global Oceans (POGO), designed to aid in the development and implementation of GOOS.

The GOOS Initial Observing System (GOOS-IOS). As mentioned in the 1998 Annual Report, there is now a GOOS Initial Observing System (GOOS-IOS) uniting the main global observing sub-systems supported by the IOC, WMO and in the case of coral reefs, the IUCN. IOS includes measurements from ships, buoys, coastal stations and satellites. In addition to these international elements, as of July 1999 many nations are now contributing substantial parts of their national observing systems to GOOS. The GOOS-IOS is the nucleus on which GOOS will grow in the future. The managers of most of these systems, including a representative of the IOC's International Data and Information Exchange programme (IODE) are working through JCOMM to make the GOOS-IOS efficient and cost-effective. During 1999

Figure 1. A regional GOOS Office was formally opened in Perth, Australia on 16-17 September 1999. Here Dr. Patricio Bernal, Assistant Director-General of UNESCO and IOC Executive Secretary with Dr. John Zillman (right), Director of the Australian Bureau of Meteorology, one of the partners in this initiative.

three new elements were added to the GOOS-IOS: (i) plankton data from the Continuous Plankton Recorder (CPR) Survey, managed by the Sir Alastair Hardy Foundation for Ocean Science; (ii) time series data from time series stations 'S' (Bermuda) and Bravo (Labrador Sea); and (iii) physical, chemical and biological data from the International Bottom Trawl Survey (ITBS) of the North Sea, managed by ICES (International Council for the Exploration of the Sea).

GOOS Pilot Projects. Pilot projects are being developed to take forward aspects of the GOOS design. The main GOOS pilot project is GODAE, the Global Ocean Data Assimilation Experiment. Its key objectives, as re-designed this year are:

- To apply state-of-the-art ocean models and assimilation methods for short-range open-ocean forecasts, for obtaining boundary conditions, to extend predictability of coastal and regional subsystems, and for initial conditions of climate forecast models.
- To provide global ocean analyses and re-analyses for developing improved understanding of the oceans, improved assessments of the predictability of ocean systems, and as a basis for improving the design and effectiveness of the global ocean observing system.

There has been good progress with national initiatives. The US will establish a server dedicated to GODAE data at the Fleet Numerical Meteorological and Oceanographic Center (FNMOC) in Monterey, California. This is a significant and important commitment. It will include high real-time capacity, distributed data handling capability, holdings of GTS and other data with a residency time of at least 30 days.

To feed the requirements of GODAE, a global net of upper ocean temperature and salinity data is needed for integration with the global net of surface ocean data provided by remote sensing from satellites. To provide global coverage of upper ocean temperature and salinity, the GOOS/GODAE community is planning the *Argo Pilot Project*, which will seed the ocean with 3000 profiling floats that will rise from about 2000m to the surface every 14 days, each one collecting 100 CTD profiles over a 4-year period. At maximum capacity *Argo* should provide 300,000 profiles that together give full global coverage of the ocean interior for the first time. Added to satellite data from the ocean surface these profiles will underpin models of ocean behaviour and of climate.

The GODAE Science Team (GST) is developing a strategic plan. Implementation plans conforming to the GODAE strategy document will be prepared for separate projects (e.g. *Argo*) by the project steering Panels. Special consideration will be given in the plan to enabling developing countries to contribute to GODAE. For example, while developed countries may provide the majority of the floats for *Argo*, developing countries may best be in a position to deploy them in regions of their interest. They may also be best able to provide logistics and maintenance for components of the GODAE observing network, benefiting from access to the data streams and synthesis products that will be generated and.from becoming acquainted with the new technologies involved in these activities.

Another major GOOS pilot project is PIRATA (Pilot Research Moored Array in the Tropical Atlantic), which extends the tropical Pacific TAO array to monitor ocean and atmospheric variables and upper ocean thermal structure at key locations in the tropical Atlantic region. PIRATA data, in real-time will improve understanding of ocean-atmosphere processes, so leading to improved climate prediction for Africa, Europe and South America. It is intended that once past the research phase, PIRATA should become a permanent operational programme (end 2000 - beginning 2001).

GOOS Services and Products Bulletin, and GOOS Newsletter. At the GOOS Steering Committee meeting in Beijing (April 26-29, 1999) it was decided to establish a GOOS Service and Products Bulletin to provide regular and continuous information on the range of products and services associated with GOOS, and to illustrate the point that GOOS is about the development and operation of an *end-to-end data and information system.*

The bulletin will be produced primarily on the Internet, updated monthly, with print issues every 6 months. It will contain highlights of products from existing GOOS programmes (IGOSS, GLOSS, TAO, DBCP), GOOS pilot programmes (PIRATA, Argo, GODAE), regional GOOS programmes, and international monitoring programmes relevant to GOOS. The bulletin will be managed by an Advisory Board, which will set criteria of quality assurance, documentation standards, and data availability standards for all products.

GOOS Regional and National Programmes[3]

GOOS is also being planned and implemented at the regional level. Several newly created GOOS regional bodies are expected to increase their capabilities and implement operational activities during the next 5-10 years, thus helping the further development of GOOS. In many respects these regional programmes, with their focus largely on coastal seas, are already implementing aspects of Coastal GOOS, as well as elements of the GOOS-IOS, like GLOSS and the GCRMN.

Small Island Developing States (SIDS). The interests of SIDS are being taken care through the development of four main GOOS regional projects. They include: PacificGOOS, covering S.W. Pacific island states; MedGOOS for Mediterranean island states; IOCARIBE-GOOS for Caribbean island states; and WIOMAP (Western Indian Ocean Marine Applications Project). In addition through a newly created IOC/GOOS Office in Perth, Western Australia, we are beginning to spin up an Indian Ocean programme, which will help Indian Ocean island states. A PacificGOOS meeting, initially proposed for 1999, will now take place in Rarotonga in 2000. A MedGOOS meeting took place in Rabat, Morocco, in November. Although we have not yet obtained funds to start WIOMAP, an Indian Ocean GOOS planning meeting involving many regional representatives took place in Perth in September. A Caribbean meeting, at which IOCARIBE-GOOS was formed, took place in Costa Rica in April with a follow-up in November.

Africa and the Mediterranean. Top priorities for the GOOS-AFRICA Coordinating Committee continue to be:

- encourage the formation of an Africa-wide network of national ocean data centres that are properly equipped and staffed by trained personnel;
- upgrade and expand the present African network of stations for the measurement of tides and sea levels so as to provide warnings on potentially hazardous and costly changes in the local marine environment - such as sea level rise;
- create a network of specialists trained in the use of data acquired by remote sensing from space satellites so that coastal managers have ready access to the rapidly increasing wealth of spatial data on the coastal environment;
- facilitate the further implementation of modern electronic communication systems such as Internet connections and data transfer mechanisms so as to promote effective communication and availability of information for coastal planning.

MedGOOS provides a link between EuroGOOS and GOOS-AFRICA, some Mediterranean countries belonging to both EuroGOOS and MedGOOS, and some African countries belonging to both MedGOOS and GOOS-AFRICA. During November 1999, the GOOS-AFRICA Committee co-sponsored a MedGOOS workshop in Rabat, Morocco, essentially on behalf of all the North African countries. The workshop, on 'The Benefits of Implementation of the Global Ocean Observing System in the Mediterranean, MedGOOS', was attended by members of all Mediterranean countries but one. The outcome of the workshop will be a set of proposals for different donor agencies, including the European Commission and the funders of the post-PACSICOM African Process. At the meeting several countries signed the MedGOOS Memorandum of Understanding and worked in the development of the MedGOOS Strategy.

[3] As for the North-east Asia region, see WESTPAC section.

Europe. The second EuroGOOS Conference, attended by over 300 people, was held in Rome, Italy, in March 1999; the proceedings will be published by Elsevier. Key reports were published on Operational Data Requirements and on Technology, the latter outlining the areas of instrumentation and the development of instrument platforms deemed most valuable in the near future. Most EuroGOOS documents are now available on the website. Significant operational developments are taking place in the six EuroGOOS sub-regions: the Mediterranean, the Arctic, the Baltic, the northwest shelf, the Black Sea and the wider Atlantic.

North Atlantic Region. A new Coordinating Committee for GOOS has been established jointly between the IOC and ICES (International Council for the Exploration of the Sea). The goal of this Committee is to build on ICES activities and databases in the region, by exploring the development of GOOS pilot projects, specially in the area of marine living resources and ecosystems.

Commitments Meeting. In July, 22 countries attended the Initial GOOS Commitments Meeting in Paris, and committed substantial parts of their present national observing systems to GOOS. As the latest details of the GOOS designs emerge over the next 18 months, we anticipate that national agencies will adapt their observing systems and data exchange practices to meet the emerging GOOS requirements, so as to make GOOS work as intended. Continued implementation of GOOS at the national level is essential to facilitate GOOS development.

Coastal GOOS (C-GOOS)

C-GOOS meetings are being held in different regions, primarily in developing countries. In 1999 the panel held meetings in Accra, Ghana (April) and Tianjin, China (November). Each included a one-day Stakeholders' Workshop to promote user input to the planning process and to determine capacity building needs.

The design strategy being developed by the C-GOOS panel is converging on two components:

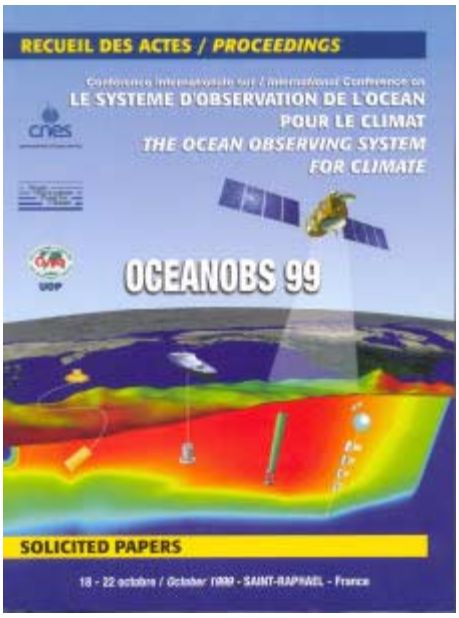
- a global network to document the global dimensions of local to regional patterns of change in coastal waters and to provide the large scale perspective required to distinguish between locally generated patterns and those generated by regional-global scale forcings; and
- area networks (pilot projects) that incorporate selected index sites where high intensity observations provide the basis for understanding the causes & effects of environmental variability and for the development of models required to translate data into useful visualisations & predictions.

The core elements of the global network will include: (i) Remote sensing (winds from scatterometers, sea surface height from altimeters, surface temperature from AVHRR sensors and ocean color); (ii) *In situ* measurements (an enhanced sea-level measuring network, enhanced arrays of instrumented moorings and fixed platforms, drifters, voluntary observing ships/ferries for monitoring critical sections, and observations from autonomous or remotely operated vehicles; (iii) Coastal Ocean Watch - a flexible observing network for making basic *in situ* measurements in the near-shore zone. (Coastal laboratories, schools, NGOs can be networked into the COW-module to monitor environmental conditions in the coastal zone; *"Community measuring kit"*); and (iv) a data management system.

The pilot projects are being developed to test C-GOOS concepts or demonstrate how the C-GOOS design works. These include for instance: (i) south-east Pacific coastal oceanography in relation to far-field forcing; (ii) a hazard warning system for the south-west Atlantic coast; (iii) an environmental pollution and forecasting project in the Adriatic; (iv) a harmful algae bloom monitoring network; and (v) a storm surge modelling project in NE Asia.

Observations for Climate

An ocean observing system for climate is being developed by the Ocean Observations Panel for Climate (OOPC), which is jointly sponsored by the WCRP and GCOS. The latest advice on what is required for implementing a physical observing system in support of climate monitoring and forecasting for GOOS and GCOS was published on the GOOS Web Site as "Global Physical Ocean Observations for GOOS/GCOS: an Action Plan for Existing Bodies and Mechanisms".



During 1999 the OOPC focused on preparing for the first international Conference on the Ocean Observing System for Climate (**OCEANOBS'99**), which was convened jointly with the CLIVAR Upper Ocean Panel (UOP) in St Raphaël, France from October 18-22, 1999. The Conference was a success; it enjoyed 21 sponsors and was well attended by key officials and senior scientists in positions to promote the implementation of the ocean observing system for climate. Some 340 individuals representing 20 countries participated. The Conference outcome generated the encouragement looked for by those who have worked long hours over many years to move the concept of a global climate ocean observing system climate closer to reality. The results also demonstrated that the close interaction and cooperation between the OOPC and the UOP was critically important in leading to an observing system design for the upper ocean that satisfies the needs of both the operational and the research communities.

In terms of *in-situ* observations, the Conference gave high priority to maintenance of the ENSO observing network. It noted that coverage of sea surface temperature by ships of opportunity and drifting buoys is poor in some locations and must be rectified. Higher quality is needed, as well as a broader suite of measurements, to better determine surface fluxes. The emphasis should shift from broad-scale areal sampling to collecting higher resolution surface and upper ocean data with higher frequency along selected SOOP lines. The Argo Project was endorsed as an effective strategy for global sampling of temperature and salinity in the upper ocean. Repeat sampling along selected hydrographic lines was endorsed to complement the more frequent sampling of systems like Argo and SOOP. Fixed location time series measurements at a selected number of stations would help to provide long time-series and resolve complex interactions. Surface wind data should be collected by dedicated surface moorings.

For the future, *'drivers'* for OOPC activities now fit into into 4 themes:

- ENSO and related seasonal-to-interannual prediction;
- climate change, including elements of the carbon cycle and sea-ice;
- short-range ocean (and marine) prediction and fields for meteorology; and
- general requirements for the climate database and climatologies.

The elements of a strategy that has developed for responding to these plans/design are:

- seek effective implementation mechanisms (e.g. through JCOMM);
- establish integrating *'frontier'* pilot projects (e.g. GODAE and Argo described in GOOS Pilot Projects section above);
- gain wider interest and involvement (e.g. through continuing interaction with the UNFCCC);
- encourage partnerships, and build consensus (e.g. cooperation with CLIVAR UOP, and the Partnership for Observation of the Global Ocean, POGO).

Living Marine Resources GOOS (LMR-GOOS)

LMR GOOS intends to provide information that:

- describes changes in ecosystems over time, including fluctuations in abundance and spatial distribution of species;
- helps interpret observed changes in relation to such factors as natural environmental variability, anthropogenic climate change (including increased UV radiation), predation/disease, and fishing activities; and
- contributes to forecasting future states of marine ecosystems.

The LMR GOOS panel met twice in 1999, in Montpellier, France, and Talcahuano, Chile, to make progress in developing a strategic design plan to achieve these ends. One first step in developing the design was to use retrospective experiments to test whether existing monitoring systems have been effective at forecasting and detecting major ecosystem changes. In 1999 panelists conducted retrospective studies for the Black Sea, the Baltic Sea, the northwest Pacific, and the coastal upwelling system off California and Mexico. Particular attention was given to such an experiment on the eastern Scotian Shelf where major changes in cod stocks occurred. In addition, as a contribution to the retrospective experiments, the 1999 PICES Annual Meeting in Vladivostok convened a symposium on the nature and impacts of North Pacific Climate Regime shifts in which the 1976-77 regime shift was analyzed.

Five programmes were recommended for inclusion in the GOOS-IOS:

- the SAHFOS Continuous Plankton Recorder (CPR) survey;
- the ICES International Bottom Trawl Survey;
- the California Cooperative Oceanic Fisheries Investigations (CalCOFI);
- Southern Ocean monitoring in connection with the Convention for the Conservation of Antarctic Marine Living Resources (CCAMLR); and
- Finland's Alg@line program.

Other programmes for possible inclusion in IOS are (1) Line P - Station P, (2) EcoFISH, (3) ECNASAP, and the Japan and Korea observing systems. Pilot projects include a North Pacific CPR Network, and a project on Biological Action Centers (BACs) in the eastern North Pacific.

Global Sea Level Observing System (GLOSS)

The Global Sea Level Observing System (GLOSS) is an international programme coordinated by the IOC for the establishment of high quality global and regional sea-level networks for application to climate, oceanographic and coastal sea level research. GLOSS is an integral component of GOOS.

The IOC Group of Experts on GLOSS, chaired by Philip Woodworth of the Proudman Oceanographic Laboratory, UK, held its sixth meeting from May 10-14, 1999 in Toulouse, France. In connection with the meeting, two workshops were held:

- Ocean Circulation Science derived from the Atlantic, Indian and Arctic Sea Level Networks, which will result in an IOC Workshop Report; and
- GPS at tide gauge benchmarks for long-term sea-level change studies for altimeter calibration, which will result in an *'IOC Manual 3'* on how to operate GPS near to tide gauges).

Two thirds of the 287 GLOSS Core Network stations appear to be operational. Eighty-five GLOSS stations report to the WOCE 'Fast Delivery/Real-time' Data Acquisition Center in Hawaii, with data usually available within one to two months of data collection. There is a growing need for real-time data, for model data assimilation or altimeter calibration, but also

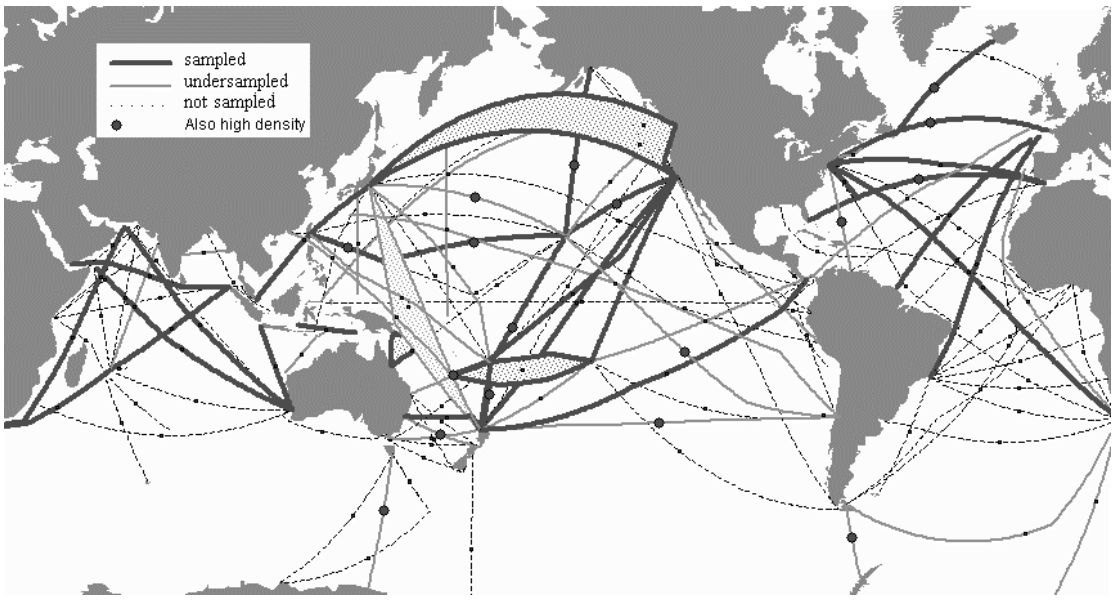
for more efficient data gathering and quality control. Special efforts will be made to get all authorities to go 'real-time' in the near future.

A training course on 'Sea-level measurements and analysis' was held at the Instituto Oceanografico da University of Sao Paulo, Brazil from August 30 - September 25, 1999, organized by Professor Affranio de Mesquitta and his staff. Participants from 8 countries in Africa and South America were represented.

Ship-of-Opportunity Programme (SOOP)

The SOOP, originally a product of IGOSS, and now to be managed by JCOMM, is now an integral part of the GOOS Initial Observing System (IOS). Information about SOOP is available on the new SOOP Web site http://www.brest.ird.fr/soopip

Some 14000 XBT profiles were made during the first six months of 1999 by SOOP operators from Australia, France, Germany, India, Japan, and USA, including about 8500 profiles in the Pacific Ocean, 3200 in the Indian Ocean, and 2300 in the Atlantic Ocean. The Equatorial and North Atlantic Ocean is well covered while the South Atlantic is under-sampled. The Indian Ocean is adequately sampled except in the south. The Pacific Ocean is relatively well sampled, except in the south. And the Southern Ocean is under-sampled. To optimise XBT deployments, SOOP operators are considering upper ocean thermal data requirements, available resources, and other sources of data, and coordinating their efforts.



To assist the development of the implementation plan, an Upper Ocean Thermal Review was conducted and a dedicated workshop held in Melbourne in August 1999, under the sponsorship of the NOAA Office of Global Programmes and the Australian Bureau of Meteorology. A paper summarising the contributions and results from the workshop and entitled *"The role of XBT sampling in the ocean thermal network"*, was presented at the OCEANOBS99 conference in Saint Raphaël, October 1999.

The programme would gradually withdraw from areal sampling while the *Argo* float programme is implemented, and would at the same time ramp up its effort in line (transect) sampling. The line sampling would include intermediate resolution, frequently repeated lines, and high-density, quarterly repeated lines. This change in approach enhances complementarity with existing elements, particularly the TAO buoy array and altimetry data, and seeks optimum complementarity for the system envisaged for the future. The new design will address several important scientific goals, both for GOOS and CLIVAR. It will make unique contributions in terms of *in situ* eddy-resolving data sets and in terms of the repeated lines.

During 1999 a comprehensive users guide for thermo-salinograph installation and maintenance aboard ship was prepared and published by IRD (France) in Nouméa. Copies of the guide can be obtained from IRD in Nouméa or can be downloaded from the SOOP website.

Since June 1999, SOOP has been served by a Coordinator, Mr. Etienne Charpentier, who also serves as technical coordinator of the Data Buoy Cooperation Panel (DBCP). Based on input from SOOP operators and data users, the Coordinator evaluates available global programme resources and real-time data flow, and, to some extent, data quality, and provides SOOP operators with information enabling them to improve coordination and overall network efficiency.

Data Buoy Cooperation Panel (DBCP)

The Data Buoy Cooperation Panel was jointly established in 1985 by WMO and IOC. It is served by a full-time Technical Coordinator funded through voluntary contributions by Member States of IOC and of WMO. In future, DBCP will report to JCOMM. The new reporting procedures necessitate some minor changes to the DBCP's Terms of Reference, which will be submitted to the forthcoming sessions of the Executive Councils of IOC and WMO for formal approval.

The panel's fifteenth session (Wellington, 26-29 October), highlighted several items for 1999. They noted that acts of vandalism had seriously damaged several deep water buoys, and asked WMO to write to the International Hydrographic Organization (IHO) requesting the promulgation of navigational warnings regarding the presence of data buoys and value of the buoy data to the safety of mariners.

In May, with assistance from the Technical Coordinator, Collecte-Localisation-Satellite (CLS)/Service Argos opened a DBCP Internet forum http://www-dbcp.cls.fr to facilitate debate on technical issues and to exchange information among buoy operators or actors. The forum presently includes themes such as Argos (technical questions, Joint Tariff Agreement (JTA) information, etc.), DBCP (QC, buoy technology, etc.), Global Telecommunication System (GTS) of WMO (formats, QC, technical questions, problems, etc.). It also includes 'sub-forums' for the work of smaller community teams: evaluation of Surface Velocity Programme buoy equipped with a barometer and a wind sensor (SVPBW)/Minimet (access reserved to the SVPBW evaluation group), DBCP (reserved to DBCP members), and European Group on Ocean Stations (EGOS, reserved to members).

At the XIXth meeting of the Argos Joint Tariff Agreement (JTA, Wellington, 1-3 November), the main topics for discussion were to: (i) assess and review the operation of the new basic principles adopted by JTA-XVII for the 1998 and 1999 JTAs at least; and (ii) devise a mechanism to overcome the financial constraints faced by the participants on the one hand and CLS/Service Argos on the other.

Integrated Global Ocean Observing Strategy (IGOS)

It is easy to see that the range of observations needed to understand and monitor Earth processes, and to assess human impacts, cannot be satisfied by any single programme, agency or country, and hence that international cooperation is essential to provide these observations. Effective monitoring of our planet on the global scale requires cooperation on that scale. Recognising this requirement, in 1998 IOC and GOOS became part of an Integrated Global Observing Strategy (IGOS) involving the agencies responsible for the major space-based and *in situ* systems for global observations of the Earth. IGOS provides an integrated framework enabling better observations to be derived in a more cost-effective and more timely fashion by building on the strategies of existing international global observing programmes.

The IGOS Partnership comprise the offices of the three UN-sponsored global observing systems: the Global Ocean Observing System (GOOS), the Global Climate Observing System (GCOS), and the Global Terrestrial Observing System (GTOS), along with their sponsoring agencies (WMO, UNEP, UNESCO, FAO, ICSU and the IOC), plus the space agencies represented by the Committee on Earth Observation Satellites, along with the World Climate Research Programme (WCRP), the International Geosphere-Biosphere Programme (IGBP), and the International Group of Funding Agencies for Global Change Research (IGFA).

3.2 The Global Climate Observing System (GCOS)

Operating under the revised Memorandum of Understanding signed by IOC of UNESCO, WMO (the lead agency), UNEP and ICSU in 1998, the Global Climate Observing System (GCOS) has undergone substantial changes during 1999. Dr. Kirk Dawson became Chairman of the GCOS Steering Committee and Dr. Alan Thomas was appointed Director, GCOS Secretariat in mid 1999.

GCOS continues to take the lead in the Global Observing System Space Panel (GOSSP), whose functions are: to facilitate communication from the global observing system users to the space agencies, as represented through the Committee on Earth Observing Satellites (CEOS); to establish clear and transparent needs and goals for space based data; to identify major issues for action; and to build on and improve the existing CEOS/WMO database of requirements and capabilities. Major oceanic data issues relate to the measurements of sea surface height, vector winds, sea surface temperature, color and salinity. Under the Joint Data and Information Management Panel (J-DIMP), GOOS, GCOS and the Global Terrestrial Observing System (GTOS) co-sponsor the Global Observing System Information Centre (GOSIC) that is providing a framework for assessing the available global climate data sets.

The fifth session of the UNFCCC Conference of Parties (COP5) met in Bonn during fall 1999 and approved two decisions (4/CP5 on National Communications and 5/CP5 on Research and Systematic Observation) that significantly expanded on the milestone decisions of COP4. On behalf of the GOOS and the other global observing systems for climate, GCOS had submitted, through the UNFCCC Secretariat, Guidance for Reporting by the Parties on Systematic Observations, which was adopted as the official UNFCCC Reporting Guidelines on Global Climate Observing Systems. In addition based in large part on additional input from GCOS, COP5 invited All Parties to submit a detailed national report on systematic observation, in accordance with these UNFCCC Guidelines. This report is voluntary for non-Annex I Parties. UNFCCC COP5 also requested:

- *The GCOS Secretariat, in consultation with relevant regional and international bodies, including the Global Environment Facility[4], to organize regional workshops to identify the capacity building needs of developing countries.*
- *Parties to address deficiencies in the climate observing networks and in consultation with the GCOS Secretariat, to bring forward proposals and to identify needs and funding for developing countries to enable them to collect, exchange and utilize data. GCOS had submitted data on the availability of routine ocean data from Météo France and the limitations in coverage of the global oceans.*
- *GCOS Secretariat to facilitate an intergovernmental process to identify priorities for action on global observing systems for climate and options for financial support.*
- *GCOS Secretariat to assist the Convention Secretariat in developing a process to synthesize and analyze the national reports in accordance with the UNFCCC reporting guidelines.*

[4] Decision 14/ CP.4 decided that the GEF should assist developing countries to "build capacity for participation in systematic observational networks to reduce scientific uncertainties relating to the causes, effects, magnitude and timing of climate change".

List of GOOS Donors on 1999		
NOAA for Coastal GOOS UK Met Office for GODAE ICSU for GOOS in general NERC for GLOSS WMO for GOOS in general FAO for LMR NOAA for LMR (via Texas A&M)	NOW for Coastal GOOS and GOOS Capacity Building NOAA for GLOSS (indirect) NOAA for GODAE NOAA for GOOS in general France for GLOSS and PIRATA	SIDA for IOCARIBE-GOOS ONR for MedGOOS IOI for MedGOOS WMO for MedGOOS IFREMER for MedGOOS OGS for MedGOOS UK Met Office for MedGOOS

***Table 2**. Meetings and training courses in brief*

Title	*Place & dates*	*Title*	*Place & dates*
JGOFS CO_2 Panel and Symposium	Tsukuba, Japan, 16-22 January	GOOS Commitments Meeting	Paris, France 5-6 July
GCOS JSTC	Geneva, Switzerland 9-12 February	GODAR Meeting	Washington, New Zealand 11-15 July
INFO Coast 99	Nordwigkerhout, Netherlands 10-14 February	JCOMM First Transition Meeting	St Petersburg, Russian Fed. 19-23 July
Explanatory Meeting for a Partnership for Observation of the Global Oceans (POGO)	Paris, France 8-10 March	IGOS Forum session at UNISPACE-III Conference	Vienna, Austria 21 July
VOS (WMO) Meeting	Athens, Greece 8-12 March	GOSSP Meeting	Pasadena, USA 5-6 August
Organizational meeting for the OceanObs99 Conference	St-Raphaël, France 11-12 March	IOC-WMO-CPPS Joint Working Group on the Investigations on «El Niño»	Concepcion, Chile 9-13 August
2nd EuroGOOS Conference	Rome, Italy 11-13 March	GLOSS Training Course	Sao Paulo, Brazil 30 August-20 September
MedGOOS Planning Meeting	Rome, Italy 11-13 March	East Indian and West Pacific Observation Systems	Perth. Australia 16-17 September
WCRP JSC Meeting	Kiel, Germany 15-20 March	RAMP Training Workshop	San José, Costa Rica 20-24 September
Scoping meeting on high-seas marine protected areas	Montpellier, France March 20	Workshop on Operational Oceanographic Products & Services	Bergen, Norway 28-29 September
LMR Panel-II	Montpellier, France March 22-26	4th Session of the Coordinating Committee for NEAR-GOOS	Tokyo, Japan 28 September - 1 October
ICES-GOOS	Bergen, Norway March 22-24	First Integrated Transboundary Coastal Area and Management Meeting	Tehran, Iran (Rep. Islamic of), 1- 6 October
GODAE-III, ARGO	Easton , USA March 22-26	8th Annual PICES Meeting	Vladivostok, Russian Fed. 6-14 October
Coastal GOOS-III	Accra, Ghana April 12-15	WOCE SSG-26	La Jolla, USA 4-8 October
Meeting on Marine Models	London, UK April 21	TAO-VIII Meeting	St Raphael, France 15-16 October
IOCARIBE Users and GOOS Workshop	San José, Costa Rica April 22-24	Ocean Climate Observations Conference	St Raphael, France 18-22 October
2nd session of the GOOS Steering Committee	Beijing, China April 26-29	COP-5	Bonn, Germany 25 October - 5 November

Title	*Place & dates*	*Title*	*Place & dates*
Earthwatch	Geneva, Switzerland 3-4 May	DBCP-XV	Wellington, New Zealand 26-29 October
PIRATA-VI	Miami, USA 3-7 May	ARGOS-JTA-XIX	Wellington, New Zealand 1-3 November
GLOBEC SSC	Yokohama, Japan 6-14 May	MedGOOS Workshop	Rabat, Morocco 1-3 November
CLIVAR SSG-8	Southampton, UK 10-14 May	Coastal GOOS -IV	Tianjin, China 2-5 November
GLOSS Workshop	Toulouse, France 10-11 May	GIPME/HOTO Indicators of Ocean and Human Health Workshop	Bermuda 16-19 November
GLOSS-VI Group of Experts	Toulouse, France 12-14 May	IOCARIBE GOOS *ad hoc* Advisory Group	Caracas, Venezuela 3-5 November
OOPC-IV / CLIVAR VOP-IV	Woods Hole, USA 17-20 May	POGO	La Jolla, USA 1-3 December
EGOS Management Committee & Sub-group meetings	Brest, France 26-28 May	EuroGOOS	Madrid, Spain 3 December
IABP Annual Meeting	Bremerhaven, Germany 2-4 June	Arctic GOOS/JCOMM	Geneva, Switzerland 6-8 December
G3OS Sponsors Meeting	Rome, Italy 6-8 June	EGOS Meetings	Paris, France 7-8 December
UK Argos Users Conference	Oban 14-15 June	LMR-III	Tacahualco, 8-11 December
I-GOOS-IV	Paris, France 23-25 June		

List of Web sites

GOOS:	http://ioc.unesco.org/goos
GCOS:	http://193.135.216.2/web/gcos/gcoshome.html
GLOSS:	http://www.pol.ac.uk/psmsl/gloss.info.html.
PSMSL:	http://www.pol.ac.uk/psmsl/psmsl.info.html
SOOP:	http://www.ifremer.fr/ird/soopip/doc/review/review.zip
DBCP:	http://dbcp.nos.noaa.gov/dbcp/
IGOSS/JCOMM Electronic Products Bulletin:	http://iri.ldeo.columbia.edu/climate/monitoring/ipb/
JCOMM:	http://ioc.unesco.org/goos/jcomm.htm)
GODAE:	http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/homepage.html
OOPC:	http://www.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/oopc.htm
Argo:	http://www.argo.ucsd.edu/
EuroGOOS:	http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/
NEAR-GOOS:	http://ioc.unesco.org/goos/neargoos.htm

Capacity Building in Marine Sciences, Services and Observations

4

OVERVIEW Research efforts have greatly increased our understanding of the ocean system in recent decades. Modelling and forecasting are playing rapidly increasing roles, complementing the largely observational nature of ocean science of the past. Society, however, is not yet fully benefiting from the results of ocean science.

Considering the major issues currently facing society it is imperative that countries build their own capabilities to make observations, analyze data, generate forecasts and communicate the results to the public, managers and policy makers. One element of any ocean governance model must be an adequate ocean observing system, built with the support of all nations. All too often, those coastal countries with the lowest capacity for marine research and technology are also the ones most vulnerable to the potential effects of climate change such as rising sea levels, to the consequences of coastal disasters and to marine pollution.

The Training, Education and Mutual Assistance, TEMA, programme is central to the overall IOC role and supports the capacity building efforts that are focused within the IOC's scientific programmes. However the IOC is not a funding agency and has limited resources. The Commission acts mainly as a link with potential donor agencies and cooperates with regional intergovernmental subsidiary bodies and with analogous mechanisms of sister organizations such as WMO, UNEP, UNDP and ICSU to build projects such as the Training-Through-Research (TTR), Floating University programme.

4.1 Training, Education and Mutual Assistance (TEMA)

During 1999 IOC contributed to the implementation of 94 TEMA activities. They were hosted in 29 Member States and included 30 specific training activities, 18 workshops and one public awareness exercise: a beach-cleanup. Thirty-six experts and students from 19 countries benefited from individual grants (24 travel grants and 12 research/study grants. More than 1000 people from 102 Member States participated in all the activities.

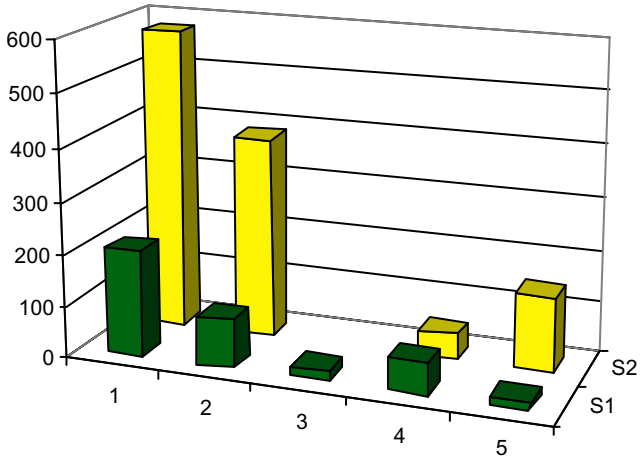


Figure 1. Activities with TEMA impact and budget (US$) implemented during 1999
S1: regular programme funds;
S2: extrabudgetary funding sources;
Numbers identify *Type of Activity* in the associated table.

	Type of activity	*Nbr.*	*Regular programme funds (S1)*	*Extra budgetary funding sources (S2)*	*Total funds*
1	Training events	30	204,336	576,955	781,291[1]
2	Other activities with TEMA component	18	93,400	385,200	478,600
3	Public awareness exercise	1	20,000		20,000
4	Grants (travel/research/study)	36	62,400	49,634	112,034
5	Contributions to operations, provision of equipment, publishing, access to scientific literature, internet access, field project coordinator work	9	15,300	143,082	158,382
	Total	94	395,436	1,154,871	1,550,307

A large number of people (scientists and students) also benefited from access to scientific literature facilities and training tools. Marine science institutions of East Africa (IOCINCWIO region) benefited with free access to Internet, ASFA (Aquatic Sciences and Fisheries Abstracts /FAO-IOC-UN/), donation of computer equipment and support for operational expenses.

[1] Note: The Training-through-Research (TTR) cruises and The Floating Baltic University cruises received direct contributions from outside the IOC budget, reaching close to a total of US$ 1,012,500. [$586.000 from diverse external sources, $16, 500 from the UNESCO Participation Programme for the TTR ; and, $380,000 for the Floating Baltic University from diverse external sources]

Funding for the IOC capacity-building programme amounted to more than $ 1,500,000 of which approximately 70% were derived from extra-budgetary sources. From this amount, 46% covered activities relating to the Ocean Science Programme, 37% to the Ocean Services section and 17% to the Operational Observing sector (GOOS). Considering the major IOC programmes individually, IODE devoted more than 33 % of their budget in activities with TEMA impact, followed by the Harmful Algal Bloom Programme (24%) and GOOS (17%).

Considering only training activities by programme OSLR/HAB implemented near 43% of them, followed by IODE (ITSU and IDNRD), 26%, and ICAM, 11%. It should be noted that the Training-through-Research (TTR) /Floating University project cruises received direct contributions from outside the IOC, amounting to more than a $ 1,000,000, and were not ranked in this comparison.

A Feasibility Study for the Implementation of a Network in Marine Science and Technology between Europe and Latin America is being carried out under the Standing Framework Agreement between UNESCO and the European Federation of Networks (FER). The first phase (implemented between 1996 and 1998) was completed (ref. IOC Workshop Reports n° 138, 139, 151) and approved by the funding agency. A second phase was financed also by the European Union. Two synthesis workshops were carried out respectively in Brasilia (Brazil) in September and Sitges (Spain) in December. The results of both activities constitute the basis for the final elaboration of a major programme proposal to be submitted to the EU for funding. In that proposal IOC is specially involved on HAB and natural dissaster issues.

4.2 Training-through-Research (TTR) Programme/Floating University

In operation since 1990, the Training-through-Research (TTR) programme combines the advantages of the formal training of students and young scientists with the experiences gained in advanced research in the field of marine geology and geophysics. Between 1991-1999, nine major TTR cruises were conducted in the Mediterranean-Black Sea Region, and in the NE Atlantic. Seven post-cruise conferences were held, in addition to a number of other field exercises, group and individual training activities, and presentation and publication of the research results through regular scientific channels.

In 1999, activities within the TTR programme started with an international conference entitled 'North-East Atlantic Slope Processes: Multi-Disciplinary Approaches', which was organized by the Southampton Oceanography Centre (UK, 24-27 January) in cooperation with IOC, IGCP[2] and ENAM[3]. The meeting brought together over 140 participants from 16 countries. Students and researchers who participated in the TTR-8 cruise (1998) reported on a number of areas of interest. Reports included studies of canyons west of Lisbon, sliding processes north of the Faeroe Islands, the northern flank of the Storegga Slide and the nearby-cemented floors associated with gas seepage. Solid gas hydrates were reported as recovered from the Haakon Mosby mud volcano (NE Atlantic).

Within the Conference, meeting of the TTR Executive Committee took place. Another meeting of the Executive Committee was held on 23 October in UNESCO, Paris. The latter discussed the main results of the TTR-9 cruise, as well as preparations for the TTR-9 post cruise conference (January 2000, Spain), finalization of the TTR-9 scientific report for publication by IOC, plans for the TTR-10 cruise in the year 2000, and strategy for publication of the TTR results.

In 1999, the TTR results were presented at over 15 national and international scientific meetings, hold in Finland, France, Georgia, Russia, UK, the Ukraine and USA.

[2] International Geological Correlation Programme (of UNESCO and the International Union of Geological Sciences of ICSU).
[3] European North Atlantic Margins of EC MAST.

Fieldwork and training activities

The TTR-9 cruise was carried out from 3 June to 27 July 1999 (St. Petersburg, Russia to Valencia, Spain). An international team of 62 scientists, post- and undergraduate students from over 20 institutions of 12 countries (Algeria, Bangladesh, Denmark, Ireland, Italy, Morocco, The Netherlands, Portugal, Russia, Spain, UK and USA) participated in it. The objectives of the cruise were to study geological processes on continental margins and to train students in marine geoscience research. The participating students were actively involved in all stages of acquisition and preliminary processing of multidisciplinary set of geophysical and geological data, working together with leading marine science specialists. A series of 29 shipboard seminars, lectures and workshops facilitated high-level on-the-job training of the students and young scientists.

Besides the IOC sponsorship, financial support for the cruise was provided by the Geological Survey of Denmark and Greenland (Denmark), Instituto Geologico e Mineiro (Portugal), Instituto Andaluz de Ciencias de la Tierra (Spain), Statoil UK, Southampton Oceanography Centre (UK) and Naval Research Laboratory (USA), this in addition to the national funding which came from Russia. Logistic support to the cruise was provided by the Netherlands Institute for Sea Research (NIOZ).

The equipment used included a big variety of modern instruments, such as: single-channel high-resolution air-gun seismic system, six-channel high-resolution sleeve-gun seismic system, OKEAN long-range side-scan sonar, hull-mounted 3.5 kHz profiler, O.R.E.tech deep-towed system containing high-resolution side-scan sonar and a 7 kHz subbottom profiler. For more detailed studies, an under-water TV-system, 6 m and 3 m gravity corers, box-corer, Kasten-corer, TV-controlled PRESSAUG grab, and dredges were used.

The programme of the expedition was divided into eight study areas located within the Faeroe Margin, Southern Rockall Trough and Irish Margin, Portuguese Margin, Gulf of Cadiz, Alboran Sea and Balearic Basin. The expedition ended up with a number of exciting research results: some highlights are given in the Annual TTR Report.

Within the TTR framework, IOC facilitated the participation of researchers and students from Georgia and Turkey in the studies of the Mediterranean Sea undertaken by The Netherlands, and a student from Russia was trained on board the RV *Belgica* (Belgium).

In 1999, two M.Sc. and one Ph.D. dissertations were successfully defended, based on the results of the TTR cruises. Nearly 50 research articles were published or submitted to international journals.

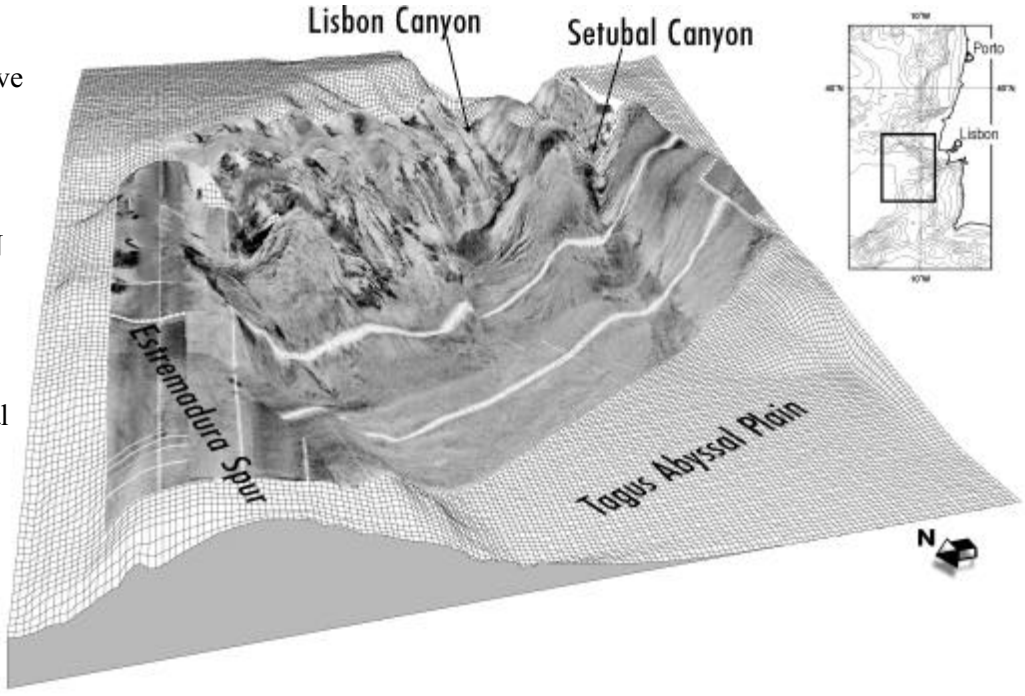


Figure 1. Perspective image of the Portuguese margin west of Portugal covered with TTR-8 and TTR-9 OKEAN long-range side scan survey.
Note the prominent high backscattering bottom of the Setubal canyon suggesting active sediment transport far to the Tagus abyssal plain.

5 Regional Activities

OVERVIEW

IOC regional subsidiary bodies were established to ensure that IOC activities take into account the specific interests and needs of the Member States in each region. These intergovernmental bodies meet every 3-4 years and identify specific workplans relevant to the Member States within a regional framework. The IOC has two types of regional subsidiary bodies:

Regional Sub-commissions:

"…are intergovernmental subsidiary bodies of the Commission, responsible for the promotion, development and coordination of the Commission's marine scientific research programmes, the ocean services, and related activities including TEMA, in their respective region…

Secretariat support for a regional sub-commission shall be provided by the IOC Secretariat (headquarter staff and staff outposted in the region), and by Member states…" (IOC Manual, Part I)

Regional Committees:

"…are intergovernmental subsidiary bodies of the Commission, responsible for the coordination and supervision of the scientific and service activities of the Commission at the regional level…" (IOC Manual, Part I)

The IOC has established the following regional subsidiary bodies:

IOC Sub-commission for the Caribbean and Adjacent Regions (IOCARIBE)

The Secretariat is based in Cartagena, Colombia
Head of the Office R. Steer-Ruiz
IOCARIBE Officers
Chairman Dr. Bradford Brown, USA
Vice-Chairmen Lic. Marco Polo Bernal, Mexico
Dr. Leonard Nurse, Barbados
Dr. José Vargas, Costa Rica
Most recent session
IOCARIBE-VI, San José, Costa Rica
26-29 April 1999

IOC Sub-commission for the Western Pacific (WESTPAC)

The Secretariat is based in Bangkok, Thailand
Head of the Office S. Mitsumoto.
Officer: M.Kuipjer
WESTPAC Officers
Chairman Dr. Keisuke Taira, Japan
Vice-Chairmen Prof. M. Hungspreugs, Thailand
Dr. H. Tack Huh, Rep. of Korea
Most recent session
WESTPAC-IV, Seoul, Rep. of Korea
22-26 March 1999

IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean (IOCINCWIO)

IOCINCWIO Officers
Chairman Dr. E. Okemwa, Kenya
Vice-chairman Dr. Jean Maharavo, Madagascar
Most recent session
IOCINCWIO-IV, Monbasa, Kenya
6-10 May 1997

IOC Regional Committee for the Central Eastern Atlantic (IOCEA)

IOCEA Officers
Chairman Dr. Ndiaga Gueye, Senegal
Vice-Chairman Dr. J. Wellens-Mensah, Ghana
Most recent session
IOCEA-IV, Las Palmas, Gran Canaria, Spain
8-12 May 1995

IOC Regional Committee for the Southern Ocean (IOCSOC)

IOCSOC Officers
Chairman Dr. M. Tilzer, Germany
Vice-Chairmen (replaced by Advisory Group:)
Mr. C. D. Carbone, Argentina
Dr. J. Chrurcj, Australia
Dr. A. Klepikov, Russian Fed.
Dr. E. Lindstrom, USA
Dr. J. Priddle, United Kingdom
Most recent session
IOCSOC-VI, Bremerhaven, Germany
9-13 September 1996

IOC Regional Committee for the central Indian Ocean (IOCINDIO)

IOCINDIO Officers
Chairman Dr. Muthunayagam, India
Vice-Chairman Dr. H. Zommorrodian, I.R. Iran
Most recent session
IOCINDIO-II, Goa, India
20-22 November 1996

IOC Black Sea Regional Committee (BSRG)

BSRG Officers
Chairman Prof. Valery Eremeev, Ukraine
Vice-Chairman Mr. Hüseyin Yüce, Turkey
Most recent session
BSRG-II, Istanbul, Turkey
5-6 May 1999

Additional to the Regional Subsidiary Bodies, the IOC has specific programmes in some other regions:

South East Pacific in coordination with the CPPS
South West Atlantic
Mediterranean Sea
Persian Gulf, Red Sea and Gulf of Aden

Although most regional activities are reported under the "programme" sections above, particular attention is given this year on activities of the IOC Sub-commission for the Western Pacific (WESTPAC), the IOC Regional Committee for the Central Indian Ocean (IOCINDIO), and to the Black Sea and Mediterranean regions.

5.1 IOC Sub-commission for the Western Pacific (WESTPAC)

The Fourth Session of the IOC/WESTPAC Sub-Commission, held in March 1999 in Seoul, Republic of Korea, marked the completion of the last intersessional period. During the session, the Sub-commission reviewed the implementation of the previous work-plan and elaborated a new work-plan that will guide the Regional Secretariat. The session endorsed some eight recommendations that subsequently received statutory approval at the Twentieth Assembly of IOC. Other notable activities carried out in the past year pertain to the International Cooperative Study of the Gulf of Thailand, Paleogeographic Mapping and the NEAR-GOOS Project. In December, the IOC External Evaluation Team visited the WESTPAC Regional Secretariat with the objective of providing an in-depth analysis of the role and functioning of the WESTPAC Sub-commission and its Secretariat. The results of the Evaluation will be reported to the DG of UNESCO in April 2000.

The Fourth Session of WESTPAC

The fourth session of WESTPAC, was held in Seoul, Republic of Korea from 22 to 26 March, and was attended by over 70 participants, including representatives from 13 Member States (Australia, China, France, Indonesia, Japan, Malaysia, Philippines, Republic of Korea, Russian Federation, Thailand, United Kingdom, United States and Vietnam), organizations and projects (CPMS-II, CREAMS-II, JECSS, PICES, SEASTART-RC, UNEP, UNU, WMO) and several observers.

The session reviewed the intersessional developments since the Third Session held in Tokyo, February 1996. Most of the activities identified in the prior session were successfully implemented, including the organization of the Fourth IOC/WESTPAC International Scientific Symposium, held in Okinawa, February 1998.

The Sub-Commission also reviewed cooperation with other regional bodies and programmes, such as UNEP, CREAMS, UNU or WMO. Following the recommendation of the Sub-Commission, the WESTPAC Secretariat is now seeking to formalize the cooperation two such organizations, SEASTART and SEAPOL.

During the session, considerable time was devoted to a discussion of a long-term strategy plan for the Sub-Commission. A paper prepared by the Secretariat was presented to the Session that set the stage for subsequent discussions. Against a background of increasing competition for financial resources, changing perceptions of the role of marine science, and new technological and scientific developments, the long-term strategy emphasizes the need for the Sub-Commission to become more effective in order to guarantee its future role in the region.

The Sub-commission re-elected Prof. Keisuke Taira (Japan), Prof. Manuwadi Hungspreugs (Thailand), and Prof. Hyung Tack Huh (Republic of Korea) for a second term in their respective capacities as chairman and vice-chairpersons.

The Sub-Commission adopted eight Recommendations on the following items:

(i) International Cooperative Study on the Gulf of Thailand (GoT)
(ii) International Conference for the IODE-WESTPAC 1999 (ICIWP'99)
(iii) Regional Graduate School of Oceanography
(iv) Global Ocean Observing System
(v) Work Programme and Budget for 1999 - 2002
(vi) International WESTPAC Symposium tentatively to be held in 2001 in Korea
(vii) Long Term Strategy
(viii) The next Session was tentatively decided to be held in 2002 at Perth (Australia)

Ocean Science Programmes in WESTPAC

OSLR- Harmful Algal Blooms Programme. Over the past year, the project leader Dr. Yasuwo Fukuyo from Japan, has continued to provide assistance in HAB-related matters to scientists in the region especially by organizing HAB Training Courses in 1997 (twice) and in 1998. For 1999 it is planned to have a WESTPAC-HAB Workshop in conjunction with the 9th International Conference on Harmful Algal Blooms in Hobart, Australia in February 2000 ('HAB2000') that will discuss future plans for the WESTPAC-HAB programme.

International Cooperative Study of the Gulf of Thailand. A Shipboard Training Workshop on Synoptic Oceanography of the Gulf of Thailand was held from 8 - 18 August, with the participation of 10 marine scientists from the four littoral countries of the Gulf (Cambodia, Malaysia, Thailand and Vietnam) on board of the KD Perantau, kindly provided by Royal Malaysian Navy as a contribution to the project. Measurements were conducted across the whole mouth of the Gulf of Thailand covering the EEZs of Malaysia, Thailand and Vietnam.Funding from Sida/SAREC supported the project.

The cruise data subsequently formed part of a data management training that was held in October with cooperation of SEASTART-RC and Chulalongkorn University. Some 33 participants from the four countries attended the course. The course made use of the IODE Resource Kit developed under the IODE programme.

The Gulf of Thailand project further saw the initial development of an online marine data and information management system for the Gulf of Thailand. For this purpose, the IOC hired a data coordinator to assist the project leader Dr. Anond Snidvongs in the establishment of the system. The on-line data management system is now operative and hosted by SEASTART-RC.

Sida/SAREC further sponsored two research projects that address the input of pollutants from rivers into the Gulf of Thailand and adjacent waters. These research projects involved both Thai and Vietnamese scientists.

Paleogeographic Mapping. Continuing with the paleo reconstruction effort in the Westpac area, in October a workshop was held in Qingdao, China, in conjunction with the Fourth International Conference on Asian Marine Geology. The workshop participants discussed the publication of the 'Second Paleogeographic Map for the Holocene Optimum' (ca. 6,000 years ago). In addition to the six countries that attended the previous workshop in Shanghai in 1997, the working group welcomed representatives from two new countries, notably Malaysia and the Philippines. It was agreed to publish the map before the end of 2000. The working group further discussed the publication of a third map for the Last Interglacial Period (ca. 200,000 years ago). Data submitted by Vietnam and Cambodia will also be included in the Holocene Map.

Operational Observing Systems in WESTPAC

North-East Asian Regional Global Ocean Observing System (NEAR-GOOS). The Fourth Session of the Coordinating Committee of NEAR-GOOS was held in Tokyo in September. A preliminary workshop was held in conjunction with the Committee session for the first time, to discuss the progress made over the three years since this project was started. The first phase of the project was judged a success, since a substantial amount of data has been exchanged through the establishment of open local databases in the four participating countries (China, Japan, Rep. of Korea and Russian Federation).

Representatives from organizations and working groups both inside WESTPAC (GOOS, HOTO, HAB, ODC, COASTAL-GOOS, and SEA-GOOS) and outside (UNEP/NOWPAP, PICES, and the US Office of Naval Research) were invited to the workshop with the objective to discuss the possibility of cooperating with the WESTPAC project and to enhance the exchanged data both quantitatively and qualitatively.

The result of a survey on the usage of the NEAR-GOOS data by end-users, such as the research community and more applied users, was the other topic of the workshop. The participants agreed that further efforts are needed from the database managers to supply data that would meet the requirements by such end-users.

Collaboration with other Organizations

Coastal Regions and Small Island States Unit of UNESCO (CSI). The *"Andaman Sea Pilot Project"* initiated in 1997 as a joint cross-sectoral project between the UNESCO Bangkok Office, IOC/WESTPAC and the UNESCO Platform for Environment and Development in Coastal Regions and in Small Islands (UNESCO/CSI) continued in 1999. Educational materials were prepared under the project that will raise the environmental and cultural awareness of the indigenous people inhabiting the Ko Surin Marine National Park (Thailand). The project further initiated a multidisciplinary marine resource assessment study with the participation of three Thai universities.

United Nations Environment Programme (UNEP). Besides the cooperation with UNEP in the Northwestern Pacific Regional Seas Programme (NOWPAP), IOC/WESTPAC continued to participate in meetings organized by UNEP/COBSEA concerning the preparation of a GEF proposal for the South China Sea. It is anticipated that IOC will be one of the implementing agencies in the field of marine pollution under the proposed project.

Economic and Social Commission for Asia and the Pacific (ESCAP). IOC/WESTPAC attended several meetings hosted by ESCAP, such as the Interagency Sub-committee and Intergovernmental Consultative Committee on Space Application for Sustainable Development (June, Bangkok) and the Ad hoc Expert Meeting on Politics and Strategies in Sustainable Development of Land and Mineral Resources in the Asian and Pacific Region (November, Bangkok).

Scientific Committee on Oceanic Research (SCOR). IOC/WESTPAC attended the 34th Executive Committee Meeting of SCOR (Scientific Committee on Oceanic Research) in October in Goa, India. One of the initiatives discussed in this meeting was the establishment of a Graduate School on Oceanography in the Southeast Asian region.

Committee for Coordination of Joint Prospecting for Mineral Resources in Asian Offshore Areas (CCOP). WESTPAC and CCOP co-sponsored the Fourth International Conference on Asian Marine Geology (described above) in October. Subsequently, WESTPAC was invited to the 36th CCOP Session in Hanoi in the end of October. WESTPAC also attended the CCOP/COASTPLAN Dissemination Seminar and suggested further cooperation between the two organizations through this project.

Running of the WESTPAC Secretariat

Dr. John Zillman (Chairman of WMO) and Prof. John Field (Chairman of SCOR) visited the WESTPAC Secretariat in early December as members of the IOC external evaluation team with the purpose of evaluating the WESTPAC Sub-commission and its Secretariat. A discussion paper was prepared to facilitate the discussion.

The Secretariat has continued to receive the kind support from the Government of Thailand through its National Research Council and also from the UNESCO Bangkok Office.

5.2 IOC Regional Committee for the Central Indian Ocean (IOCINDIO)

A regional workshop was held in New Delhi during 20-21 October 1999 on Storm Surges. The workshop was sponsored by the IOC, WMO and the Government of India. Representatives from governments of Bangladesh, Islamic Republic of Iran, India, Maldives, Mauritius, Myanmar, Pakistan and Sri Lanka participated in the workshop. Prof. T.S. Murthy, Storm Surge expert from Canada, Prof. S.K. Dube, Dr. S.R. Shetye, Prof. U.C. Mohanty and Prof. M. Ravindran, experts from India made presentations on Storm Surge Modelling, Observational systems, Meteorological aspects, Tides and sea level measurements.

IOC and WMO convened a regional meeting on the Storm Surges Disaster Reduction in the Northern Indian Ocean at New Delhi, 22-26 October 1999. The Department of Ocean Development, Government of India and the Indian Institute of Technology, Delhi also sponsored the meeting. Representatives from governments of Bangladesh, Islamic Republic of Iran, India, Maldives, Mauritius, Myanmar, Pakistan and Sri Lanka participated. Representatives from 4 international organizations and regional bodies including one funding agency also took part in the meeting. The main purpose of the meeting was to discuss the implementation of a project proposal prepared by IOC, WMO & IHP through an international group of experts in February 1998. The regional meeting also designated a Pre-Project Manager for interacting with the international funding agencies for seeking funds for implementation of the project. The total cost of the project is US$ 45.66 million out of which US$ 11.61 million is expected as national contributions and the rest from international funding agencies.

Earlier the Chair IOCINDIO had represented IOC in the first inter-governmental meeting of Ministers on South Asian Seas Programme on 26th March 1999 at Islamabad, Pakistan. The Chairman of the committee made a brief presentation on IOC and the regional programmes, the activities of IOCINDIO having relevance to the Member States of the South Asian Seas Region, which included the ongoing initiatives for establishing a regional tide gauge network, the proposed regional tropical Cyclone and Storm Surge project and IOCINDIO regional workshops.

5.3 Black Sea

IOC activities in the Black Sea were coordinated by the Black Sea Regional Committee (BSRC). The main results were summarized at the Second Session of the Black Sea Regional Committee which took place in Istanbul from 5 to 6 May.The National Coordinators from Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine reported on their national activities towards the implementation of approved IOC Pilot-Projects PP 1 & 2 "Black Sea GOOS" and "Black Sea Fluxes" respectively. The very important issue concerning the procedures for the international oceanographic data exchange in the Black Sea region was also discussed. It was recognized that the existing IODE mechanism could be used for this purpose. It was decided that scientific results of the three international expeditions which took place within the framework of Pilot-Project n° 1 (PP-1) would be discussed during the seminar ‘Sediment fluxes and radionuclides in the Black Sea’ to be organized in cooperation with the International Atomic Energy Agency, in Istanbul, Turkey, in September 2000. The workplan for 2000-2001 has been approved. In accordance with the above-mentioned plan the workshop "Black Sea GOOS" took place in Albena resort, Bulgaria, from 11 to 15 September, where the programme and strategy plan for the implementation of Pilot-Project 1 were approved. The summary report of the workshop will be published in the year 2000 by the Bulgarian Academy of Science.

The BSRC established cooperative links with other regional programmes and their coordination units such as: PCU of GEF, PERMIS, BCEC, IAEA, WMO (HYCOS), NATO.

5.4 Mediterranean

IOC continued its efforts in 1999 towards establishing an integrated approach to the development of research, operational oceanography and services across the Mediterranean, including MedGOOS, MedGLOSS, data exchange under IODE and MED/ICAM.

A major conference on the Oceanography of the Mediterranean and the Black Seas was held in Athens, Greece (23-26 February 1999), under the co-sponsorship of IOC, EU and the Institute of Oceanography of the National Center for Marine Research, Greece. The conference was attended by more than 300 scientists and almost 100 papers were presented. The participants reviewed and analyzed the outstanding evidence that the Mediterranean and the Black Sea are experiencing natural and anthropogenic induced changes on a multitude of time-scales. They stressed that these two basins because their scale and clear semi-enclosed nature provide unique opportunities to investigate the links between anthropogenic impacts and the changes induced in their chemistry. and ecosystems. These links have both regional and global significance. Interdisciplinary, multi-purpose research framed within a system approach is essential. The approach should necessarily involve interdisciplinary data assimilative models linked to observing and data management systems that are capable of transmitting data in real, near-real and delayed mode (and a suite other services). The scientific efforts needed require cooperation at regional and global scales. The conference further identified the emerging scientific issues in the Mediterranean as well as in the Black Sea. A series of recommendations in regard to scientific issues, capacity building, data management and cooperation between the regions was adopted.

AN INTERNATIONAL CONFERENCE ON OCEANOGRAPHY OF THE EASTERN MEDITERRANEAN AND BLACK SEA

Figure 1. On 23-26 February in Athens (Greece), an international conference co-sponsored by IOC dand the European Union discussed similarities and differences of the two basins.

As part of the drive to develop a coordinated programme for the Mediterranean, all Mediterranean nations have been encouraged to draw together under the MedGOOS umbrella their interests in operational oceanography (see also 4.3.1.1 above). All Mediterranean nations, with the exception of only one, attended a MedGOOS meeting in Rabat in November 1999 to discuss the benefits of applying GOOS Principles in the Mediterranean. Most Mediterranean countries have now signed the MedGOOS Memorandum of Understanding, and through MedGOOS are now working to develop for submission to various funding agencies proposals to take forward the development of operational oceanography in the Mediterranean. Many of these countries are actively involved in the existing EuroGOOS sponsored Mediterranean Forecasting Project.

MEDAR/MEDATLAS II Project continued with IOC participation to enhance the existing data management structures in the Mediterranean and the Black Seas through job training and workshops in data quality, processing and exchange.

A conference organized by IOC was held on 25 May 1999 at the UNESCO Headquarters in Paris, in order to focus attention on the need of increasing sustainable development in the Mediterranean Basin, as regards environmental protection, increased social equity, stability and peace in this area. The conference was chaired by the ADG for the IOC and Executive Secretary, Dr. Patricio Bernal and the participants included representatives of the UNESCO Science Sector Programmes, permanent

delegations and several NGOs. Possible inter-sectorial efforts within UNESCO on Mediterranean projects were considered and the need for enhanced inter-institutional synergies and for close cooperations with UNEP and the European Commission in reinforcing integrated coastal area management in the Mediterranean Basin and associated training activities were stressed.

In pursuit of developing partnerships with authorities of the Mediterranean coastal regions active in promoting environmental protection and sustainable development, an international meeting was held between the policy makers of the France's Provence-Alpes-Côte d'Azur and the policy makers of nine Mediterranean countries (Avignon, 20-21 October 1999). The meeting discussed and agreed on the basic elements of the cooperative efforts needed and ways of reinforcing synergies between interdisciplinary marine and coastal area research the actors of socio-economic development. The meeting paid particular attention to the need for training and public awareness activities. As a first step, an advanced study course supported by the European Commission, IOC, CSI/UNESCO and University of Nice will be organized in Nice, France in September 2000.

International Cooperation

6

6.1 Cooperation with other Organizations of the United Nations System and other Bodies

ICSPRO, GESAMP and Related Matters

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). GESAMP held its 29th Session at the IMO Headquarters(London 23-26 August). Through GIPME, IOC continued to contribute to the GESAMP activities, most particularly to the GESAMP Working Group on Marine Environmental Assessments (MEA).

Two reports are being prepared by the MEA Working Group: one entitled *"The State of the Marine Environment - current major issues and emerging problems";* and a second entitled *"Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment".* Drafts of these reviews were considered during three editorial meetings (June, August and November). Both documents were sent out for peer review at the end of 1999. GESAMP adopted both reports at its session in May 2000 at the IAEA Marine Environment Laboratory.

GESAMP 29 also agreed to establish cooperative arrangements on all scientific and technical issues related to the preparation of marine environmental assessments within the *GEF GIWA Project.* GESAMP also raised, as matters of particular concern, the appearance of anoxia in coastal areas, the lack of proper environmental impact assessments in offshore oil and gas exploration activities, particularly in areas under the jurisdiction of developing countries; and the global disease burden and economic impacts of various human diseases associated with exposures to marine waters or the consumption of contaminated seafood's.

In its decision 7/1 on Oceans and Seas, the Commission on Sustainable Development at its seventh session reiterated its call for the sponsoring organizations of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) to review the Group's methods of work with a view to improving its effectiveness and inclusiveness, while maintaining its status as a source of agreed, independent scientific advice.

In response to the recommendation of CSD-7, GESAMP adjusted its terms of reference at its twenty-ninth session. An updated MOU dealing with GESAMP's operational procedures and guidelines for their implementation was prepared and sent to sponsoring agencies in September 1999 requesting their endorsement or comments. In answering this request. Dr. Klaus Tofler, Executive Director of UNEP, suggested in December 1999, that the GESAMP mechanism should undergo first an external review process. In its last meeting the group of sponsoring agencies endorsed this idea and the GESAMP Secretariat reported to the ACC-SOCA meeting on its plans for implementation of such a review.

Cooperation with ICSU and SCOR

IOC continued cooperation with ICSU, mostly through the joint sponsoring of Major Global Research Programmes, and through the participation in the World Conference on Science. Sponsored by UNESCO and ICSU. ICSU and IGBP representatives participated directly in the deliberations of the 30th General Conference of UNESCO. A one morning private working session with the Head of the IGBP, Dr. Berriam Moore III, was held in the wake of the General Conference, with all the UNESCO Environmental Science Programmes, with the purpose of identifying gaps and complementarities among the programmes run by both organizations and to define direct channels for conducting consultations.

SCOR continue to act as one of the scientific advising bodies to IOC in several specific projects reviewed in the body of this report. Special mention is reserved to the completion of the Ocean Sciences Assessment Workshop in Potsdam (October 1999) and the

preparation of the final report. SCOR also helped in the nomination of participants for the coming COASTS Workshop.

6.2 Follow-up to UNCED and UNCLOS

Follow-up to UNCED

Chapter 17 of *Agenda 21* states that '*the marine environment – including the oceans and all seas and adjacent coastal areas – forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development. International law, as reflected in the provisions of the United Nations Convention on the Law of the Sea, sets forth rights and obligations of States and provides the international basis upon which to pursue the protection and sustainable development of the marine and coastal environment and its resources. This requires new approaches to marine and coastal area management and development, at the national, subregional, regional and global levels, approaches that are integrated in content and are precautionary and anticipatory in ambit.'*

To this end, seven main programme areas of collaboration were defined:

- Integrated management and sustainable development of coastal and marine areas, including exclusive economic zones;
- Marine environmental protection;
- Sustainable use and conservation of marine living resources of the high seas;
- Sustainable use and conservation of marine living resources under national jurisdiction;
- Addressing critical uncertainties for the management of the marine environment and climate change;
- Strengthening international, including regional, cooperation and coordination
- Sustainable development of small island

There was a need within the UN system to coordinate activities aimed at implementing Chapter 17 of the *Agenda 21*. As a result, the ACC Subcommittee on Ocean and Coastal Areas, SOCA, was established in 1993 on proposal by the ACC Inter-Agency Committee on Sustainable Development (IACSD). ACC-SOCA was designated the task manager of Chapter 17 and IOC as the sub-task manager for addressing critical uncertainties for the management of the marine environment and climate change.

Follow-up to UNCLOS

Further to the decisions of the 31st Session of the Executive Council and 20th Session of the Assembly, the Secretariat ensured the follow up to UNCLOS.

Relation of IOC with the International Seabed Authority (ISBA). The IOC continued to participate as an Observer to the International Seabed Authority Assembly and Council, which exceptionally held, due to budgetary constraints, a Unique Session in 1999 (Kingston, Jamaica, 9th to 27 August).

After the 'Workshop on the development of guidelines for the assessment of the possible environmental impacts arising from exploration for deep seabed polymetallic nodules in the Area' (Sanya, China, June 1998), the results of the meeting were submitted for consideration to the ISBA's Legal and Technical Commission. GESAMP was duly informed of this issue.

The ISBA's Secretary General expressed his interest to cooperate with IOC in the field of oceanographic data exchange. To this end a first draft of a MOU was sent to ISBA for discussion and further negotiation.

The IHO/IAG/IOC Advisory Board on the Law Of the Sea (ABLOS). The ABLOS conducted a Business Meeting in Monaco on 8th September 1999 and sponsored an International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation including UNCLOS Art. 76 in Monaco on 9-10 September 1999.

The IOC Representative, Dr Ron Macnab was elected Vice-Chairman of ABLOS, with automatic accession to the Chairman's position in two years. He also served as Geoscience Editor for the revised edition of the IHB's Manual on Technical Aspects of the UNCLOS (TALOS).

Regarding the IHO/IOC multi-authored volume *Continental Shelf Limits: the Scientific and Legal Interface*, the manuscripts and digital files have now been sent to Oxford University Press for publication scheduled in October 2000. This book will serve as a tool for capacity building for those countries to planning continental shelf and EEZ surveys.

International Conference on Technical Aspects of Maritime Boundary Delineation and Delimitation, Including UNCLOS Article 76 Issues

(organized by the Advisory Board on Technical Aspects of the Law of the Sea (ABLOS), Monaco, 9-10 September 1999)

76 attendees from 29 countries were present at the Conference. In addition the International Hydrographic Bureau (IHB) personnel, members of the UN Commission on the Outer Limits of the Continental Shelf and the UN Division of Ocean Affairs and Law of the Sea participated. The sessions and papers were organized by the Conference Committee chaired by P. Vaniçek, chairman of ABLOS, and the Conference Proceedings, containing the 26 paper presented, will be produced early in 2000 by the IHB. The Conference was divided into four sessions over a span of two days.

First session: "Issues concerning the UN Commission on the Limits of the Continental Shelf", convened by Galo Carrera, topics related to the approach of the UN CLCS to submissions made by coastal states were considered in contributions presented by members of the Commission.

Second session: "Geodetic issues, with emphasis on errors in maritime boundaries and how to reduce them", convened by B.G. Harsson, dealt with specifically geodetic problems of delineation and delimitation of maritime boundaries.

Third session: "Tools needed for boundary delimitations", convened by R. Macnab, dealt specifically with hardware and software that would be necessary to obtain the data to substantiate a continental shelf claim.

Fourth session: "Other issues and case studies (not necessarily related to Article 76)", convened by C. Rizos, specific issues and case studies were the subjects of discussion.

List of Experts in Marine Scientific Research for Use in Special Arbitration. In accordance with Article 2 of Annex VIII of the UNCLOS, the IOC Secretariat sent to the DOALOS a list of 61 Experts in Marine Scientific Research nominated by Member States for use in Special Arbitration.

Advisory Body of Experts on the Law of the Sea (ABE-LOS). Following the decision of the 20th Session of the IOC Assembly (29 June to 9 July 1999) to accelerate the first meeting of the Group of Experts on the Law of the Sea (ABE-LOS), the IOC Officers requested the Secretariat to identify the issues to be included for discussion of the group, and among them those identified in documents IOC/INF-1114, ODAS and ARGO. A letter will be sent to Member States asking them to give an opinion on the Agenda and the timing.Updated as of 31 January 2000, the list of ABE-LOS experts received at the IOC Secretariat comprised of 94 experts from 49 Member States.

Development of IOC within UNESCO

7

The 20th session of the IOC Assembly recommended increasing the level of coordination and participation of its member states in the working of the UNESCO governing bodies. In this context the Secretariat did prepare two circular letters to:

1. inform the competent national authorities about the requirements of the IOC programme and budget in advance of the General Conference of UNESCO with the intention of obtaining their support during the discussion of the programme.
2. report on the deliberations and main decisions that were adopted by the 157th Session of the Executive Board and the 30th session of the General Conference of UNESCO that are directly relevant for the working of the IOC.

Summary of the deliberations of the 30th General Conference of UNESCO concerning IOC.

Several Members States in their general policy statements recognized the work of the Intergovernmental Oceanographic Commission as the UN focal point organization coordinating the acquisition of the knowledge and information on the Oceans. Countries welcomed the efforts of IOC to increasingly design its programme in a policy oriented and issue driven mode.

Developed countries highlighted the importance of the global programmes of the Commission, in particular the Global Ocean Observing System, as well as expressed their willingness to help IOC to build capacity in developing countries. Developing countries, in particular from Africa and Small Island States, highlighted the urgent need for programmes that would enable them to manage coastal zones and to alleviate the several negative impacts from Climate and Global change. In this context, ocean related or ocean-generated disasters, such as Tsunamis, Storm Surges, Cyclones, Hurricanes and the El Niño and La Niña, were specifically mentioned.

The Chairman of IOC, Professor Su Jilan, addressed Commission III on Science, reporting on IOC programme, and requesting on behalf of the Commission to retain the original language of the IOC statutes, as approved by the 20th Session of the IOC Assembly. IOC received strong support from the Member States participating in the debate. During the discussion in Commission III, there was unanimous and enthusiastic support for the efforts of the IOC together with the other four Science Programmes of UNESCO: Man and the Biosphere (SC/ECO), Management of Social Transformations (SHS/MOST), International Geological Correlation Programme (SC/GEO), and the International Hydrological Programme (SC/HYD); to increase the coordination of their programmes.

The identification by the major Science Programmes of UNESCO of: large river basins, coastal marine ecosystems, coastal mega-cities as common sites for joint-action is a major achievement that deserves further attention and a carefully designed follow-up. Comments by member states valued the centripetal nature of this effort by the five programmes, and would like to see in this agreement the end of a trend to further diversify the number of specialized programme platforms, that tend to stretch the available resources in UNESCO.

Revision of IOC Statutes. The 30th session of the General Conference also approved the new Statutes of the Intergovernmental Oceanographic Commission, retaining the original text approved by the 20th session of the IOC Assembly. This approval culminates a process of six years during which, Member States of IOC endeavour to adapt the statutes to the new international context created by the United Nations Conference on Environment and Development (UNCED) in 1992 and the associated new Global Conventions and by the entry into force of the United Nations Convention on the Law of the Sea (UNCLOS) in 1994.

In this context, and despite the severe budgetary limitations approved by the Executive Board and the GC, several countries supported a request for increased budgetary support for IOC.

Annexes

I. Finance
II. Statutes
III. Publications
IV. Acronyms

I. Finance

Support to IOC programmes. A wide spectrum of activities is described within the body of this report, which highlights the relevant 1999 implementation phases of the IOC programmes. In concert with national and non-governmental initiatives, implementation of IOC programmes and related staff costs during 1999 was financed through income from UNESCO as part of its regular programme allocation, as approved by the UNESCO General Conference, and from extra-budgetary resources, notably that provided by IOC Member States through their contributions to the IOC Trust Fund (*Special Account*).

***Table 1**. 1999 Income*

	IOC TRUST FUND $		UNESCO Regular Programme $	TOTAL $
	Earmarked	General		
Programme Funding	1,351,158	877,265	1,691,180	3,919,603
Regular Programme Staff Posts			1,801,600	1,801,600
Grand total	**2,228,423**		**3,492,780**	**5,721,203**

Table 1: In regard to the funding of $3,492,780 provided by UNESCO, $1,801,600 was distributed to staff costs and $1,691,180 to programme implementation. Within the funding of $2,228,423 contributed through the IOC Trust Fund, $715,809 was attributed to staff costs (either through established, temporary posts or consultancy contracts).

Table 2: In addition to the total of $2,228,423, through Funds-in-Trusts arrangements, Japan provided $75,000 ($66,372 after deduction of UNESCO overhead) and Belgium/Government of Flanders provided $141,250 (125,000 after deduction of UNESCO over-head) in support of ODINAFRICA. Other contributions are provided by Member States (either direct or in-kind), which do not enter the budgetary flow of IOC. In addition, $29,000 was provided for supervision research for MEDPOL, through a MOU with UNEP.

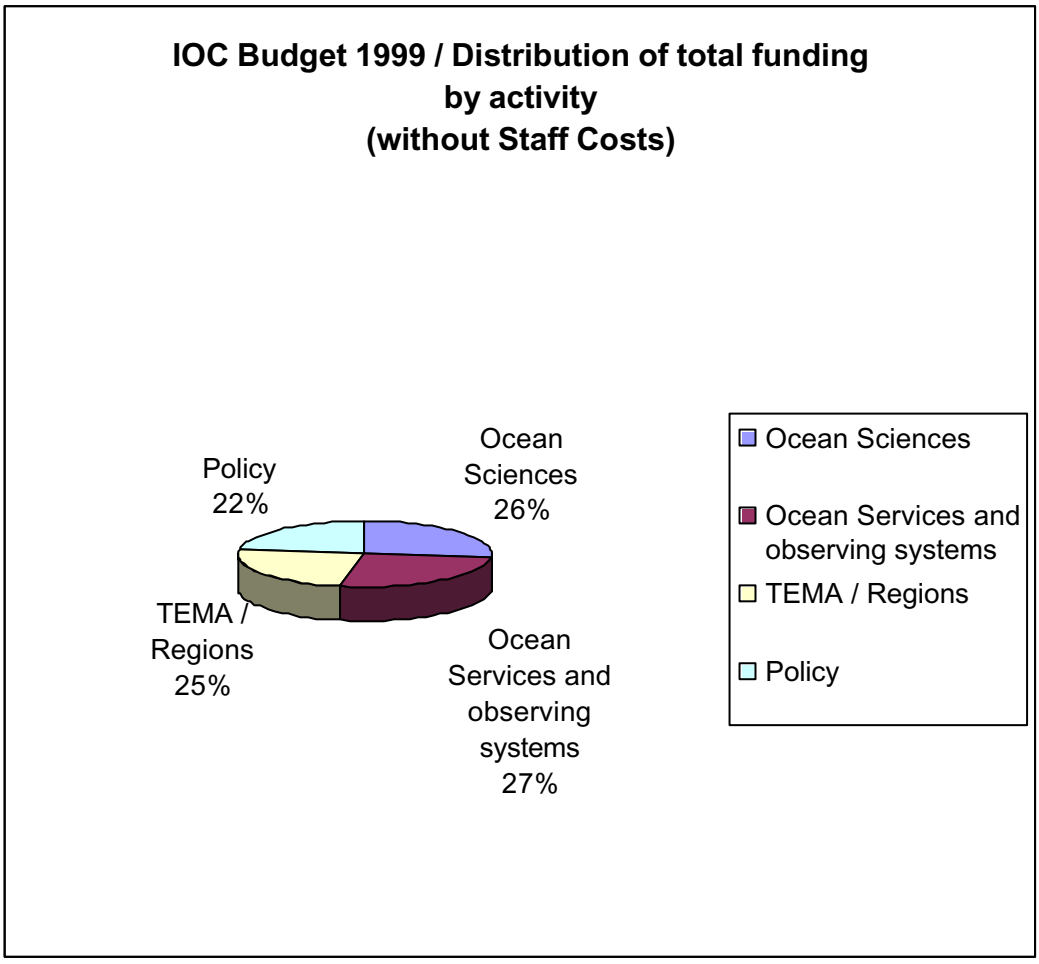
***Table 2**. 1999 Contributions to the IOC Trust Fund*

Contributor	Total / $	Component	Purpose
Canada	19,944	9,740	General
		10,204	General
Denmark	252,000		OSLR/HAB
EUMETSAT	5,296		Ocean and Climate
European Union	46,580	2,429	IODE/Dublin Mtg
		5,368	Galendzic Cruise
		3,614	IODE/GODAR Ghana
		35,169	IODE/GODAR
FAO	24,209	12,209	OSRL/Panel LMR
		12,000	OSLR/LMR
FER	52,300		General
France	71,072	2,000	GLOSS/Mtg Toulouse
		32,574	Seconded personnel
		31,892	SIDS/ICAM
		4,606	Ocean and Climate
ICSU	20,000		GOOS Steering Committee
ICSU / SCOR	4,500		GODAR
India	25,000		IOCINDIO activities
IOI	4,000		Med/GOOS
Netherlands	96,600	76,600	GOOS
		20,000	ICAM
Sri Lanka	1,350		OSLR/CR
Sweden/Sida Sarec	357,100	351,515	Regions
		5,585	Coastal GOOS Panel Mtg 98
UK	79,384	20,000	GODAE
UK / DFID		18,591	OSLR / Coral Reefs
UK/ FUGRO GEOS		14,793	El Niño Publication
UK NERC		10,000	GLOSS
UK NERC		15,000	OSLR
UK Met Office		1,000	Med/GOOS
USA	782,707	66,000	GOOS Seconded personnel
		62,500	OSLR Seconded personnel
USA		525,000	General
USA/Naval Research		10,000	Med/GOOS
US NOAA		20,000	IODE/GODAR
US NOAA		10,000	Coastal GOOS
US NOAA		50,000	GODAE
US NOAA		20,000	GOOS coordination activities
US NOAA		6,000	Ocean Mapping
US NOAA		5,000	Potsdam Conference
US NOAA		7,500	Coastal GOOS China
USA/Univ. Maryland		707	GIPME
UNDP/Argentina	300	300	Ocean Mapping
WMO	160,650	5,369	GOOS Steering Committee
		20,000	GOOS
		5,000	Med/GOOS
		130,281	GOOS/DBCP
Sub-Total	2,002,992		
Interests 1999	280,021		
Cancel DFID contribution 97	-54,590		
TOTAL	**2,228,423**		

Table 3. *Distribution of total funding 1999 by activity (without Staff costs)*

	Ocean Sciences	Ocean Services and observing systems	TEMA / Regions	Policy	Total 1999
RP	354,729	347,448	585,619	403,384	1,691,180
TF	748,535	762,113	441,385	533,104	2,485,137
TOTAL	1,103,264	1,109,561	1,027,004	936,488	4,176,317

Table 3: shows the total funding broken down by activity, without the Staff costs. The category "Ocean Services" includes GOOS.



II. Statutes

The Intergovernmental Oceanographic Commission was established by resolution 2.31 adopted by the General Conference of UNESCO at its eleventh session (Nov.-Dec. 1960), and in conformity with the recommendation of the Intergovernmental Conference on Oceanic Research (Copenhagen 11-16 July 1960). Drafted in 1960, the Statutes of the Commission were revised in 1970 and 1987. In 1999, new proposed amendments to these Statutes were adopted by the IOC Assembly at its twentieth session and were approved in the same terms by the General Conference of UNESCO at its thirtieth session. The present statutes of the Commission came into force through adoption of 30 C/Resolution 22 on 16 November 1999.

Article 1: The Commission

1. The Intergovernmental Oceanographic Commission, hereafter called the Commission, is established as a body with functional autonomy within the United Nations Educational, Scientific and Cultural Organization (UNESCO).

2. The Commission defines and implements its programme according to its stated purposes and functions and within the framework of the budget adopted of its Assembly and the General Conference of UNESCO.

Article 2: Purpose of the Commission

1. The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services and capacity building, in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making processes of its Member States.

2. The Commission will collaborate with international organizations concerned with the work of the Commission, and specially with those organizations of the United Nations system, which are willing and prepared to contribute to the purpose and functions of the Commission and/or to seek advise and cooperation in the field of ocean and coastal area scientific research, related services and capacity building.

Article 3: Functions

1. The functions of the Commission shall be to:

   (a) recommend, promote, plan and coordinate international ocean and coastal area programmes in research, observations and dissemination and use of their results;

   (b) recommend, promote and coordinate the development of relevant standards, reference materials, guidelines and nomenclature;

   (c) respond, as a competent international organization, to the requirements deriving from the United Nations Convention of the Law of the Sea (UNCLOS), the United Nations Conference on Environment and Development (UNCED), and other international instruments relevant to marine scientific research, related services and capacity building;

   (d) make recommendations and coordinate programmes in education, training and assistance in marine science, ocean and coastal observations and the transfer of related technology;

(e) make recommendations and provide technical guidance to relevant intersectorial activities of UNESCO and undertake mutually agreed duties within the mandate of the Commission;

(f) undertake, as appropriate, any other action compatible with its purpose and functions.

2. The Commission shall prepare regular reports on its activities, which shall be submitted to the General Conference of UNESCO. These reports shall also be addressed to the Member States of the Commission as well as to the organizations within the United Nations system covered by paragraph 2 of article 2.

3. The Commission shall decide upon the mechanisms and arrangements through which it may obtain advice.

4. The Commission, in carrying out its functions, shall take into account the special needs and interests of developing countries, including in particular the need to further the capabilities of these countries in scientific research and observations of the oceans and coastal areas and related technology.

5. Nothing in these Statutes shall imply the adoption of a position by the Commission regarding the nature or extent of the jurisdiction of coastal States in general or of any coastal State in particular.

Article 4: Membership

A. Membership

1. Membership of the Commission shall be open to any Member State of any one of the organizations of the United Nations system.

2. States covered by the terms of paragraph 1 above shall acquire membership of the Commission by notifying the Director-General of UNESCO.

3. Any Member State of the Commission can withdraw by giving notice of its intention to do so to the Director-General of UNESCO.

4. The Director-General of UNESCO shall inform the Executive Secretary of the Commission of all notifications received under the present Article. Membership will take effect from the date on which the notification is received by the Executive Secretary. Notice of withdrawal will take effect one full year after the date on which the notice is received by the Executive Secretary, through the Director-General of UNESCO. The Executive Secretary will inform Member States of the Commission and the Executive Heads of the relevant United Nations organizations of all notifications.

B. Responsibilities of Member States

5. The responsibilities of Member States imply:

(i) compliance with the Statutes and Rules of Procedure of the Commission;

(ii) collaboration with and support of the programme of work of the Commission;

(iii) specification of the national coordinating body for liaison with the Commission;

(iv) support of the Commission at an appropriate level using any or all of the financial mechanisms listed under Article 10.

6. The notification by a Member State requesting membership shall include a statement indicating acceptance of the above responsibilities or its intention to comply at an early date.

Article 5: Organs

The Commission shall consist of an Assembly, an Executive Council, a Secretariat and such subsidiary bodies it may establish.

Article 6: The Assembly

A. Composition

1. The Assembly shall consist of all States Members of the Commission.

B. Functions and Powers

2. The Assembly is the principal organ of the Commission and shall perform all functions of the Commission unless otherwise regulated by these Statutes or delegated by the Assembly to other organs of the Commission.

3. The Assembly shall determine the Commission's Rules of Procedure.

4. The Assembly shall establish general policy and the main lines of work of the Commission, and shall approve the IOC Biennial Draft Programme and Budget in accordance with paragraph 2 of Article 1.

5. During the course of each ordinary session, the Assembly shall elect a Chairperson and, taking into account the principles of geographic distribution, shall elect five Vice-Chairpersons who shall be the officers of the Commission, its Assembly and its Executive Council, and shall also elect a number of Member States to the Executive Council in accordance with Article 7.

6. In electing Member States to the Executive Council, the Assembly shall take into consideration a balanced geographical distribution, as well as their willingness to participate in the work of the Executive Council.

C. Procedure

7. The Assembly shall be convened in ordinary session every two years.

8. Extraordinary sessions may be convened if so decided or if summoned by the Executive Council, or at the request of at least one-third of the Member States of the Commission under conditions specified in the Rules of Procedure.

9. Each Member State shall have one vote and may send to sessions of the Assembly such representatives, alternates and advisers, as it deems necessary.

10. Subject to provisions in the Rules of Procedure regarding closed meetings, participation in the meetings of the Assembly, of the Executive Council and subsidiary bodies, without the right to vote, is open to:

    (a) representatives of Member States of organizations of the United Nations system, which are not members of the Commission;

    (b) representatives of the organizations of the United Nations system;

    (c) representatives of such other intergovernmental and non-governmental organizations as may be invited subject to conditions specified in the Rules of Procedure.

11. The Assembly may set up committees or other subsidiary bodies as may be necessary for its purpose, in accordance with conditions specified in the Rules of Procedure.

Article 7: The Executive Council

A. Composition

1. The Executive Council shall consist of up to 40 Member States, including those Member States represented by the Chairperson and the five Vice-Chairpersons.

2. The mandate of the Members of the Executive Council shall commence at the end of the session of the Assembly during which they have been elected and expire at the end of the next session of the Assembly.

3. In selecting representatives to the Executive Council, Member States elected to the Executive Council shall endeavour to appoint persons experienced in matters related to the Commission.

4. In the event of the withdrawal from the Commission of a Member State that is Member of the Executive Council, its mandate shall be terminated on the date the withdrawal becomes effective.

5. Members of the Executive Council are eligible for re-election.

B. Functions and Powers

6. The Executive Council shall exercise the responsibilities delegated to it by the Assembly and act on its behalf in the implementation of decisions of the Assembly.

7. The Executive Council may set up committees or other subsidiary bodies as may be necessary for its purpose, in accordance with conditions specified in the Rules of Procedure.

C. Procedure

8. The Executive Council shall hold ordinary and extraordinary sessions as specified in the Rules of Procedure.

9. At its meetings, each Member State of the Executive Council shall have one vote.

10. The agenda of the Executive Council should be organized as specified in the Rules of Procedure.

11. The Executive Council shall make recommendations on future actions by the Assembly.

Article 8: The Secretariat

1. With due regard to the applicable Staff Regulations and Rules of UNESCO, the Secretariat of the Commission shall consist of the Executive Secretary and such other staff as may be necessary, provided by UNESCO, as well as such personnel as may be provided, at their expense, by other Organizations, the United Nations system, and by Member States of the Commission.

2. The Executive Secretary of the Commission, at the level of Assistant Director-General, shall be appointed by the Director-General of UNESCO following consultation with the Executive Council of the Commission.

Article 9: Committees and Other Subsidiary Bodies

1. The Commission may create, for the examination and execution of specific activities, subsidiary bodies composed of Member States or individual experts, after consultation with the Member States concerned.

2. To further the cooperation referred to in Article 11, other subsidiary bodies composed of Member States or individuals may also be established or convened by the Commission jointly with other organizations. The inclusion of individuals in such subsidiary bodies would be subject to consultations with the Member States concerned.

Article 10: Financial and Other Resources

1. The financial resources of the Commission shall consist of:

   (i) funds appropriated for this purpose by the General Conference of UNESCO;

   (ii) contributions by Member States of the Commission, that are not Member States of UNESCO;

   (iii) additional resources as may be made available by Member States of the Commission, appropriate organizations of the United Nations system and from other sources.

2. The programmes or activities sponsored and coordinated by the Commission and recommended to its Member States for their concerted action shall be carried out with the aid of the resources of the participating Member States in such programmes or activities, in accordance with the obligations that each State is willing to assume.

3. Voluntary contributions may be accepted and established as trust funds in accordance with the financial regulations of the Special Account of the IOC, as adopted by the Assembly and UNESCO. Such contributions shall be allocated by the Commission for its programme of activities.

4. The Commission can establish, promote or coordinate, as appropriate, additional financial arrangements to ensure the implementation of an effective and continuing programme at global and/or regional levels.

Article 11: Relations with Other Organizations

1. The Commission may cooperate with specialized agencies of the United Nations and other international organizations whose interests and activities are related to its purpose, including signing memoranda of understating with regard to cooperation.

2. The Commission shall give due attention to supporting the objectives of international organizations with which it collaborates. On the other hand, the Commission shall request these organizations to take its requirements into account in planning and executing their own programmes.

3. The Commission may act also as a joint specialized mechanism of the organizations of the United Nations system that have agreed to use the Commission for discharging certain of their responsibilities in the fields of marine sciences and ocean services, and have agreed accordingly to sustain the work of the Commission.

Article 12: Amendments

The General Conference of UNESCO may amend these Statutes following a recommendation of, or after consultation with, the Assembly of the Commission. Unless otherwise provided by the General Conference, an amendment of these Statutes shall enter into force on the date of its adoption by the General Conference.

III. Publications

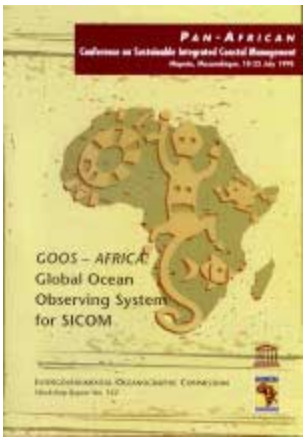
This list cover main IOC Series publications published during 1999. It completes and updates Document IOC/INF-700 rev. 12, *List of IOC Publications (as of October 1998)*. The IOC's electronic library provides free and unlimited access to hundreds of IOC publications.

Visit the IOC electronic library on

http://ioc.unesco.org/iocpub

IOC TECHNICAL SERIES

Kenyon, N.H; Ivanov, M.K.; Akhmetzhanov, A.M. (eds.). *Geological Processes on the Northeast Atlantic Margin*. 1999. 141 pp. (Technical Series, 54). (English)



IOC MANUALS AND GUIDES

Guide to Operational Procedures for the Collection and Exchange of JCOMM Oceanographic Data. 3rd rev. ed. 1999. 38 pp. (Manuals and Guides, 3). (English, French, Spanish, Russian)

IOC WORKSHOP REPORTS

Taller Pluridisciplinarion TEMA sobre Redes del Gran Caribe en Gestión Integrada de Áreas Costeras. Cartagena de Indias, Colombia, 1998. 1999. 69 pp. (Workshop Report, 151). (Spanish)

GOOS–AFRICA: Global Ocean Observing System for SICOM. Maputo, Mozambique, 1998. 1999. 44 pp. (**Workshop Report, 152**). (English, French; Summary in English, French, Spanish, Portuguese, Arabic)

IOC-Sida-Flanders-SFRI Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA project). Capetown, South Africa, 1998. 1999. 45 pp. (Workshop Report, 154). (English)

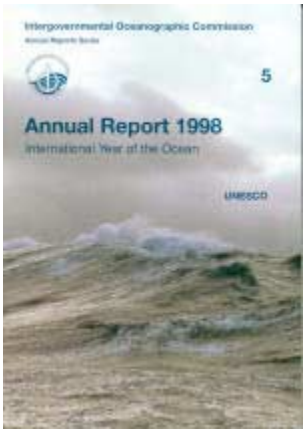
Science of the Mediterranean Sea and its Applications. Paris, 1997. 1999. 102 pp. (Workshop Report, 155). (English).

IOC TRAINING COURSE REPORTS

IOC/GLOSS-GOOS Training Workshop on Sea-Level Data Analysis, Cape Town, South Africa, 1998. 1999. 19 pp. (**Training Course Reports, 51**). (English)

IOC ANNUAL REPORT

IOC Annual Report 1998. 1999. 129 pp. (**Annual Reports Series, 5**). (English)



INFORMATION DOCUMENTS

IOC/INF-1115 International Co-ordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU) Officers Meeting, Summary Report Honolulu, January 1999. March 1999.

IOC/INF-1120 Information and Guidelines for Participants in the Twentieth Session of the Assembly, Paris, June-July 1999. March 1999

IOC/INF-1121 Ocean Science in Relation to Non-living Resources (OSNLR) Group of Experts Meeting, Paris, December 1997. May 1999

IOC/INF-1122 Report of the IOC Consultative Group on Ocean Mapping (CGOM) to the 20th Session of the IOC Assembly, Paris June-July 19999

IOC/INF-1123 Relevant Excerpts of the Fourth Conference of the Parties (CP.4) to the Framework convention on Climate Change (FCCC), Paris, April 1999

IOC/INF-1124 ITSU Master Plan, 2nd ed., April 1999

IOC/INF-1125 Joint IOC/UNIDO Workshop on Marine Debris/Waste Management for the Gulf of Guinea, Summary Report, Abidjan, April 1999

IOC/INF-1126 Draft Project Proposal. Intra-Americas Sea Tsunami Warning System Education, Warning, Management and Research, submitted by IOCARIBE Tsunami Steering Group of Experts, June 1999

IOC/INF-1127 Global Physical Ocean Observations for GOOS/GCOS: an Action Plan for Existing Bodies and Mechanisms, July 1999. (GOOS Report No. 66)

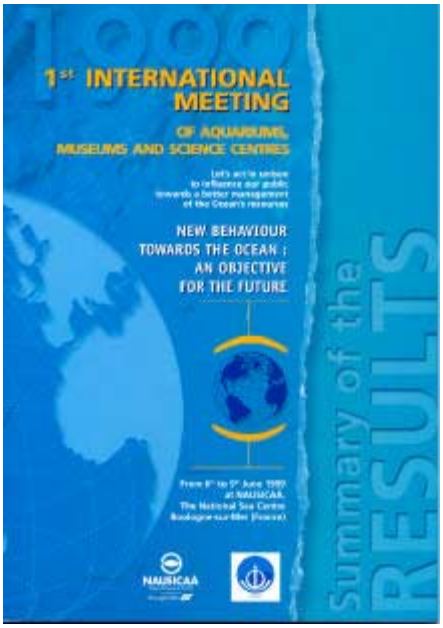
IOC/INF-1128 IOC's Electronic Information Services and Products - 1999 Status Report, June 1999.

IOC/INF-1131 Project Proposal on Storm Surges Disaster Reduction for the Northern Part of the Indian Ocean, December 1999.

IOC/INF-1132 International Ocean Assessment Report, May 2000.

IOC/INF-1133 CO_2 Disposal in the Oceans, abstracts from *Science*, No. 284, pp. 934-945, 1999.

The Tsunami Warning System Master Plan (**IOC/INF-1124**) is designed as a long-term guide of technological innovations and progress in tsunami modelling, which identifies ways for further improvement of national systems and extension of collaboration amongst Member States.



Public awareness

In 1999, IOC co-sponsored a few events and publications.

The 1st international Meeting of Aquariums, Museums and Science Centres, which took place at NAUSICAA National Sea Centre, France, from 6 to 9 June counts among them. NAUSICAA holds a "Centre of Excellence" certificate granted by IOC/UNESCO.

IV. Acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea
ABLOS	Advisory Board on Hydrographic, Geodetic and Marine Geo-Scientific Aspects of the Law of the Sea
ACC-SOCA	Administrative Committee on Coordination – Sub-Committee on Oceans and Coastal Areas
APEC	Asia-Pacific Economic Cooperation Council
Argo	Array for Real-time Geostrophic Oceanography
AVHRR	Advanced Very High Resolution Radiometer
Black SeaGOOS	Black Sea regional GOOS
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CEADIR	Central Eastern Atlantic Directory of Marine Professionals
CGOM	Consultative Group Ocean Mapping
CIMAR	Centro de Investigacion en Ciencias del Mar y Limnologia (Costa Rica)
CLCS	Commission on the Limits of the Continental Shelf (UN)
CLIVAR	Climate Variability and Predictability
CMM	Commission for Marine Meteorology (WMO) (see JCOMM)
COASTS	Inter-disciplinary Study of Coastal Processes Programme
COBSEA	Coordinating Body on the Seas of East Asia /UNEP/
COP	Conference of the Parties
CSD	Commission on Sustainable Development
DBCP	Data Buoy Cooperation Panel
DFID	Department for International Development (UK)
DNA	Designated National Agency /IODE/
DOALOS	Division for Ocean Affairs and the Law of the Sea (UN)
EEZ	Exclusive Economic Zone
EGOS	European Group on Ocean Stations
ENAM	European North Atlantic Margin Project (EU)
ENSO	El Niño and the Southern Oscillation (An Ocean/Atmosphere Interaction Study) (USA)
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
EU	European Union
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EURASLIC	European Aquatic Sciences and Libraries and Information Centres
EuroGOOS	European GOOS
FAO	Food and Agriculture Organization (UN)
GCOS	Global Climate Observing System
GDA	GEBCO Digital Atlas
GEBCO	General Bathymetric Chart of the Oceans
GEF	Global Environment Facility
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms
GESAG	GIPME Expert Scientific Advisory Group
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
GIPME	Global Investigation of Pollution in the Marine Environment
GIWA	Global International Water Assessment
GLOBEC	Global Ocean Ecosystems Dynamics
GLODIR	Global Directory of Marine (and Freshwater) Professionals
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
GOOS-AFRICA	African Global Ocean Observing System
GOOS-IOS	GOOS Initial Observing System
GOSIC	Global Observing System Information Centre
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
GPO	GOOS Project Office

GSC	GOOS Steering Committee
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System
HAB	Harmful Algal Blooms
HTDB/PAC	Historical Tsunami Database for the Pacific
HOTO	Health Of The Oceans
IACSD	Inter-Agency Committee on Sustainable Development
IAEA	International Atomic Energy Agency
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centres
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic (IOC)
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
ICAM	Integrated Coastal Area Management
ICES	International Council for the Exploration of the Sea
ICG/ITSU	International Coordination Committee for the Tsunami Warning System in the Pacific
ICLARM	International Centre for Living Aquatic Resources Management
ICM	Integrated Coastal Management
ICSEM	International Commission for the Scientific Exploration of the Mediterranean Sea
ICSPRO	Inter-secretariat Committee on Scientific Programmes Relating to Oceanography (UN-FAO-UNESCO-WMO-IMO)
ICSU	International Council for Science
ICZM	Integrated Coastal Zone Management
IDNDR	International Decade for Natural Disaster Reduction (1989-1999)
IFREMER	Institut français de recherche pour l'exploitation de la mer
IGBP	International Geosphere-Biosphere Programme (ICSU)
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System
IGU	International Geographical Union
IHB	International Hydrographic Bureau
IHO	International Hydrographic Organization
IHP	International Hydrological Programme (UNESCO)
ILMS	Integrated Library Management system
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Sub-commission for the Caribbean and Adjacent Regions
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCINCWIO	IOC Regional Committee for the Cooperative Investigations in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IOCSOC	IOC Regional Committee for the Southern Oceans
IODE	International Oceanographic Data and Information Exchange (IOC)
IOI	International Ocean Institute
IPHAB	IOC Intergovernmental Panel on Harmful Agal Blooms
IPO	International Programme Office (GEOHAB)
IRD	Institut français de recherche scientifique pour le développement en coopération (ex. ORSTOM)
ITSU	International Coordination Group for the Tsunami Warning System in the Pacific (IOC)
IUCN	International Union for the Conservation of Nature (and Natural Resources) [World Conservation Union]
IUGG	International Union of Geodesy and Geophysics
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology (WMO-IOC)
J-DIMP	Joint G3OS Data and Information Management Panel
JECSS	Japan and East China Seas Study
JGOFS	Joint Global Ocean Flux Study /SCOR-IOC/
JTA	Joint Tariff Agreement (Argos)
KMFRI	Kenya Marine & Fisheries Research Institute
LME	Large Marine Ecosystems
LOICZ	Land-Ocean Interactions in the Coastal Zone (ICSU/IGBP)
MAMCOMP	Training Programme on Modelling and Monitoring of Coastal Marine Processes
MAP/UNEP	Mediterranean Action Plan of the United Nations Environment Programme
MEA	Marine Environmental Assessments

MED POL	Programme for the Assessment and Control of Pollution in the Mediterranean region
MEDAR/MEDATLAS	Mediterranean Data Archaeology and Rescue, & Mediterranean Atlas
MedGOOS	Mediterranean regional GOOS
MIM	Marine Information Management
MOST	Management of Social Transformations Programme
MoU	Memorandum of Understanding
NATO	North Atlantic Treaty Organization
NEAR-GOOS	North-East Asian Regional GOOS
NERC	Natural Environment Research Council (UK)
NGO	Non-Governmental Organizations
NIOZ	Netherlands Institute for Sea Research
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre /IODE/
OCEANOBS'99	First International Conference on Ocean Observations for Climate
ODAS	Ocean Data Acquisition System
ODINAFRICA	Ocean Data and Information Network for Africa (IOC-Flanders)
ODINEA	Ocean Data and Information Network for Eastern Africa
OECD	Organization for Economic Cooperation and Development
OGS	Istituto Nazionale di Oceanografia e di Geofisica Sperimentale
ONR	Office of Naval Research (US Navy)
OOPC	Ocean Observation Panel for Climate
OSLR	Ocean Science in Relation to Living Resources
PacificGOOS	Pacific regional GOOS
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management (Maputo, Mozambique, 18-25 July 1998)
PCB	I-GOOS Panel on Capacity Building
PICES	North Pacific Marine Science Organization (Pacific ICES)
PCU	Programme Coordination Unit of the Black Sea Environmental Programme /GEF/
PIRATA	PIlot Research Array (of buoys) in the Tropical Atlantic
POGO	Partnership for Observation of the Global Ocean
POPs	Persistent Organic Pollutants
PTWC	Pacific Tsunami Warning Centre
RAMP	Rapid Assessment of Marine Pollution
RDFU	Rapid Focal Mechanism Determination
RECOSCIX-CEA	Regional Cooperation in Scientific Information Exchange for the Central Eastern Atlantic (see ODINAFRICA)
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SAP	Strategic Action Plan
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SBSTA	Subsidiary Body for Scientific and Technological Advice (see UNFCCC)
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOR	Scientific Committee on Oceanic Research
SEAPOL	South-East Asia Programme on Ocean Law, Policy and Management
SIDA	Swedish Development Agency
SOA	State Oceanic Administration of China
SOLAS	Safety of Life At Sea (SOLAS) Convention
SOOP	Ship-of-Opportunity Programme
SOPAC	South Pacific Applied Geoscience Commission
SPACC	Small Pelagic Fish and Climate Change Group /SCOR/
SSG	Scientific Sub-Group
SVPBW	Surface Velocity Programme buoy equipped with a barometer and a wind sensor
TALOS	Working Group on Technical Aspects of the Law of the Sea /IHO/
TAO	Tropical Atmosphere Ocean Array
TEMA	Capacity Building in Marine Sciences, Services and Observations
TREMORS	Tsunami Risk Evaluation through Seismic Moment from a Real-time System
TTR	Training-Through-Research Programme [see Floating University]
TWS	Tsunami Warning System
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Convention on the Law of the Sea
UNDP	United Nations Development Programme

UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICPOLOS	United Nations open-ended Informal Consultative Process on Oceans and the Law of the Sea
UNIDO	United Nations Industrial Development Organization
UNU	United Nations University
UOP	Upper Ocean Panel (CLIVAR)
USAID	United States Agency for International Development
WDC	World Data Centre
WESTPAC	IOC Sub-commission for the Western Pacific
WIOMAP	West Indian Ocean Marine Applications Programme
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WWF	World Wide Fund for Nature
WWW	World Wide Web (Internet)