Intergovernmental Oceanographic Commission

Annual Reports Series

5

Annual Report 1998

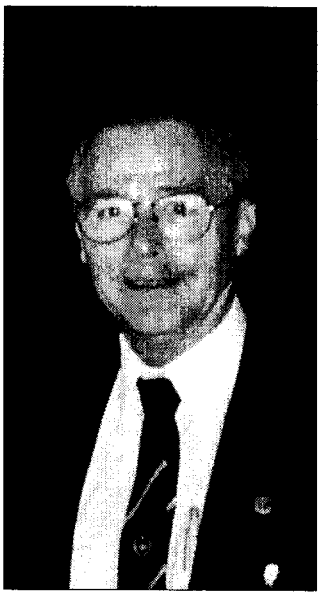
International Year of the Ocean

UNESCO

Contents

Foreword

Message from the Chairman



1998 was a singularly important year for the IOC. The International Year of the Ocean gave us the opportunity to promote our existence and our activities both nationally and internationally. We said goodbye to an old friend, Dr. Gunnar Kullenberg, and welcomed the beginning of a new friendship with the arrival of Dr. Patricio Bernal from Chile. These events perhaps overshadowed the regular programmes of the Commission, their successes and their setbacks, that nevertheless had to be addressed. I shall not dwell on the programmes, however, as they are dealt with at length elsewhere in this document.

I was proud of the efforts of the Secretariat in dealing with the additional management burden imposed by the International Year of the Ocean. It was not a funded programme and the responsibilities had to be undertaken on top of regular duties. There is no doubt that the year was a success.

I do have a concern. Will the momentum generated by the event be translated into public and governmental support in the long term? It is, of course, too early to judge, but several significant statements were made during the course of 1998, that may have an impact in future years.

The Summit of the Sea (St. John's, September, 1997); the ACOPS/GLOBE Conference (Stockholm, January, 1998); PACSICOM, Maputo, July, 1998); the Independent World Commission on Oceans (Lisbon, August, 1998), the Pacem in Maribus Conference (Halifax, November 1998) and others, all in various ways called on the United Nations and governments for increased recognition and action in world ocean affairs. We expect that the statements, and the sentiments expressed therein, will be taken to the UNCSD debate on Oceans and Seas and will hopefully lead to more frequent and more prominent meetings on ocean matters within the UN System.

On the public and governmental side, the attention generated in 1998 will, I hope, lead to more resources being allocated to the ocean environment and to managing ocean resources in a sustainable manner. This was the message contained in The Ocean Charter that 85 countries have now signed.

One important question remains. "How does this affect the IOC?" This, I cannot answer. The answer lies with the Member States of the Commission. What needs to be done is to harness the global capacity in ocean science and technology to gather the necessary knowledge and data for understanding, protecting and predicting the ocean environment, for sustaining marine resources and managing ocean and coastal regions.

The requirement is for intergovernmental action, which the IOC could supply, but not, I believe, with our current visibility and resources. At present the Commission has, per country, less than one month of a professional's time, and under $20,000, to co-ordinate the global activities in all sectors and disciplines. For regional activities the situation is worse. The survival of the planet rests with the oceans. Sooner or later governments will need to address the question of resources and adequate co-ordination. Perhaps there is an opportunity today.

Geoffrey L. Holland
IOC Chairman

Introduction

Science to protect the global commons

The year 1998 will be remembered as the International Year of the Ocean. For IOC this was an extraordinary opportunity to rally the support of the common citizen for the immense task we have before us: *to develop the knowledge base to make possible the sustainable use of the world Ocean.*

Although IOC's, mandate, as part of UNESCO, is solidly based in science, our work is not bounded by the traditional limits of the scientific endeavor. The Ocean has always had some societal use, but imperfect regulations* and insufficient institutional arrangements today put those uses at risk. This is a major concern for all Member States of IOC.

In the last three decades of this century environmental issues have moved from the sidelines to the center of the political scene. Since the adoption of the paradigm of Sustainable Development in 1992 in Rio de Janeiro, environmental issues are becoming central to the process of governing. This is a significant political transformation, propelled by an emerging awareness of citizens in every nation of the world.

In the final analysis, sustainable development requires governments to guide and regulate the economic process, keeping the incentives that make development possible, but ensuring at the same time the protection of the natural environment.

On land, political accountability in environmental matters is ensured by the institutional presence of the national state. But this is not so clear for most of the world Ocean. This was stressed in the message sent by the IOC to the Ministerial Segment CSD-7: *The Oceans are a global commons and as such require an integrated approach by governments.* If we want to learn from the experience of fishery management, we should remember that when you have a *commons* you might end with a *tragedy.*

This is why I think that the United Nations Convention on the Law of the Sea represents such an important achievement. It took more than 20 years to agree on a text that actually represents a true Constitution for the Ocean. It also took thirty years to make possible the new environmental Conventions

* The word *regulation* has many connotations. It is not used here to mean the heavy-handed application of command and control techniques. Borrowing from control theory, a regulated system has a built-in, automatic, capacity to return to a pre-defined state after being exposed to some external perturbation.

adopted in the nineties. However, the constituencies that participate in the environmental conventions, present at each Conference of the Parties, have been absent in the existing *fora* on the Ocean. This is certainly a limitation, but there are some hopeful signs.

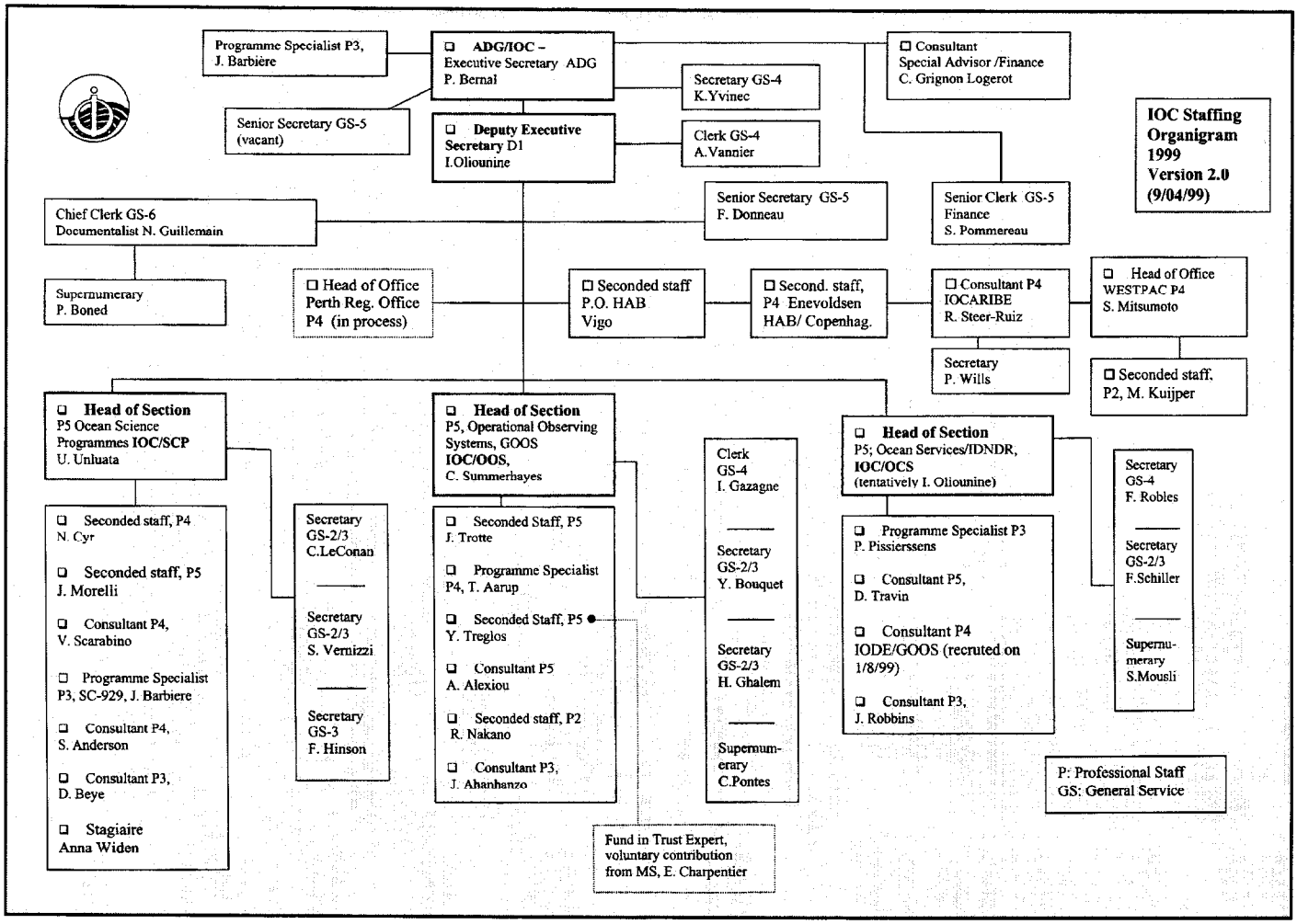
Within the UN several proposals aim to improve the quality and level of the reporting and discussion of ocean issues. At the same time, the possibility of using available knowledge in new applications, increasing the value of knowledge and information on ocean processes, has opened the way for the creation of global partnerships between the different users of the ocean.

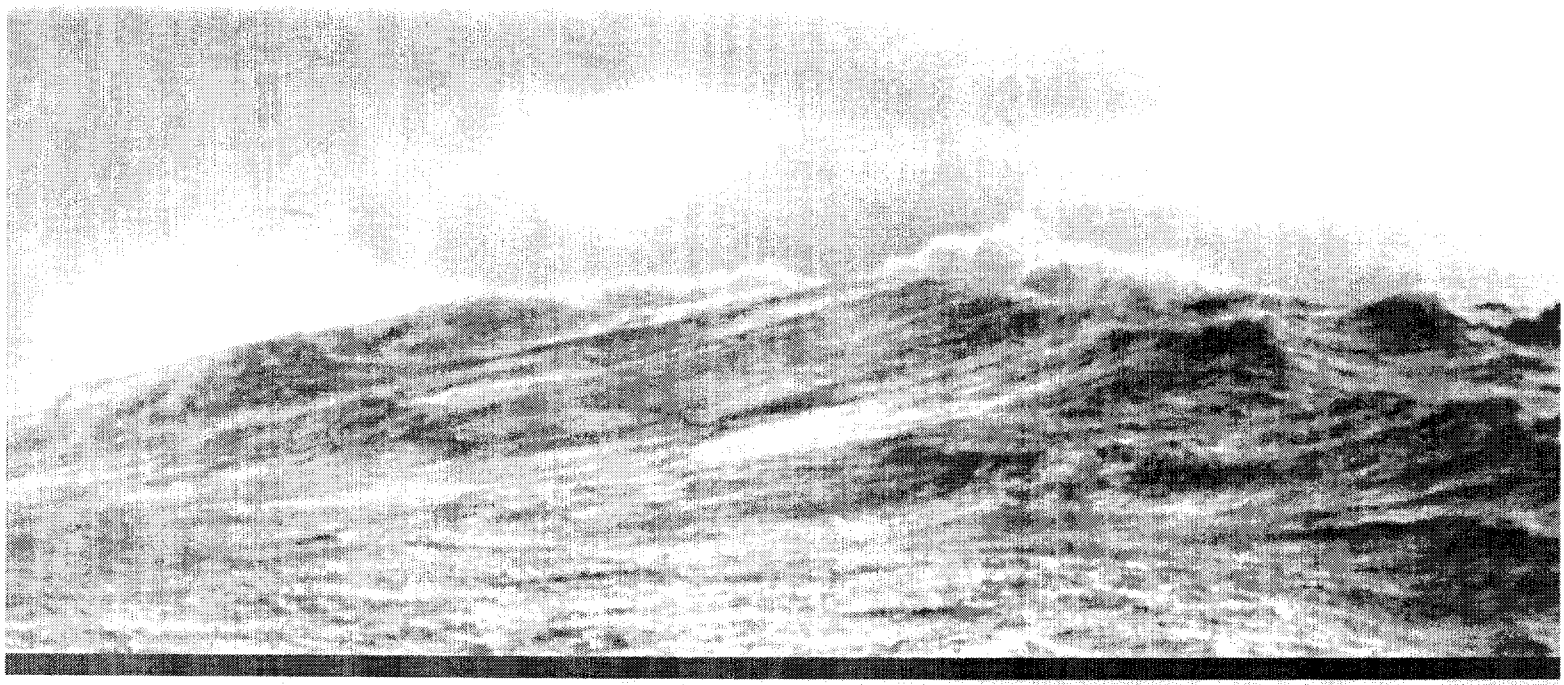
Global issues are raising a new consciousness in citizens of all nations. This should result in improved global institutions, accountable through the democratic participation of the global citizens of the next millennium.

Patricio Bernal
Assistant Director-General
IOC Executive Secretary

OVERVIEW OF IOC PROGRAMME STRUCTURE

(Administrative diagram)





Ocean Sciences 1

1.1 Ocean and Climate

WORLD CLIMATE RESEARCH PROGRAMME (WCRP)

The World Ocean Circulation Experiment (WOCE)

The year 1998 marked a major milestone and turning point for the WCRP World Ocean Circulation Experiment programme. WOCE completed nearly a decade of fieldwork and brought closure to the Intensive Observational Phase (IOP) started in 1990. Last year also saw the ramping up of the final phase of Analysis, Interpretation Modelling and Synthesis (WOCE AIMS) that will provide the real payoff for all the investment made so far by participating nations. The AIMS phase will continue for at least another five years.

WOCE IOP stimulated major breakthroughs in ocean observational technology that will be employed by generations to come. Examples that stand out are the TOPEX/POSEIDON satellite altimeter for high precision ocean topography, and the PALACE floats for obtaining temperatureconductivity profiles of the ocean via satellite link, on a near real time basis, at an affordable cost (Fig. 1). These are some of the anticipated legacies of WOCE that upcoming programmes such as CLIVAR, GOOS and GCOS are already adopting.

In May 1998, 400 delegates met in Halifax for the International WOCE Conference that marked this turning point - a sort of mid-life - in the Programme. The scientific contributions presented at the Conference showed good progress towards the achievement of WOCE objectives, primarily the development and validation of improved ocean models for climate research. The WOCE data set collected during the IOP will be a much needed benchmark with which to compare all past and future ocean observations in order to assess natural and anthropogenic change. The first set of CD-ROMs of WOCE data is available and was distributed to all conference delegates. The Conference proceedings are being published and several atlases of WOCE global data are planned. Together with the wealth of scientific results, these products will be a lasting tribute to the scientists who first planned WOCE in 1979 and to those who carried it out.

Even at this early stage of analysis, WOCE scientists were able to show a remarkable number of findings at the Conference. Among them:

- The ocean responds strongly to continuous atmospheric forcing on inter-annual and decadal time scales;
- Mixing in the ocean is a strong function of bottom topography;
- New estimates of the magnitude of the freshwater flux balance of major ocean basins are smaller than earlier ones, making the global thermohaline circulation an even more delicate feature of our planet (Fig. 2);
- The Atlantic really transports heat from the southern to the Northern Hemisphere;
- Transports in some deep ocean basins are still largely unknown;
- Tracer concentration measurements add information mainly about time scales of oceanic transport;
- The WOCE field phase years were characterised by rather abnormal conditions with respect to atmospheric forcing.

WOCE continues to develop its science through a series of regional and subject-based workshops, which also serve to promote a better understanding of the regional implications of global circulation. A final WOCE Conference is being planned for 2003 to present the programme's findings.

Climate Variability and Predictability Study (CLIVAR)

CLIVAR is the newest and most wide-ranging component of the World Climate Research Programme (WCRP), co-sponsored by the WMO, IOC and ICSU. Experience with the decade of El Niño research clearly demonstrated that there is real promise that improved understanding of the mechanisms at play in the Earth's climate system will provide a firm scientific basis on which economic and societal decisions can be made. CLIVAR has as its focus the realization of that promise.

After publishing its initial Implementation Plan in August, CLIVAR invited nations to express their interests in participating in this 15-year programme. For this purpose, the

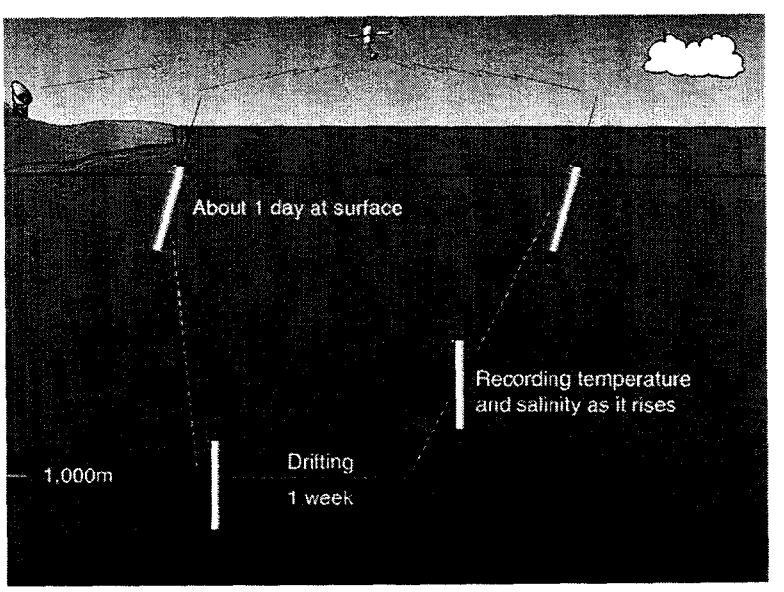


Fig. 1: PALACE (Profiling Autonomous LAgrangian Circulation Explorer) (courtesy of WOCE)

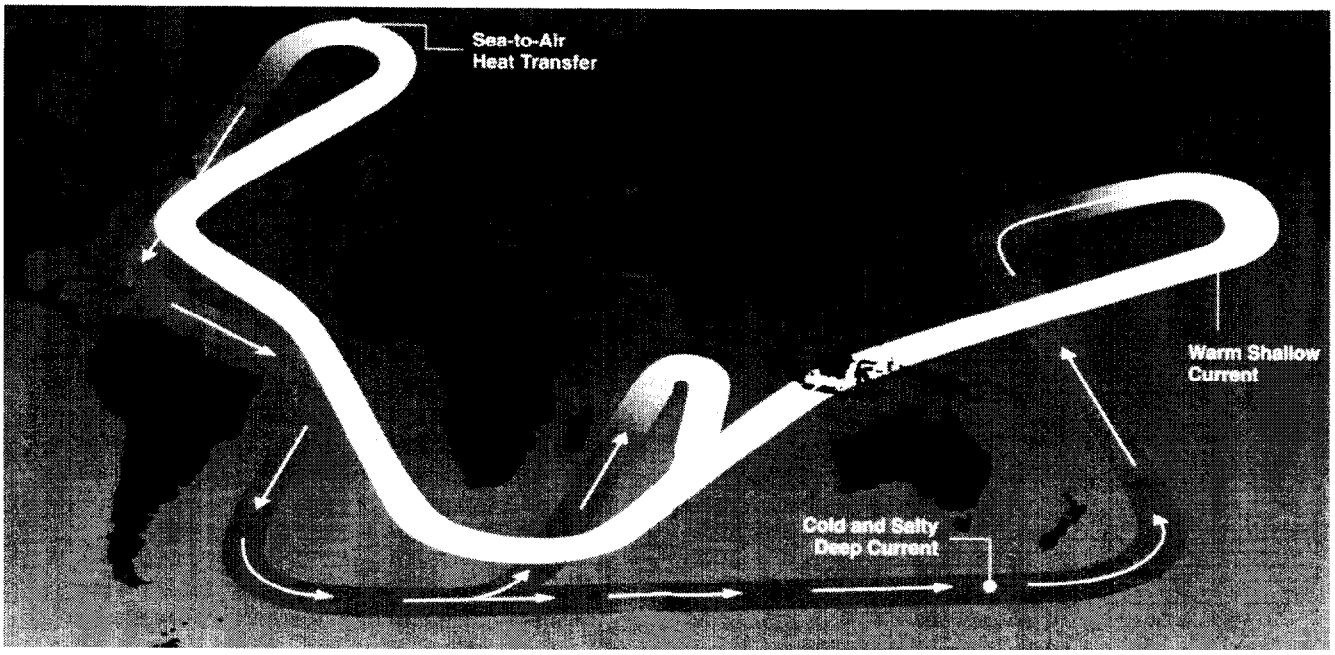


Fig. 2: Simplified Chart of the Thermohaline Circulation

IOC hosted the first International CLIVAR Conference at UNESCO Headquarters in Paris, December 2-4 1998. Some 250 scientists, policy makers and donors from 63 countries met to consider the implementation of CLIVAR and to present to the Conference the likely contributions they could make to CLIVAR. The CLIVAR Scientific Steering Group and its sub-Panels are now working to harness these national intentions so that the programme's objectives can be met. Countries have established national CLIVAR Committees and contact points as a first step to integrating the efforts from their contributing national institutions. These Committees also facilitate co-ordination with the international planning effort.

The Conference endorsed the overall scientific objectives of CLIVAR, which are to:

- Describe and understand the physical processes responsible for climate variability and predictability on seasonal, inter-annual, decadal and centennial time scales, through the collection and analysis of observations and the development and application of models of the climate system;
- Extend the record of climate variability over the time scales of interest, through the assembly of quality-controlled palaeoclimate and instrumental data;
- Extend the range and accuracy of seasonal to inter-annual climate prediction through the improvement of global and regional climate models;
- Understand and project the response of the climate system to increases of greenhouse gases and aerosols and to compare these projections with the observed climate record in order to detect any anthropogenic modification of the natural climate signal.

The Conference called on nations to make available the new resources required for conducting CLIVAR. It specifically called for the implementation of *"long-term, systematic climate observations, both space-based and* in-situ, *such as the Global Climate, Ocean and Terrestrial Observing Systems (GCOS/GOOS/GTOS), as are being advocated by the agencies collaborating in the Climate Agenda."*

Based on the experience of the last two decades, the participants reaffirmed that the timely investments by countries in monitoring and research of the climate system will certainly benefit their citizens and economies.

OCEAN OBSERVING PANEL FOR CLIMATE (OOPC)

During the past year, the OOPC focussed on the steps and organizational structure to convert the design of an ocean observing system into reality. Both the satellite and *in situ* measurement technologies have been developing rapidly. Several factors forced a revisit of the original observing system design for ocean climate published in the final report of the Ocean Observing System Development Panel (OOSDP) in March of 1995. These included: the spectacular performance of the TOPEX/POSEIDON altimeter, the vastly improved global wind fields provided by the NSCATT scatterometer and the increased lifetimes and reliability

WHY WCRP NEEDS IOC'S SUPPORT

by Professor Hartmut Grassl, WCRP Chairman

In 1993, the Intergovernmental Oceanographic Commission (IOC) of UNESCO became a co-sponsor of the World Climate Research Programme (WCRP), started in 1980 by the World Meteorological Organization (WMO) and the International Council for Science (ICSU)* as the research component of the World Climate Programme (WCP).

The success of WCRP is largely based on this unique structure, with one non-governmental and two intergovernmental organizations as real sponsors. This structure attracts the full scientific community to WCRP as well as many of the national meteorological, oceanographic and hydrological services. These are immediate users of the new scientific findings, based on improved observations and models. As the time-scales of interest in climate research are extended, the contribution of the oceanographic research and operational community to WCRP also increases, due to the longer memory of the oceans as compared to the atmosphere, and partly due to the influence of the ice-free land surface.

The new CLIVAR (Climate Variability and Predictability) project is an example of this. CLIVAR is much more than a continuation of TOGA (Tropical Ocean/Global Atmosphere) and WOCE (World Ocean Circulation Experiment). CLIVAR is the first scientific programme that aims to understand decadal and century time-scale climate variability as well as attributing causes to observed climate change.

The continued strong commitment of the co-sponsors to WCRP was shown by an agreement, in 1996, to increased financial contributions from IOC and ICSU in order for CLIVAR (Climate Variability and Predictability) to reach earlier relative shares for ICSU and to account for the increased involvement of the oceanographic community (upon request of the World Meteorological Congress XII). The attendance of 63 countries at the CLIVAR Conference, generously hosted by IOC at UNESCO Headquarters in Paris, 2-4 December 1998 also confirmed this commitment.

TOGA and WOCE successes were based mainly on new oceanographic research observation systems. But CLIVAR will need further additions in *near-real-time* ocean observations as well. Besides networks in tropical areas of the Atlantic (an enhanced PIRATA array) and the Indian Ocean, similar to the now operational TOGA-TAO Array in the Pacific, networks expanded to include mid- and high-latitude, sub-surface, near-real-time observations are a prerequisite for success. These oceanographic observations, which have nearly always started as research networks, will serve several purposes. They will lead to improved climate variability predictions, especially outside the strongly ENSO-affected areas; will permit "ocean weather forecasting" as foreseen in GODAE, improved medium-range weather forecasting, and will supply the outer boundary conditions for coastal process modelling and forecasting.

However, WCRP needs these observations to answer other major scientific questions as well, such as: how much anthropogenic carbon dioxide will the ocean absorb, where and when? Will the thermohaline circulation in the North Atlantic be slowed down or even stop due to human activities? How fast will sea level rise due to thermal expansion of seawater?

The important technology developments of the *Lagrangian drifter and satellite altimetry* during the WOCE era have turned earlier, expensive, dreams into feasible tasks. These are exciting and, in comparison to the meteorological networks, even cheaper on *a* per *observation basis*. Therefore, the decision by the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Buenos Aires last November (COP-4) may soon be implemented. That decision by COP-4 urges Parties *"to actively support national oceanographic observing systems to ensure that the elements of the Global Climate Observing System and Global Ocean Observing System networks in support of ocean climate observations are implemented..."*

** formerly called the International Council of Scientific Unions*

At the forthcoming Thirteenth World Meteorological Congress in May 1999, all three co-sponsors of WCRP will again be asked to confirm their Agreement on the joint conduct of WCRP. The financial contributions to the Joint Climate Research Fund are distributed in a proportion of about 75% (WMO), 15% (ICSU) and 10% (IOC). These contributions enable the Joint Planning Staff for WCRP, based at WMO, to co-ordinate five global projects, two major modelling groups and about 40 meetings of steering groups, workshops, conferences and panels *per* year. In comparison to expenditures for climate research in national programmes, these resources are only in the *per* mil range, even if we add the international project offices for all WCRP projects.

WCRP thanks IOC, a *real* sponsor

of profiling floats. This successful and timely exercise resulted in modification of several of that report's recommendations and priorities. It also provided the basis for a course of action to develop an OOPC Implementation Plan starting with sections for a Surface and Marine Data Sub-Programme, and for a special set of permanent moored surface reference sites.

Because of the rapid progress in implementing ocean observations, scientists and agencies involved with CLIVAR, GOOS, GCOS, GODAE and other programmes felt that it would be valuable to schedule an Ocean Observations for Climate Conference in 1999. With an underlying motive of consensus building for the minimum observing system, the Conference would aim to define the mix of measurements, as well as the data management and modelling activities needed to meet the goals of climate programmes such as CLIVAR, GCOS and GOOS.

Planning for the Conference moved swiftly, generating an enthusiastic response from both the scientific community and potential sponsors. After inter-agencies consultations, the Conference was scheduled for 18-22 October 1999 in Saint Raphael, France. The OOPC and the Upper Ocean Panel (UOP) of CLIVAR agreed to act as co-convenors and adopted the title *OCEAN OBS 99* for the Conference.

On another front, OOPC joined the GCOS-led effort to assist IACCA in preparing a report on The Adequacy of the Global Observing Systems. This invitation offered one-time opportunity to raise the observing system issue at the highest levels of governments and under the global spotlight. Providing a solid scientific and technical contribution to the OOPC report, IOC ensured that the oceanographic requirements were fully incorporated. This work was central to underpinning the key conclusions and recommendations adopted by COP-4 in Buenos Aires (see also GOOS).

GLOBAL OCEAN DATA ASSIMILATION EXPERIMENT (GODAE)

The Global Ocean Data Assimilation Experiment, which began as an OOPC initiative, has rapidly evolved into an experimental project. It has established its own organizational structure consisting of "Patrons", and "Partners". A GODAE Scientific Steering Team is in place that has already produced a proposal for ARGO (Array for Real-Time Geostrophic Oceanography), a global array of 3000 profiling floats. The design of ARGO design will satisfy the upper ocean requirements of both CLIVAR and GODAE and will eventually become a part of GOOS.

OCEAN CO_2 (JGOFS)

The main efforts of the Joint IOC-JGOFS Advisory Panel on Ocean CO_2 were confined to participating in the organization of the 2nd International Symposium on Ocean CO_2 held in Tsukuba, Japan, 16-22 January 1999 and preparing scientific papers for the symposium. Like WOCE, JGOFS has completed its field phase. Its main efforts are now shifting into data analysis. This shift raises the need to reconsider the Panel's terms of reference, which currently focus on the completed task of obtaining a coherent global data set on ocean CO_2. It is planned to negotiate new terms of reference with SCOR and JGOFS and to appoint a new membership with expertise consistent with a new focus for the Ocean CO_2 Panel. In this context, the IOC has new ocean CO_2 interests as well. Such a Panel can assist GOOS in establishing ocean CO_2 observational requirements and can provide a ready source of expertise to IOC on issues that are of increasing concern such as the sequestering of CO_2 in the deep ocean.

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

Today, after almost two decades of evolution, the Ocean Science in Relation to Living Marine Resources Programme has several research and observational components. These include: the Harmful Algal Bloom Programme, Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB), a new international initiative - the Copenhagen and Vigo Centres, the Living Marine Resource Module of GOOS, the Global Coral Reef Monitoring Network and the South Asia Coral Reef project. The last two are also being developed for GOOS.

HARMFUL ALGAL BLOOM PROGRAMME (HAB)

Despite the large body of information available on harmful algal blooms and blooms of other microalgae, little is known about the mechanism controlling the dynamics of individual species or the hydrographic or ecological conditions which result in massive blooms of species. Such blooms may consist of toxic species that kill fish, contaminate seafood and adversely affect human health. Or they may be composed of non-toxic species that disrupt the ecosystem by depleting oxygen during bloom decay or that degrade recreation areas by producing mucilage.

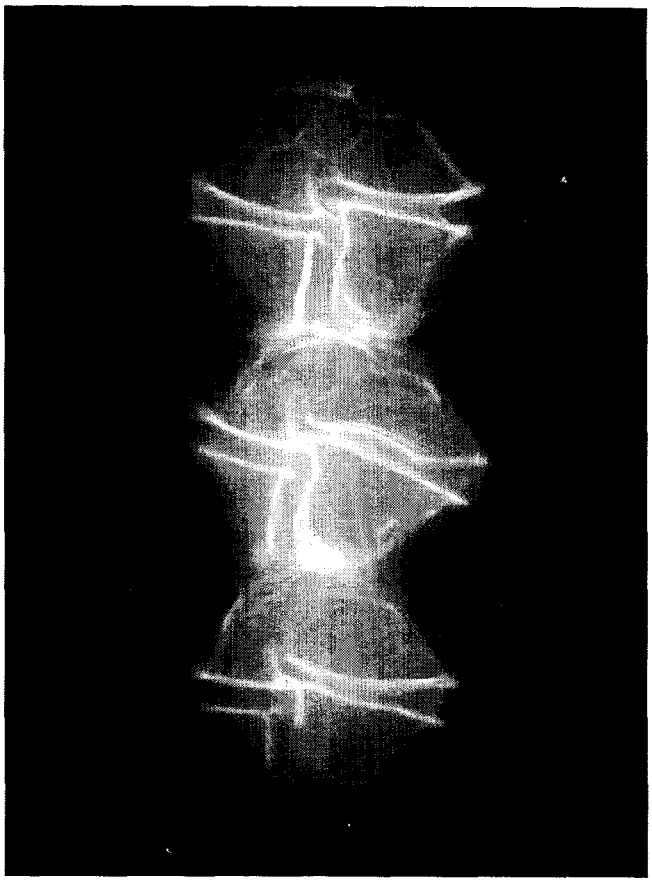


Fig. 3: Results of 'training-through-research' projects are often very concrete as in the case of the HABViet Project where new records of potentially harmful species are made and may influence future monitoring practices and management decisions. The light micrograph shows the first record from Vietnamese waters of the toxic dinoflagellate *Alexandrium tamiyavanichi* (Photo by Nguyen Ngoc Lam)

A co-ordinated, international programme on the ecology and oceanography of blooms was needed in order to understand their causes and to be able to predict when they will occur. SCOR and IOC jointly sponsored a workshop in October 1998, which drafted a plan to establish the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) Programme. This programme will co-ordinate an international co-operative research effort on harmful algae in the context of the ecological systems and oceanographic processes that influence them. The GEOHAB Programme was endorsed by SCOR in November and by the Thirty-first Session of the IOC Executive Council.

The IOC Centre in Copenhagen acts as co-ordinator between the complementary IOC centres on HAB in Copenhagen, Vigo and the WESTPAC/HAB focal point at the University of Tokyo, Japan. The co-operation, planning and implementation of activities works well and the synergetic effect of the complementary centres is significant. The centres exchange experience, training materials and advice on a regular basis and assist each other as required.

In addition to the courses and workshops offered by the two Centres at Copenhagen and Vigo, an Advanced Phytoplankton Course was organized and offered by the Stazione Zoologica A. Dorhn in Napoli from 10-30 May 1998.

LIVING MARINE RESOURCES MODULE OF GOOS (LMR-GOOS)

The re-structured LMR Panel of GOOS was appointed and held its first session in March 1998 under the chairmanship of Warren Wooster. The Panel agreed that to detect patterns and trends of living marine resources, systematic measurements of marine ecosystems and processes that affect them are required. An elaboration of key ecosystem components and conditions for which information is required was summarized. The Panel also identified the minimum basic monitoring products that are required at the global scale. Additional products can be added as appropriate, depending upon regional conditions and needs. The Panel also agreed to undertake a series of studies, called "retrospective experiments" in areas where drastic regime shifts in key resource population have occurred, with the objective of predicting the extent to which changes might have been identified from the ancillary ecosystemic measurement programme that was in place. The report on the first session of the Panel has been published as IOC Workshop Series 146.

THE IOC COPENHAGEN AND VIGO SCIENCE AND COMMUNICATION CENTRES ON HARMFUL ALGAE

These two Centres were established to provide assistance in training, capacity building and dissemination of information to developing countries with respect to harmful algae. Their activities are co-ordinated.

The **Copenhagen Centre** was established in 1995 and is sponsored by DANIDA, University of Copenhagen, the Danish Ministry of Environment, The Danish Ministry of Fisheries and IOC. It is located at the University of Copenhagen. In 1998, the Centre was involved in the organization of three courses at which forty five scientists received training in identification of harmful algal species, culture techniques, quantitative and qualitative assessments, planning of monitoring programmes and management of harmful algae blooms. The courses were:

- Fifth IOC-DANIDA Course on the Biology and Taxonomy of Harmful Marine Microalgae. University of Copenhagen, 23 July to 5 August 1998.
- NORFA-IOC Course on Harmful Algae in the Baltic Sea. Vortsijarv Limnological Station, Estonia.
- IOC-DANIDA Training Course. Institute of Oceanography, Nhatrang, Viet Nam, 9-16 November 1998.

Staff from the Centre has continued their close co-operation with colleagues from Viet Nam (Fig. 3). A Guide is being prepared for the identification of harmful microalgae in Vietnamese waters. Two Vietnamese scientists working under supervision at the Centre received their M.Sc. degrees from the University of Copenhagen. The Centre helped to organize and participated in the workshop that led to a plan for a co-ordinated international research programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB).

The Centre is compiling a bibliographic database on harmful algae consistent with the guidelines of Aquatic Sciences and Fisheries Abstracts of FAO, UNEP and IOC. It also provides literature searches to libraries and researchers in developing countries. The Centre helped plan and participated in a European Commission Workshop on Harmful Algal Blooms which led to the preparation of a science plan for harmful algal blooms research and training in the European Union.

The **Vigo Centre** was established in 1996 and is located at the Instituto Español de Oceanografía (IEO). It is sponsored by the Spanish Ministry of Foreign Affairs, the Instituto de Cooperación Iberoamericana, IEO and IOC. The Centre's major interests are training in toxin chemistry and the ecological aspects of algal blooms. It co-operates especially with research institutions in Latin America.

The Centre was involved in two training courses and meetings, one on toxic phytoplankton and the other on harmful algae in the Caribbean Sea:

- Toxic Phytoplankton, Vigo, Spain, 1-12 June 1998.
- First meeting of the IOCARIBE-ANCA Working Meeting on Harmful Algae in the Caribbean Sea and Adjacent Regions, Havana, Cuba, 29 June to 1 July 1998 (organizational support).

A representative from the Centre participated in discussions at the Hague on Organization of the Prohibition of Chemical Weapons regarding handling and legislation for saxitoxin. The Centre's personnel contributed to the development of the Harmful Algae Events Database (HAEDAT) in conjunction with the ICES/IOC Working Group on Harmful Algal Bloom Dynamics. It collaborated with the Task Team on Aquatic Biotoxins in the updating and publication of IOC Manuals and Guides on Aquatic Biotoxins for diarrhetic, amnesic and paralytic shellfish poisoning. In collaboration with WESTPAC a CD-ROM was produced showing illustrations of harmful algae species. Harmful Algal Newsletter numbers 17 and 18 were published.

GLOBAL CORAL REEF MONITORING NETWORK (GCRMN)

The GCRMN is a partnership of people, governments, agencies and institutions whose objective is to assess the status and trends in coral reefs around the world. The approach is to raise awareness on reef status by involving all stakeholders – communities, volunteers, governments and scientists (Fig. 4).

Four assessment techniques are used:

- Rapid assessment by volunteers and communities using simple but reproducible methods (Reef Check methodology, (see below);
- Government-level monitoring of corals and fishes using GCRMN methods;
- Scientific monitoring by active coral reef scientists; and
- Social, cultural and economic assessments of coral reef user communities using methods currently in development.

Globally the status of reefs varies from essentially undisturbed to those that are heavily impacted by human activities. It has been estimated that 58% of the world's reefs are potentially threatened by coastal development, over-fishing, pollution and run off.

The GCRMN functions through independent Nodes within UNEP regional seas areas. The developing Nodes (about sixteen in all) form a global network to produce annual reports on reef status through the Global Co-ordinator, Clive Wilkinson. Although most regions are monitoring reefs, organized regional Nodes are in varying states of development. The South Asia Node, (India, Maldives, Sri Lanka) supported by funds from the U.K., is functional as are two others: (i) the Western Indian Ocean Islands (Comoros, Madagascar, Mauritius, Reunion and the Seychelles) with assistance from Indian Ocean Commission and the European Union, and (ii) the East African region where Kenya, Tanzania, Mozambique, South Africa and Somalia are co-operating in reef monitoring. Proposals have been submitted to support the latter two Nodes.

The GCRMN was heavily involved in the "International Tropical Marine Ecosystems Symposium" sponsored by ICRI, where it sponsored a session on the regional conditions of coral reefs and presented the report *Status of Coral Reefs of the World: 1998*. The Global Co-ordinator (Clive Wilkinson), the Chairman of the Science and Technology Committee (Bernard Salvat) and the South Asia Regional Co-ordinator (Jason Rubens) made presentations at Plenary and Working Group Sessions.

There were several other significant events in the GCRMN Programme this year.

- The World Bank has agreed to join with IOC, UNEP, IUCN in co-sponsoring GCRMN. GCRMN and Reef Check - co-ordinated by Gregor Hodgson, (Institute for Environment and Sustainable Development, Hong Kong University of Science and Technology) - entered into a collaboration in their reef monitoring programmes. Reef Check methodology is directed at detecting effects of humans on coral reef ecosystems and the two programmes complement each other.
- The GCRMN produced *Status of the Coral Reefs of the World: 1998*, a 200-page book containing status reports from all regions and a summary of recent coral bleaching.
- The new Chairperson of the Science and Technology Committee is Edgardo Gomez, who replaced retiring Bernard Salvat. The Secretariat of the International Coral Reef Initiative (ICRI), the sponsoring organization of GCRMN is now hosted by France which succeeded Australia.

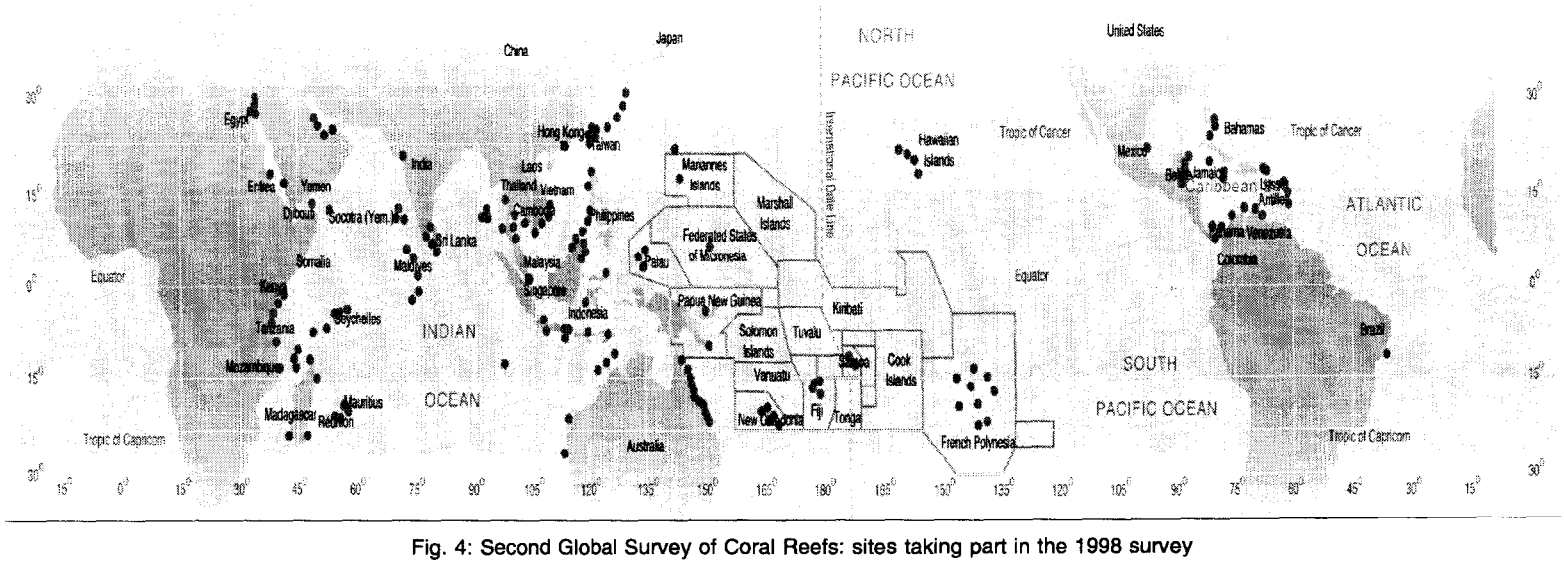


Fig. 4: Second Global Survey of Coral Reefs: sites taking part in the 1998 survey

GLOBAL OCEAN ECOSYSTEM DYNAMICS PROGRAMME (GLOBEC)

The First Open Science Meeting of the GLOBEC Programme, which IOC co-sponsors, was hosted by the IOC at UNESCO Headquarters in March 1998. The draft of the implementation plan was presented and discussed at plenary and workshop sessions. In addition, there were sessions on GLOBEC regional and national programmes. Over 200 scientists from 40 countries attended the four-day meeting.

LARGE MARINE ECOSYSTEMS (LME)

The second session of the Consultative Meeting on LME was held in UNESCO, in March 1998. Several regional monitoring and assessments projects were discussed. Two LME projects, Yellow Sea and Gulf of Guinea, are in progress and several others are in various stages of development. The meeting was attended by 17 participants from 10 countries.

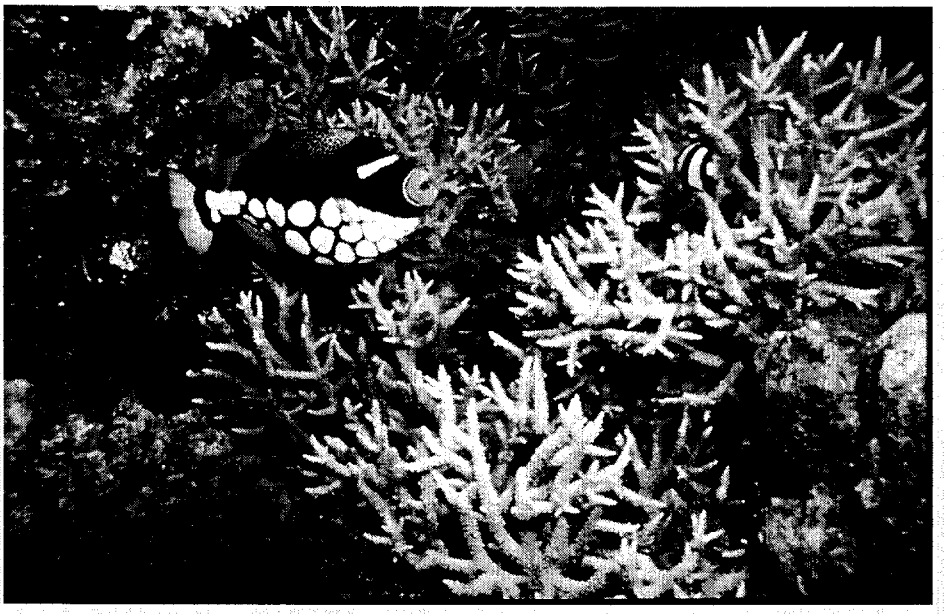


Fig. 5: Clown Triggerfish (*Balistides conspicullum*) surrounded by bleached corals (*Acropora sp.*) during severe coral bleaching in Maldives in May 1998. (Photo by Arjan Rajasuriya)

Coral reefs have recently been affected by mass bleaching during 1997-1998 coinciding with a large El Niño event. Reports of bleaching from the tropical oceans of the world suggest that it has been the most geographically extensive ever recorded. The effects ranged from catastrophic bleaching accompanied by mass mortality of corals in several regions to severe bleaching with a mix of recoveries in some reefs to finally, in large areas, no bleaching. Bleaching results from the loss of symbiotic algae and/or pigment of the algae such that the coral assumes a clear white colour. Frequently corals recover from bleaching but mortality may result if the bleaching is extreme or prolonged.

Some boulder corals estimated to be several hundred years old have died. Branching, fast growing corals have been especially susceptible to bleaching. Recovery may be slow and there could be changes in coral communities, either of which, in the short term, could adversely affect those communities that depend on reefs, either for their direct livelihood or indirectly through the loss of tourist income. Continued monitoring and observations are essential to document when and how bleached reefs will recover and to determine whether this is a rare event or part of a pattern of increasing disturbance associated with global climate change.

SIR ALISTER HARDY FOUNDATION FOR OCEAN SCIENCES (SAHFOS)

The tow routes of the Continuous Plankton Recorder (CPR) survey were maintained in the North Atlantic and new trial routes put in place in the Baltic Sea, Mediterranean Sea and Pacific Ocean. The development of new instruments such as electromagnetic flow meters, self logging temperature sensors and microplankton samplers are newly developed technologies that can be added to CPR.

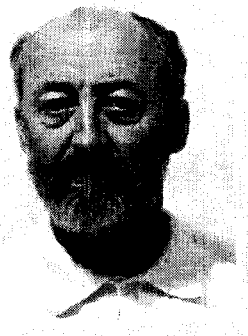
OTHER OSLR ACTIVITIES

IOC supported the Third International Seagrass Biology Workshop, which considered issues of sustainable management of seagrass resources. One of the events during the workshop was the formation of the World Seagrass Association and the launching of the World Seagrass Directory. The Workshop was held in the Philippines, 19-26 April 1998.

To develop common efforts on marine biodiversity, meetings and informal planning sessions have taken place with the DIVERSITAS Programme.

THE GLOBAL CORAL REEF MONITORING NETWORK

By Clive Wilkinson, GCRMN Co-ordinator and Editor of Status of Coral Reefs of the World: 1998



The divers came out of the water and excitedly started discussing the condition of the reef near Cancun, Mexico in terms of percent coral cover with Dr Judy Lang of the University of Texas. They were also surprised to note that there was a high proportion of recently dead corals after the extensive bleaching event. This was a complete change from the language they had used to describe the reefs before they received their first training in coral reef monitoring as part of Reef Check monitoring in 1998. After this, they would continue to spread the word about the status of coral reefs and the need for monitoring.

This anecdote illustrates the second major objective of the Global Coral Reef Monitoring Network (GCRMN) – that of raising awareness about the status of coral reefs around the world and spreading an understanding of the increasing threats to the very existence of such reefs in many parts of the world. With this increased awareness amongst all stakeholders (from the subsistence fisher to the senior government official), and armed with valid data on the status of reefs across the world (the primary objective), it will be possible to implement the necessary changes in human behaviour to reduce and hopefully remove completely many of the human-induced stresses that are currently damaging reefs around the world.

The GCRMN is an operational component of the International Coral Reef Initiative that aims to establish coral reef monitoring at selected reference sites in the over 140 tropical countries and states that have coral reefs. These should all perform annual monitoring of the status of the corals and the populations of fishes and other resources as a contribution to their fulfilment of the Chapter 17 of Agenda 21 – the Rio Convention and as a means of providing data for annual State of the Environment reporting.

In parallel it is planned to have thousands of communities in these countries go out and assess the status of their adjacent reefs using less detailed methods, that have been developed by Reef Check out of the Hong Kong University of Science and Technology. Our goal is to replicate what has already been achieved for birds with thousands of volunteers providing data, although reefs are more difficult because only a small area can be observed at a time.

Every two years the GCRMN will publish the Status of the Coral Reefs of the World that will serve as the report card measuring our success at conserving coral reefs. We need to do this because reefs contain immense resources of biodiversity, and particularly because millions of people in tropical countries rely on reef resources (food, building materials, cultural objects, and income from tourism) in their daily lives. We also need to conserve reefs as a demonstration of our commitment to conserving the natural heritage of the world.

The GCRMN has been greatly assisted by the Intergovernmental Oceanographic Commission in getting started, and in return we will provide data on the status and trends in coral reefs as a component of the Global Ocean Observing System.

1.3 Ocean Science in relation to non-Living Resources

Based on the recommendations of the Nineteenth Assembly of IOC in 1997, the OSNLR Consultative Meeting which was held in December 1997 provided follow-up to the Coastal Change Conference, Bordeaux, 1995. The activities of OSNLR in 1998 consisted mainly of: (i) an Informal Consultative Meeting to develop the OSNLR Research Modules on Deep Sea and UNCLOS; (ii) ICM related Meetings for examining the Experiences and possible contributions from IOC in the implementation of Chapter 17 of Agenda 21; and (iii) a training course on Marine Environmental Conservation in the IOC-WESTPAC Region.

OSNLR INFORMAL CONSULTATIVE MEETING ON DEEP SEA MODULES AND UNCLOS

As a follow-up to the recommendation made during the OSNLR Consultative Meeting (Resolution XIX-2) of the Nineteenth Assembly of the IOC, an Informal Consultative Meeting for OSNLR Modules on Deep Sea and UNCLOS was held on 27 January 1998 in Monaco. The following are some of the discussion points and conclusions.

- A more interdisciplinary approach should be adopted to study the processes of the seafloor including: (i) chimney zone in the back-fore arc, (ii) hydrate zone on the slope, and (iii) polymetallic crust on the bank; with a focus on bio-zonation of the Ocean. Swath mapping provides a good tool in this respect;
- IOC, through its Ocean Science Programme, should help SIDS in sea-level rise monitoring and coastal management assessment of resources and hazards. Training is necessary particularly in the South Pacific and the Indian Ocean, and should be carried out in co-operation with WESTPAC and SOPAC;
- Concerning the Ocean Drilling Project, it was recommended that IOC should continue its effort in helping scientists from developing countries to participate in the project. Japan is launching a new phase of ODP, which may provide an opportunity for the IOC to involve developing countries;
- It was recommended that IOC should be prepared to help developing countries, at their request, in their efforts to define the outer edge of the continental margin and on the submission of claims on continental shelf beyond 200 nautical miles.
- For UNCLOS-related work in OSNLR, assessment of existing data in terms of science and technology inputs, should be given priority during 1998-1999. This could be done as a co-operative effort of IOC and IHO.

SECOND IOC/KOICA/KORDI TRAINING COURSE ON MARINE ENVIRONMENTAL CONSERVATION FOR THE MARINE SCIENTIST IN THE WESTPAC REGION

This second training course was jointly organized by the IOC Secretariat and the Korean International Co-operation Agency (KOICA), with the Assistance of the Korea Ocean Research and Development Institute (KORDI), for the benefit of marine scientists from the IOC-WESTPAC region. The course was held from 18 to 31 October 1998 at the Campus of KORDI, Ansan City, and at its Jangmok Marine Station in Koje island in the Southern Coast of the Republic of Korea. Sixteen trainees from six countries of the region participated. The training course for this year was focused on the problems of coastal environment related to the presence of trace metal in the coastal water and bottom sediments in particular. The participants had the opportunity to gain experience in handling sophisticated surveying equipment and instruments such as Seabeam-2000 Multibeam Ecosounder, Multi-channel Seismic Profiler, Deeptow sidescan sonar, Piston corer and Box corer on board the Korean *R.V. ONNURI*. During the course, they also participated in a field excursion to a coastal area of the Eastern Yellow Sea and to visit relevant universities and research institutes.

1.4 Ocean Mapping

At present IOC contributions to the Ocean Mapping activities fall within three categories:

- GEBCO
- GAPA
- Regional Ocean Mapping projects.

GENERAL BATHYMETRIC CHART OF THE OCEANS (GEBCO)

Major achievements of GEBCO over the past years have been the digitization of the contours of the fifth edition and preparation of the *GEBCO Digital Atlas*. The *GEBCO Digital Atlas (GDA)* is now available on CD-ROM. This provides the results of interpretative contouring in a computer-compatible form so that they can be widely used and flexibly manipulated. This initial success can only be maintained if the GDA is updated regularly – a two-year interval has been proposed between updates. The second edition was printed in January 1997. 860 copies of the GDA have been distributed so far in 77 countries.

Work has continued on the "GEBCO Guidelines". The final part (of the initial planned contents) "Digital Bathymetric Data (Multibeam Echo-Sounders)" was approved by the Joint IOC-IHO Guiding Committee for GEBCO.

In addition to the increasingly fine resolution requirements of marine geologists and geophysicists, there is an increasing demand for an authoritative and global description of the bathymetry of the world's oceans from physical and chemical oceanographers, who are involved in modelling the ocean environment and predicting changes in global circulation. Operational ocean observations, as anticipated in the Global Ocean Observing System (GOOS) will require a secure framework of global bathymetry. For this purpose a gridded data set is clearly needed, so a Task Team of Experts has been set up to conduct a study of the requirement and how it might be achieved.

The Eleventh Meeting of the GEBCO Officers took place in March 1998 in Wellington, New Zealand. The Seventeenth Session of the GEBCO Guiding Committee is planned to take place in June 1999 in the offices of the Geological Survey of Canada (Atlantic), Dartmouth, Nova Scotia, Canada.

INTERNATIONAL GEOLOGICAL/ GEOPHYSICAL ATLAS OF THE ATLANTIC AND PACIFIC OCEANS (GAPA)

GAPA is another IOC endeavour in Ocean Mapping. The Atlantic Ocean Atlas was published in 1991 and has now been widely distributed to contributors and to IOC Depository Centres. The companion atlas for the Pacific Ocean has now reached the cartographic drawing, editing and printing stages; compilation work is complete.

Under contract from the Houston Advanced Research Centre (HARC), the Russian Mapping Production Association "Kartografia" is expected to release the atlas to the end 1999 or early 2000.

REGIONAL OCEAN MAPPING PROJECTS

International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series (IBCM)

The Seventh Session of the IOC Editorial Board for IBCM took place in Dubrovnik, Croatia, 2-4 June 1998, during the 36th Congress of ICSEM. There has been progress in the Geological/Geophysical Series within which the *Unconsolidated Sea-bed Surface Sediment Chart* was printed in 1998 and approved by the Editorial Board. It is presently available to users and more than 200 requests from scientists from different countries of the world have been received during 1998.

The 1:5 000 000 scale version was printed in October 1998 by the Geological Survey of Israel and is available too. In addition two supporting volumes *The Magnetic Anomalies of the Mediterranean Sea* (IBCM-M) and *the Bouguer Gravity Map of the Mediterranean Sea* (IBCM-G) were printed at the end of 1998 under the IOC-UNESCO logo. The colour proof of the *Magnetic Anomalies Chart*, the last in the Geological/Geophysical series of IBCM, is being prepared by the Head Department of Navigation and Oceanography of the Russian Navy and needs to be approved by the Editorial Board for printing. The Eighth Session of the Editorial Board is planned to take place in Kaliningrad, Russian Federation, in 1999.

A second edition of the IBCM is planned for publication after completion of the five Geological/Geophysical Series. At present, a full cover of 1:250 000 plotting sheets for the region is being maintained by a network of Hydrographic Offices.

International Bathymetric Chart of the Central Eastern Atlantic (IBCEA, 1990)

The First Meeting of the Editorial Board for IBCEA was held in Lagos, Nigeria, in February 1990. Due to shortage of funds in 1992, the Second Session was postponed to a later date; it took place in Paris in September 1996.

In spite of a lot of difficulties, significant progress was achieved within this project as follows:

- Sheet 8: The colour proof has been approved since the last status report from the Portuguese Hydrographic

Service. The sheet was accepted and is now on the stage of printing.
- Sheet 6: Compilation sheets at scale 1:250 0000 and 1:500.000 were completed. The colour proof is under preparation. The colour proof will be sent to members of the Editorial Board in the course of March 1999.
- Sheets 10, 11 and 12: Large amounts of data have been received for these sheets from SISMER. The toponyms introduced in the sheets which do not appear in the IHO Gazetteer will be submitted for approval to SCUFN.
- Sheets 4 and 5: These two charts will be sent by the Southampton Oceanographic Centre (UK) to the Editorial Board.

International Bathymetric Chart of the Western Indian Ocean (IBCWIO, 1989)

The Sheet Assembly Diagram for IBCWIO has been modified and now consists of 21 sheets (Fig. 6). In accordance with the revised Terms of Reference (EB-IBCWIO-IV, RSA 1997), significant progress was achieved in 1998. The data collection has been completed and is now available for scientific reviewers.

Paper sheets and CD have already been sent to the voluntary contributors in the region. The National Geophysical Data Center (NGDC) USA, has already published new data available through Internet and a special page for IBCWIO is opened in NGDC homepage. Technical assistance and support to developing countries which are not in a position to use this information directly has been provided by IOC. The actual progress of IBCWIO is summarized below:
- Sheets N° 04 and 07 are ready for publication. The printing is planned in the beginning of 1999 by the Hydrographic Survey of Germany;
- The draft of Sheet n°19 is ready and submitted to scientific reviewers. It is planned to be printed in May 1999.

The Fifth Session of the IOC Editorial Board for IBCWIO is planned to be hosted by the Hydrographic and Topographic Brigade of Seychelles in Victoria, in December 1999.

International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA)

The Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (EB-IBCCA-VII) took place in Aguascalientes, Mexico, in November 1998. Ms. G. Lopez Chavez, Director of INEGI, chaired the meeting. The following countries were represented: Cuba, Colombia, Costa Rica, France, Russia, USA. Dr. D. Travin and M. Huet represented the IOC Secretariat and the IHO, respectively. The actual progress of the IBCCA project is summarized hereafter on a diagram (Fig. 7):
- Sheets 1.04 and 1.09 have been printed. Copies are available to users.
- Sheets 1.01, 1.02, 1.03, 1.08, 1.11 and 1.15 have been fully digitized. Editing of several of them is in progress at INEGI. Printing of the above-mentioned sheets has been delayed due to internal printing problems at INEGI which, hopefully, will be overcome shortly.
- Remaining sheets are in various stages of compilation or digitization.

The meeting agreed that all IBCCA data currently available in digital form would be assembled on a CD-ROM to be presented at the next meeting of CGOM (Consultative Group on Ocean Mapping) to be held in April 1999. This CD could be the prototype of a future IBCCA Digital Atlas.

Production programme of IBCEA sheets attributed to France (SHOM)

Number of Sheet	*Expected preparation date**	*Dispatch for validation*	*Return from validation/ Start of publication*	*Printing*
Sheet 6		01.04.1999	01.07.1999	01.11.1999
Sheet 8			01.08.1998	01.04.1999
Sheet 9		01.05.1999	01.08.1999	01.12.1999
Sheet 10	01.04.1999	01.07.1999	01.10.1999	01.02.2000
Sheet 11	01.06.1999	01.10.1999	01.01.2000	01.05.2000
Sheet 12	01.09.1999	01.01.2000	01.04.2000	01.09.2000

** Corresponds to the latest date of new data taken into account*

The Editorial Board agreed that the following three maps of Geological/Geophysical Series at scale 1:1 million should be produced: magnetic anomalies, gravity anomalies and seismicity. They will be based on the bathymetric series, similarly to the IBCM. The Eighth Session of the IOC Editorial Board for IBCCA is planned in September 2000 at the National Geophysical Data Center (NGDC), Boulder, Colorado, USA.

International Bathymetric Chart for the Western Pacific (IBCWP)

The IBCWP data base, data catalogue, standardization and data quality control have been established. The Editorial Board agreed that all countries should submit their data catalogues to the Chief Editor, who is responsible to finalize the catalogue and make it available to all countries and the GEBCO permanent secretariat. The meeting agreed to use the bathymetric chart of the Mediterranean as a model for the IBCWP project.

Due to the importance of wider participation in IBCWP, the meeting discussed the participation of more countries and organizations; the necessity of conducting a training course and provision of appropriate financial support. The representative of NGDC/USA informed the meeting that his organization would be interested in hosting a training course for IBCWP.

The progress made in sub-regions

In 1998, **Russia**, responsible for the first sub-region, plans to compile two plotting sheets at scale of 1:500,000 covering another half of 1-14. Russia will present to the Chief Editor copies of charts for approval as these become available.

Japan, the responsible country for the second sub-region, reported that it will produce the charts by digital methods, but the development of the digital bathymetric charting system has not yet been completed.

China is responsible for the third sub-region, having completed 27 sheets at scale of 1:500,000 covering the South China Sea. According to the IBCWP implementation plan discussed at the Second Session of its Editorial Board, China plans to complete the following work before the next session:

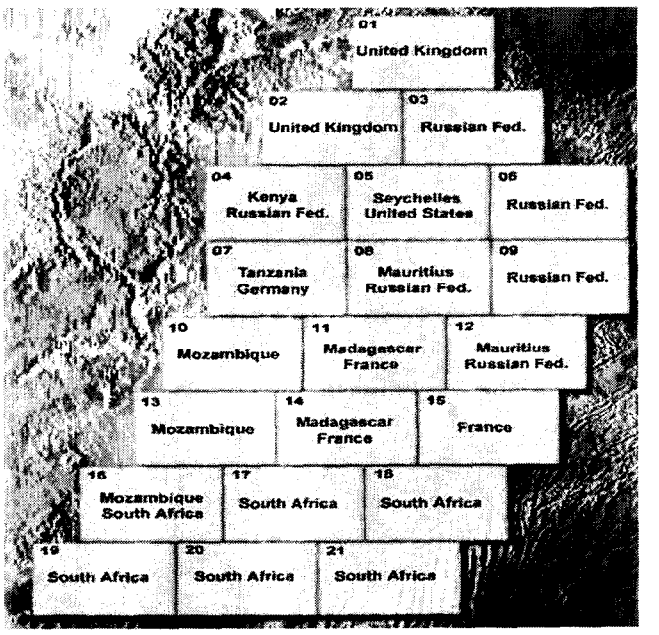


Fig. 6: International Bathymetric Chart of the Western Indian Ocean (IBCWIO)

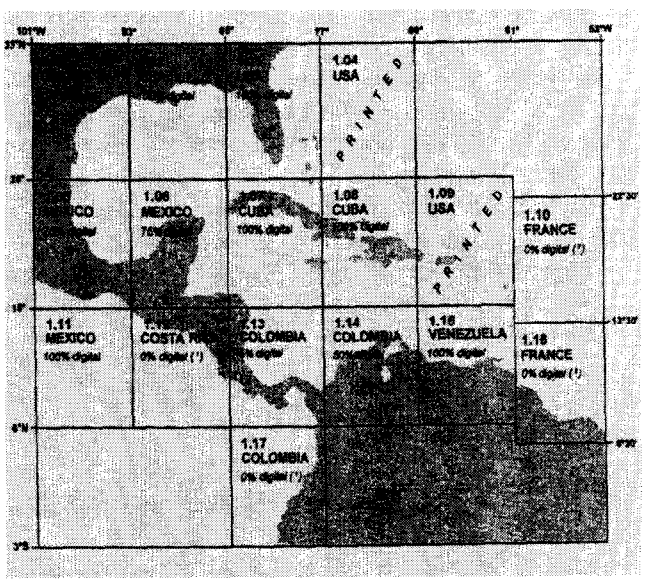


Fig. 7: International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA). Status of production: November 1998

- Compile 5 sheets of charts at scale of 1:1,000,000 (3-6, 3-7, 3-11, 3-12, 3-16) and complete their color proofs;
- Compile in co-operation with Korea the sheet of 2-8 at scale of 1: 1,000,000, complete the compilation sheet;
- Compile in co-operation with Japan the sheet of 211 at scale of 1:1,000,000, complete the compilation sheet.

Malaysia has continued its efforts in the compilation of two sheets at scale of 1:1,000,000 for areas 3-16 and 3-17, and is now continuing to gather the data sources.

Concerning the **Philippines**, it was decided to elevate the status of their participation in the IBCWP to that of a producing country. As an initial activity, they have started the preparation work on sheet 312.

Australia is responsible for the fourth sub-region. Their compilation of bathymetric maps should concentrate on the Tasmanian region (roughly coinciding with standard sheets 4-10, 4-12 and 4-14). They have collected some new and additional data sets for inclusion in the chart compilations and over 20,000 kms of sea beam and 2000 multibeam data. They expect to have the Tasmania and South Tasman Rise draft charts in 1999.

SOPAC has agreed to join the IOC Editorial Board for IBCWP and Thailand would volunteer to be a member of the IBCWP project at the level of a producing country if they can obtain funding.

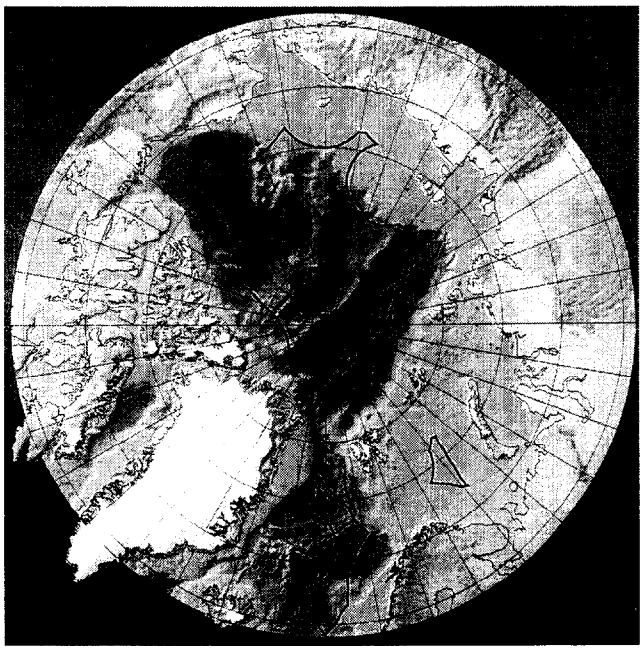


Fig. 8: International Bathymetric Chart of the Arctic Ocean (IBCAO) High Seas (patterned) and approximate limits of Zones of National Interest (ZNIs) north of 64N

International Bathymetric Chart of the Arctic Ocean (IBCAO)

The First Meeting of the IOC/IASC/IHO Editorial Board for the International Bathymetric Chart of the Arctic Ocean (IBCAO), a new regional project, took place in Copenhagen in October 1998. Mr. Ron Macnab, Geological Survey of Canada and Mr. Arne Nielsen, Danish Navigation and Hydrography Administration, chaired the meeting. The Member States involved in the project are Canada, Denmark, Germany, Iceland, Norway, Russian Federation and United States. Twenty delegates from marine geological institutes, submarine laboratories and hydrographic offices participated in the meeting.

The database would comprise a Digital Database containing original sounding whether point, profile or swath, but which had been released into the public domain. Analogue observations will be converted into digital. The operating methods and structure of the database would be considered further. Observations from within the EEZs of States will be stored in a separate database. The third database could incorporate digital contours from existing contour maps. The main product envisaged would be a grid of depth values covering the entire project area. Additional products such as digital terrain models, profiles and contours may also be compiled where needed. The grid size and methodology would be investigated early 1999. The responsibility for the co-ordination for the high seas portion of the project would be as follows (Fig. 8):

- Arctic Ocean: Canada, Russian Federation, USA
- Norwegian and Barents Sea: Denmark, Iceland, Norway, Russian Federation

The Second Meeting of the IOC/IASC/IHO Editorial Board for IBCAO is planned in Monaco in October 1999.

1.5 Marine Pollution Research and Monitoring

GLOBAL INVESTIGATION OF THE POLLUTION IN THE MARINE EMVIRONMENT (GIPME)

According to Resolution XIX-4 of the Nineteenth IOC Assembly, a GIPME Expert Scientific Advisory Group (GESAG) is to be established. GESAG is to undertake further developments and implementation of the GIPME Programme. In agreement with UNEP, the IOC-UNEP Intergovernmental Panel for GIPME has been abolished and the regional responsibilities of the Panel are assigned to GESAG. Resolution XIX-4 further specifies that the members of GESAG should comprise the Chairman and Vice-Chairman of GIPME and the present chairmen of the three Expert Groups (the Group of Experts on Methods, Standards and Intercalibration (GEMSI), the Group of Experts on the Effects of Pollutants (GEEP) and the Group of Experts on Standards and Reference Materials (GESREM)) as core members, supplemented, as appropriate, with additional experts. The three Expert Groups are disbanded.

Pursuant to the implementation of the restructured GIPME, as sanctioned in Resolution XIX-4, a preliminary GIPME Officers' meeting was held at IMO Headquarters London, December 2-4, 1998 to review the entire programme and its activities. It was emphasized at this meeting that the restructured GIPME Programme should have strong orientation towards end-users and its activities should be fully co-ordinated with the co-sponsoring agencies, IMO and UNEP, and operational oceanographic developments under GOOS.

The restructuring will also take into account the requirements of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, specifically the requirements for Clearing House assistance from the IOC on the topics of nutrients and sediment transport. Detailed restructuring of the GIPME Programme, which requires the concurrence of the three co-sponsoring agencies IOC, IMO and UNEP, was planned for a GESAG meeting in April 1999. However, the reorganization of UNEP is taking longer than anticipated and this meeting has been deferred until both the Division and officer in UNEP responsible for the GIPME Programme have been identified. It is therefore proposed that the detailed restructuring of GIPME be undertaken in draft form during mid-1999 in preparation for a GESAG meeting that will be convened once the UNEP reorganization has been fully implemented.

As a GIPME co-sponsoring agency, IOC has continued to contribute to the GESAMP activities, most particularly to the activities of the GESAMP Working Group on Marine Environmental Assessments. This Working Group is charged with the following:

- Preparation of biennial statements on the conditions of the marine environment first issued in 1998.
- A global assessment of the state of the marine environment from the perspective of land-based activities for the purposes of the GPA to be completed in 1999;
- A new major comprehensive assessment of the state of the marine environment to be completed in 2002.

The first biennial review is in draft form and was considered during editorial meetings held 2-14 August and 9-14 November 1998. The Land-Based Activities review is in an advanced stage of drafting. It comprises 7 Chapters of which Chapters 4, 5, 6 and 7 now exist in draft form.

In the context of the GESAMP MEA activities, particularly the GPA assessment, a number of regional assessments have been prepared, or are being prepared, for the purposes of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. Furthermore, it is expected that the GEF Global International Waters Assessment (GIWA), under a Core Team recently established in Kalmar Sweden, will be operational early in 1999. GIWA will be conducting a series of regional and sub-regional assessments during the course of the next few years. There are also other assessments conducted for specific regional areas such as that for the Northeast Atlantic under OSPAR to be completed in 2000.

GIPME continued its involvement in the ICES-IOC-IMO Working Group on Ballast Water and has been requested to assist in the development of standards for ballast water sampling and analysis. This work is being undertaken in co-ordination with the work of ICES and European Union. GIPME has also been requested to assist in the identification/specification of sensitive sea areas for the purposes of the MARPOL Convention.

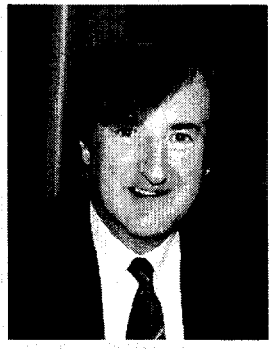
The co-operation between IOC and SIDA in matters related to marine pollution has allowed GIPME to undertake regional assessments of various pollutants in the Caribbean, East Africa, WESTPAC, and, to a minor extent, West Africa.

In 1998, there was little communication between GIPME and UNEP, primarily because of the major UNEP reorganization. Similarly, there is a need to ascertain the future extent and nature of UNEP support for, and the demand from, the Marine Environmental Studies Laboratory (MESL) of the IAEA Marine Environmental Laboratory in Monaco, particularly in the areas of methods manual preparation and the preparation of standard reference materials.

Assembly Resolution XIX-4 also designated GIPME as the appropriate IOC programme within which Health of the Oceans (HOTO) Pilot Projects within the Global Ocean Observing System (GOOS) should be implemented subject to full consultation with the GOOS Project Office, the GOOS Steering Committee and the relevant GOOS panels. The first specific action taken by GIPME in response to this decision was the implementation of a HOTO Pilot Project in Brazil entitled "Rapid Assessment of Marine Pollution: a HOTO Pilot Project in South America".

THE MARINE ENVIRONMENTAL LABORATORY (MEL)

by Hugh Livingston, MEL Director



The Marine Environment Laboratory (MEL) in Monaco is working with IOC to improve the health of the oceans generally, and the well-being of the coastal oceans in particular. Economic, social and health issues converge and are influenced strongly by environmental quality in the coastal oceans. As the 21st century approaches, increased efforts are being made to try to maintain progress in the health of the coastal ocean.

The 1998 International Year of the Ocean brought many ocean issues to the fore, including an emphasis on assessing and reducing marine pollution. The jointly sponsored International Symposium on Marine Pollution, held in Monaco in October 1998, served as a valuable review of the current status of the environmental quality of the ocean and as a springboard for initiating the next generation of programmes and studies to improve oceanic quality.

The Inter-Agency Programme (IAP) between the IAEA, UNEP and IOC of UNESCO exists to contribute to ocean quality improvement through:

- Generating essential information for marine pollution assessments and follow-up activities for implementation of International Conventions and co-operative programmes;
- Assistance in building the technical capacity of regional laboratories for assessing non-nuclear marine pollution;
- Provision of emergency assistance;
- Establishment of Regional Technical Support Centres.

The IAP implements its programme in several ways through the Marine Environmental Studies Laboratory, a section of MEL in charge of studies of non-nuclear marine pollutants. Activities range from analytical support and implementation of regional marine monitoring programmes to analytical technique training and operation of a Quality Assurance Programme for marine pollutants.

One of the primary focuses in the QA Programme has been and will continue to be the co-ordination of world-wide comparison exercises for trace contaminants. National and regional pollutant monitoring efforts are only as useful as the quality of the data they produce and, as experience has shown us, poor quality analytical results often compromise the best efforts of scientists and decision makers in assessing the true state of the health of their marine environments.

It is not easy to overcome this obstacle in emerging countries. It has only been through the continued participation of such Member State laboratories in ongoing inter-comparison and Inter-calibration exercises, coupled with positive feedback from experienced analytical centres such as MEL, that we have made progress in upgrading national and regional capabilities in pollutant monitoring.

To backstop these activities, another major focus in the future will be the production of new internationally recognized reference methods for the analysis of marine contaminants, and revision of previously existing ones. These highly appreciated products have been widely distributed in the developing world and are considered as one of the main factors leading to improved analytical results and performance in inter-comparison exercises. Nevertheless, they require continuous scrutiny and updating in order to remain acceptable to the international scientific community. The MEL laboratory is perfectly positioned for the next generation of marine pollution challenges since the opening of the spacious and well equipped, state of the art new facility in Monaco in 1998.

The assurance of the continuation of these activities depends on the ongoing support of their sponsors. The recent restructuring at UNEP has raised some uncertainties in respect of its future role and it is hoped that it will resume the active participation which it has maintained previously.

The project aims to test and provide easy-to-use, inexpensive, chemical and biological markers that can be used to assist and improve environmental management in developing countries.

Rapid assessment methods are expected to provide simple and inexpensive approaches to global marine pollution monitoring and will also enhance the level and scope of national/regional participation in GOOS. This HOTO Pilot Project will be carried out in close co-ordination with C-GOOS.

GIPME also contributed, through IOC co-sponsorship, to conferences organized for the International Year of the Ocean. These conferences included: the Second International Conference on Marine Pollution and Ecotoxicology held in Hong Kong, 10-14 June 1998; and the international seminar and workshop on "Metocean Services for Marine Pollution Emergency Response Operations" held in Townsville, Australia, 13-17 July 1998. IOC also provided support for scientists from developing countries and two experts to participate in the International Symposium on Marine Pollution (Monaco, October 5-9 1998) organized by IAEA and co-sponsored by IOC, UNEP and IMO.

IOC support for the Marine Environmental Studies Laboratory at the IAEA Marine Environment Laboratory, Monaco, was continued, to promote the production of Methods Manuals and Reference Materials. The MESL Laboratory is expected to continue to provide assistance primarily by generating information for marine pollution assessments and by building technical capacity of regional laboratories towards this goal. This assistance is therefore crucial to the regional activities carried out under GIPME.

IOC continued to co-operate with UNEP in the context of the MEDPOL Programme in 1998. In addition to the co-ordination of nine MEDPOL research projects involving eutrophication, remote sensing and modelling of pollutant dispersion and water quality, IOC participated in the meetings of MEDPOL National Co-ordinators, MAP National Focal Points and the Mediterranean Commission on Sustainable Development. Through GIPME, the standard reference material bank for organic contaminants and trace metals at IAEA/MEL in Monaco was further developed and eight reference methods were prepared or revised.

The standards are available cost-free to all institutes participating in the MEDPOL Programme. On a case-by-case basis and depending on availability, these standard reference materials are also provided cost free to other GIPME related activities. Such was the case in March 1998 in support of an International Mussel Watch Training Workshop that was convened in Thailand at the environmental Research and Training Centre.

In summer 1998, the chairmanships of the GIPME Programme and the HOTO Panel were changed. Dr. Neil Andersen stepped down from the tenure of both positions after a long period of dedicated service to both GIPME Programme and the IOC. The chairs of the GIPME Programme and the HOTO Panel have been separated and are now held by Dr. Michael Bewers and Dr. Anthony Knap respectively. In June 1998, Dr. Umit Unluata joined the IOC secretariat appointed as the new Head of the Marine Pollution Research and Monitoring Unit after a long period of vacancy.

THE IOC PROGRAMME OF GLOBAL INVESTIGATIONS OF POLLUTION IN THE MARINE ENVIRONMENT (GIPME)

By J.M. Bewers, GIPME Chairman

The GIPME programme began in 1976 on the basis of an excellent design published as IOC Technical Series No. 14, prepared by a team of scientists. In the late 1970s marine pollution was a growing subject of concern as a result of widely publicized incidents such as that in Minimata, Japan, and numerous oil spills. From the late 1970s, Dr. Neil Andersen played an important leadership role in the programme as Chairman of the Group of Experts on Methods, Standards and Intercalibration (GEMSI). Later, the complementary Groups of Experts on the Effects of Pollutants (GEEP) and on Standards and Reference Materials (GESREM) were created to ensure full coverage of relevant topics. Both UNEP and IMO became sponsors of the GIPME programme with the IAEA becoming a major co-sponsor of the work of GESREM through the participation of the IAEA Marine Environmental Studies Laboratory based in Monaco.

In 1984, the original design of the GIPME programme was revised. This revision did not contravene the basic objectives but altered the programme structure for achieving the same ends in the context of the improved scientific understanding developed in the intervening eight years. The redesign also incorporated the *new* contaminants of concern that had come to the fore in these same intervening years. The new strategy was published as IOC Technical Series 25.

The last decade has seen major improvements in scientific understanding of the sources, transport, fate and effects of contaminants. More significantly, with this enhanced understanding, there has been an increasing recognition that "contaminants" *per se* are not necessarily the greatest of the causes of damage and threats to the marine environment. On a global scale, other human activities, such as habitat destruction and sediment mobilization, are equally significant as causes of damage to the marine environment. Accordingly, there has been a need to revise approaches to the issue of "marine pollution" to take account of all facets of human activities potentially affecting the condition of the marine environment, its resources and amenities.

Accordingly, during the 1990s, the thrust of the GIPME programme was substantially revised. This revision was also a response to changes in perceptions and demands among the co-sponsors and regional organizations. It was for this reason that the programme was administratively streamlined through a Decision reached at the 19th IOC Assembly that is to be followed by a further scientific redesign of the programme during 1999.

An example of the changing nature of the GIPME programme is provided by the design of the Health of the Oceans (HOTO) Module of the Global Ocean Observing System, which was undertaken largely by the GIPME Officers as members of the HOTO Panel. The HOTO design reflects a much broader appreciation of the underlying causes of damage and threats to the marine environment as a basis for ocean observations.

The challenge before us now is to reconsider the design of the GIPME programme in a manner that serves all three sponsoring agencies in a coherent and integrated manner while taking account of the diverse nature of human activities potentially affecting the marine environment. In reorienting the programme, emphasis will be placed on subject areas of current interest to the co-sponsoring agencies that are not being addressed by other international programmes.

Priorities are the amalgamation of biological and chemical factors relating to biological cycling, sediment quality and indicators of state and response to stress needed for a variety of applications, including the London Convention and the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities. Implementation of the revised programme will continue to focus on regional issues and problems but within a framework that fully recognizes the relative global importance of different causes of prejudice to the marine environment. I remain optimistic that this can be done expeditiously to the mutual benefit of all three co-sponsoring organizations, IOC, IMO and UNEP.

1.6 Science for Integrated Coastal Area Management (ICAM)

1998 was a turning point for IOC in the field of Integrated Coastal Area Management. Following the recommendations of the IOC Assembly to convene a group of expert on the establishment of an IOC programme on ICAM, a consultation meeting was organized at Headquarters in Paris (21-23 October 1998) with the task to review the proposed ICAM programme drafted by the IOC Secretariat. As a result of the consultation, a proposal was presented at the IOC Executive Council in November 1998 which led to the endorsement of the programme by Member States. The programme is structured around the five following core components:

- Inter-disciplinary Approaches to an Integrated Coastal Area Management;
- Marine Scientific and Technological Information System for Integrated Coastal Area Management;
- Methodology Development in Support of Integrated Coastal Area Management;
- Monitoring Systems for Integrated Coastal Area Management;
- Training, Education and Mutual Assistance (TEMA) in Integrated Coastal Management.

The programme is progressively expanding, through interacting with other IOC programmes such as GOOS, OSNLR, OSLR, GIPME. A special effort has been made to complement activities and planning with the CSI programme of UNESCO. IOC, through its WESTPAC secretariat is actively supporting and co-financing activities with Andaman Sea Project. At the same time, CSI and IOC have co-sponsored the publication of the Coral Reef database developed by CARICOMP in the Caribbean.

INTER-DISCIPLINARY STUDY OF COASTAL PROCESSES (COASTS)

Continuing work in the Inter-disciplinary Study of Coastal Processes Component, a consultation meeting was organized at Headquarters in Paris (21-22 January 1999) for the planning and implementation of the Coastal Ocean Advanced Science and Technology Studies (COASTS) Programme. The fundamental goal of the COASTS programme is to develop the scientific and technical basis necessary for the management of the coastal seas.

Continuing with the successful series *Global Coastal Ocean*, and after the publication of the first two volumes: *Processes and Methods* and *Regional Studies and Synthesis*, the editorial group is planning a new set of volumes in the series. The new volumes will attempt an inter-disciplinary overview and synthesis of the knowledge base on coupled physical-biological-chemical and geological processes in the coastal zone. The next COASTS workshop is scheduled to take place in June 2000 in Paris.

CO-OPERATION WITH LOICZ FROM IGBP

The START/IOC/LOICZ workshop on Climate Change and Coastal Processes in West Africa was held from 23 to 25 November 1998 in Benin. Thirty-four participants from West Africa and Europe attended the workshop.

The objectives of the workshop were to:

- Explore ways of making the best use of existing information on coastal processes and resources as a step towards adaptation and mitigation to cope with the impacts of climate change;
- Assess the scope and accessibility of relevant data both within the region and elsewhere;
- Consider the potential benefits of building thematic databases relating to key coastal environmental issues, networking more widely in Africa and further afield;
- Appraise the value of regional data both from the perspective of Integrated Coastal Area Management within the region and for use by researchers involved in global syntheses and modelling.

The proceedings of the workshop will be published in 1999 and should provide state of the art knowledge for the region.

MARINE SCIENTIFIC AND TECHNOLOGICAL INFORMATION SYSTEM FOR INTEGRATED COASTAL AREA MANAGEMENT

In October 1998, IOC together with US-NOAA (NOS) and the University of Delaware (Centre for the Study of Marine Policy) launched a Web site on ICAM (Fig. 9). The Web Site provides practitioners with timely access to information on international guidelines on ICAM, descriptions of the ICAM programmes of other countries, ICAM approaches to address specific problems (e.g. coastal erosion, coral reef management, beach replenishment, etc.). The Internet offers a splendid tool for the effective dissemination of this kind of information. IOC and the other partners are contributing financially to support the development and maintenance of the web site. The URL of this Web Site is

http://www.nos.NOAA.gov/icm/

* K. Brink and A. Robinson, 1998, *The Sea*, Vol. 10, New York, J. Willy, 604 pp.
** K. Brink and A. Robinson, 1998, *The Sea*, Vol. 11, New York, J. Willy, 1062 pp.

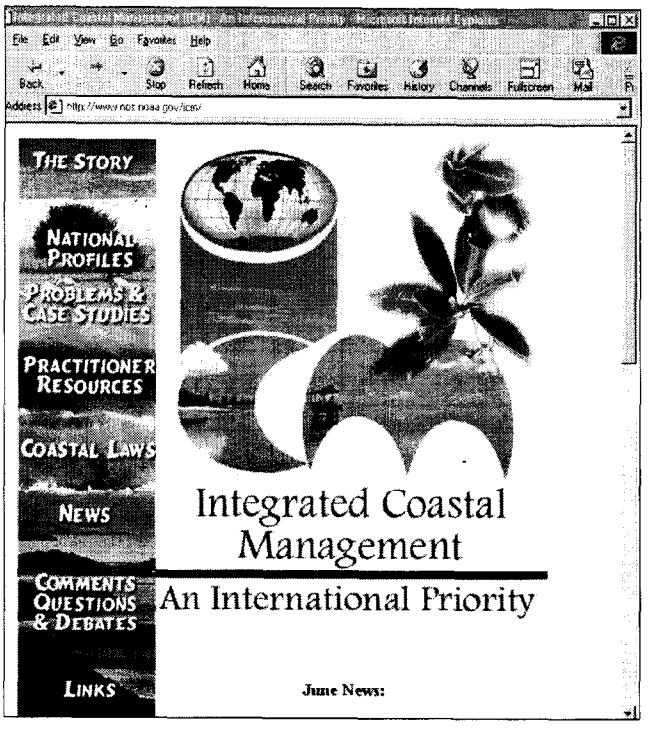


Fig. 9: ICAM Web site page

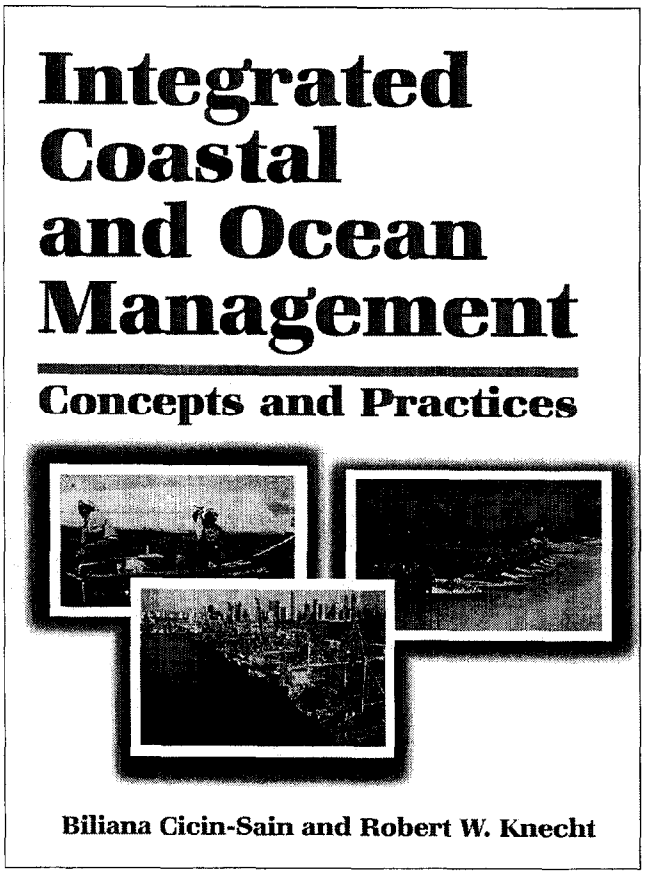


Fig. 10: Cover of Integrated Coastal and Ocean Management

METHODOLOGY DEVELOPMENT IN SUPPORT OF INTEGRATED COASTAL AREA MANAGEMENT

The long awaited textbook entitled *Integrated Coastal and Ocean Management, Concept and Practices* was published in 1998. The book authored by Biliana Cicin-Sain and Robert Knecht (University of Delaware) provides a comprehensive tool for the understanding of the ICAM concept, the development of ICAM plans, the establishment of the institutional context that is needed, the development of related implementation strategies and the evaluation of results. The book is already being used in a variety of education and training courses around the world. This initiative was partly supported by IOC. Some copies of the book are available at the IOC Secretariat (Fig. 10).

In April 1998, IOC and the Korean Maritime Institute organized an international workshop on ICAM as part of the activities of the IYO. It was one of a series of IOC workshops focussing on the assessment of institution building since the Rio Conference. The main topics of the workshop included :

- Policy co-ordination mechanisms at the national level: challenges in harmonizing sectoral ocean and coastal activities;
- Policy co-ordination at provincial and local level;
- Bringing international ocean and coastal agencies together (dialogue between UN agencies and NGOs);
- Bringing science and policy together in integrated coastal management. The workshop adopted the Seoul Statement, which among other things recommended the initiation of a Global Ocean Forum for exchange of views, discussion of new developments and state of oceans and coasts, assessments of progress in ICAM and other management efforts. Taking advantage of the Korean workshop, a consultation was held on the issue of coastal mega-cities, in view of the planned international symposium on Coastal Mega-cities which will take place in the latter half of 1999 in Hangzhou (China).

In March 1998, IOC participated in the Consultative Meeting on Common Methodology for Assessing Progress in Coastal Management, which was organized by the Coastal Resources Centre, of the University of Rhode Island. As a result a manual was produced. The manual is another effort to develop and make accessible approaches to assess progress towards coastal management goals and learn from experience.

TEMA IN INTEGRATED COASTAL MANAGEMENT

As a contribution to the International Year of the Ocean, IOC together with the International Geographical Union, UNEP, UNESCO, ICCOPS, UNIDO and the EU organized the International Conference on Education and Training in Integrated Coastal Area Management : The Mediterranean Prospect (25-29 May 1998, Genoa, Italy). Ninety papers were presented at the Conference, attended by 270 participants from 35 countries. The main output was the adoption of a declaration promoting the implementation of education and training in integrated coastal management in the Mediterranean region and small regions.

The Declaration was followed by three recommendations, concerned respectively with:

- The blueprint of an interdisciplinary master degree in integrated coastal management;
- The establishment of the electronic coastal educational forum Educoast;
- The development of a European network of coastal geographical information systems (ICAMGIS).

THE AFRICAN OCEAN DAYS, (AOD'98)

The Intergovernmental Oceanographic Commission (IOC), in collaboration with the Government of Senegal, organized the African Ocean Days (AOD'98) from 26 - 28 October in 1998 in Dakar (Senegal). Following the Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM, Maputo, Mozambique, 18-25 July 1998), this event constitutes the second initiative of joint IOC/Africa activities in the framework of the International Year of the Ocean.

The AOD'98 concept involves an increased implementation of concrete awareness-building activities, while using local knowledge for the protection and preservation of both coastal and marine resources among all stakeholders (Government, Members of Parliament, scientists, private sector, local population, NGOs, specialised coastal and marine organizations). This can be achieved by sharing experiences and maintaining the momentum of the dialogue between stakeholders and users.

Two workshops were organized within the AOD'98 framework. With a view to promoting the preservation of biodiversity, the first workshop addressed integrated and sustainable management of coastal areas and marine environments. The second highlighted the preservation of the coastal environment and its protection from pollution.

Fig. 11: H.E. Mr Alassane Diali N'Diaye, Minister for Fisheries and Maritime Transport of Senegal chaired the meeting. On his right: Mr Patricio Bernal, IOC Executive Secretary

The co-operative relationship with the organizer of the German Training Course on Protection and Utilization of Oceans (Carl Duisberg Gesellschaft, March-August) is continuing. IOC was invited to give lectures on marine science and international co-operation.

Five travel grants were provided to allow participants from developing countries to attend the Coastal Zone Canada '98 (Victoria, B.C. Canada, 30 August - 3 September 1998).

A study grant was processed to allow the participation of a scientist from Ghana to the Fifth International Training Programme in Coastal Management - Summer Institute, which was held at the Coastal Resource Centre (CRC) of the University of Rhode Island (1-26 June 1998). IOC has agreed to sponsor one participant every year to attend this highly relevant training course.

CO-OPERATION WITH OTHER BODIES

In 1997 (Paris, 28-29 April) the International Geographical Union (IGU) and IOC convened a workshop on *The role of ocean science and geography in facing ocean management for the third millennium*. The aim was to explore the prospects of co-operation on subject areas relating to Chapter 17 of Agenda 21. After discussions, participants were able to identify areas

IOC Meetings on ICAM

Type of Meeting	*Number of attendants*	*Number of Countries*	*Region*	*Budget**
'98 IOC-KMI International Workshop on ICAM, Seoul, Korea, 16-18 April 1998	27	9	SE Asia	$20,000 from RB
International Conference in Education and Training in Integrated Coastal Area Management, Genoa, Italy, 25-29 May 1998	270	35	Med.	$14,000 from RB
IOC-IGU Seminar on the role of ocean science and geography in facing ocean management for the 21st century, Sagres, Portugal, 3-5 September 1998	26	15	Global	$18,000 from RB
START-IOC-LOICZ Workshop on Coastal Processes in West Africa, Cotonou, Benin, 23-25 November 1998	34	12	West Africa	$11,000 from RB $10,000 from TF Netherlands
IOC Consultation on Marine Science Input to ICAM 21-23 October 1998, IOC, Paris	11	5	Global	$ 10,000 from RB
COASTS Consultation Meeting, 21-22 January 1999 IOC, Paris	8	5	Global	$7,000 from RB

Travel Grants

Type of Meeting	*Number of attendants*	*Number of Countries*	*Region*	*Budget*
Coast Zone Canada '98	5	5	Developing Nations	$ 8,000
URI Summer Course on ICAM	1	1	Ghana	$ 5,000

** RB: Regular Budget; TF: Trust Fund*

THE PEOPLE BEHIND OCEAN SCIENCES PROGRAMME

Stefan Andersson is our Swedish consultant with a background in Engineering Physics, an M.Sc. in environmental physics and a MBA. He joined IOC in 1991 as an associate expert in charge of the GIPME / Marpolmon activities in the Caribbean and South America. In 1993, he was transferred to Headquarters to assist the Executive Secretary IOC and the Head of the MPU. Stefan returned to Sweden in 1995 and is presently working part time to assist the Head of MPU on regional GIPME related programmes. He liaises with several donor agencies and more recently, has been heading the International Department of one of Europe's top 15 consulting companies.

Julian Barbière, our Anglo-French consultant, has been at IOC since October 1995. He is responsible for IOC's regional programmes in East Africa (IOCINCWIO Regional Committee), and has organized several workshops on coastal management activities in these regions. Following the departure of our colleague Haiquing Li, Julian has also became the technical co-ordinator of the newly established IOC programme on Marine Science Inputs and Observations for ICAM.

Mrs **Diénaba Beye** is a consultant from Senegal and has been at IOC since April 1997 (although she first came to IOC in September 1995 on internship). She developed the concept of the African Ocean Days (AOD'98), organized and implemented this programme, including the preparation and execution of an integrated coastal and marine zone exhibition in Africa. She has visited and reported on many West African centres of oceanographic and fisheries research from Mauritania to Côte d'Ivoire. She was a panelist at PACSICOM and LME workshops and is also working for IOCEA regional programmes. With her legal expertise, Mrs BEYE is following up activities dealing with UNCLOS.

George Grice joined IOC as a consultant from the U.S. He came to Paris from Cape Cod where he was Associate Director at the Woods Hole Oceanographic Institution and later Deputy Director of the Northeast Fisheries Science Centre of US-NOAA. George has served for almost two years as head of the Ocean Science in Relation to Living Marine Resources Programme. He is also the Technical Secretary for the Living Marine Resources Panel of GOOS, Administers the Global Coral Reef Monitoring Network, and the South Asia Coral Reef Project. His sparse but always wise and stimulating remarks (delivered with an impeccable Southern accent) have been a hallmark at Headquarters.

Victor Scarabino is from Uruguay and works as a consultant at IOC. He has contributed to work related to TEMA in Latin America and the Caribbean since 1995. Victor has been helping to set up a series of networks on marine science and technology for the region. This is part of the long-term capacity-building strategy revised and adopted by IOC governing bodies in 1996. It also fits within the framework of a feasibility study mostly funded by the European Union and by several bi-lateral and multilateral agencies. He also assists backstopping from Headquarters activities related to marine biodiversity and HAB activities.

Umit Unluata is from Turkey. He joined IOC in June 1998 as the new Head of the Marine Pollution Research and Monitoring Unit. He also serves as the Technical Secretary for the HOTO Panel of GOOS and as the IOC Technical Secretary for GESAMP. Since December 1998, he has been Secretary of the UN-ACC Sub-committee on Oceans and Coastal Areas. Umit has been assigned to co-ordinate IOC activities in the Mediterranean Region and the overall Ocean Sciences Programme. He was previously Director of the Graduate School of Marine Sciences of the Middle East Technical University. Before joining IOC, he served as a representative of Turkey to the IOC Assembly and the Executive Council during the period 1985-1997.

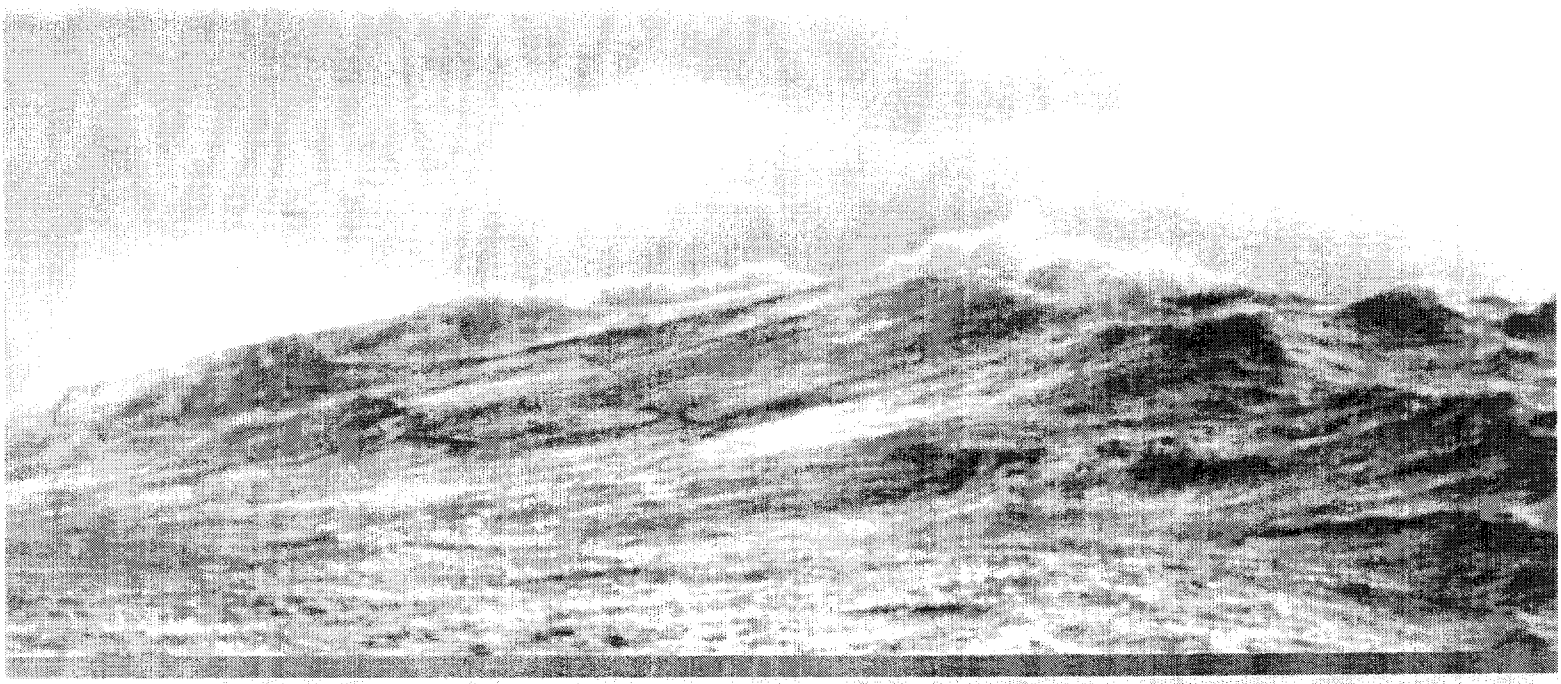
Justin Ahanhanzo from Benin started consultancy in IOC in 1994 on marine pollution issues in Eastern Africa. As assistant to Robin Harger, UNESCO Co-ordinator for PACSICOM, he helped to ensure the overall administration and scientific co-ordination of the UNESCO contribution. Justin has assisted the Executive Secretary in the implementation of IOC Programmes in Africa. As co-ordinator of the GOOS-AFRICA, MedGOOS programmes and UNESCO Chairs/UNITWIN in Marine Sciences, he co-organized and co-convened the first Pan-African LME Symposium in Cape Town while ensuring the IOC contribution to the LME projects. Justin has carried out ecohydrodynamical modelling in the Black Sea and was one of the first to apply fractals to the description of dynamics in the Indian Ocean. He is fluent in Russian, English and French.

Fanny Hinson, Silvia Vernizzi and **Christiane Le Conan** provide administrative assistance to the activities of the Ocean Sciences Programme. Fanny is from Ghana, joined UNESCO in 1987 and IOC in 1993, assisting in matters related to marine pollution. Silvia is from El Salvador, joined IOC in 1989 and assists in OSNLR and UNCLOS activities. Christiane is from France, joining UNESCO in 1987 and IOC in 1989 and has been mostly involved with the MPU activities.

of mutual interest for IOC and IGU. They agreed that a scientific event should be convened in the framework of the International Year of the Ocean (1998), as a way to implement co-operation and to design an IOC-IGU joint programme of action in support of ICAM.

As a result the joint seminar *The role of ocean science and geography in facing ocean management for the 21st* century was convened in Sagres, (Portugal), 3-5 September. A main conclusion was that there is a need, continuously and iteratively, to integrate knowledge and information of the natural sciences with that of the social sciences in describing anthropogenic activities and pressures that profoundly affect the coastal area. As a result a Memorandum of Understanding was established between the two organizations, calling for increased co-operation in the field of ICAM. A programme of joint core ICAM projects has been drafted. It was also agreed that IOC would take responsibility for gathering expertise from the natural process themes, whilst IGU would perform the same task for the social processes, using IGU and other expertise. A joint IOC-IGU Steering Committee will meet in 1999 to oversee the implementation of the projects.

Other activities related to ICAM were organized in 1998, these can be found in the Regional Committees/Commissions section of this annual report.



Ocean Services 2

2.1 Oceanographic Data Management (IODE)

MESSAGE

from BEN SEARLE, IODE Chairman

The ratification of the United Nations Convention on the Law of the Sea (UNCLOS) by many coastal states is increasing interest in marine affairs. Governments are recognizing the huge economic potential of the ocean as a resource. To fully understand and to exploit this resource in a sustainable way countries must be able to aggregate marine data collected through a variety of programmes in order to develop relevant knowledge. The International Oceanographic Data and Information Exchange (IODE) programme provides the mechanism for this in the international arena.

IODE provides a significant and essential component in the process of improving knowledge of the World Ocean. Participants gain through access to larger databases than most countries could develop alone. The pooled data is more valuable than the sum of the individual contributions.

IODE provides the data management framework for a number of regional and international marine programmes and scientific experiments. IODE will play a significant role in the development of the non-operational data management activity of the Global Ocean Observing System (GOOS). IODE will also continue to develop its capabilities to address the priority areas identified by the IOC and IODE Member States, in particular the management of data and information supporting coastal zone needs.

IODE will create systems to improve the free and open access to data and information. IODE will continue to take a lead role in the creation of standards and protocols to facilitate the management and exchange of marine data. It will achieve this through activities such as the Global Ocean Data Archaeology and Rescue (GODAR) project and the Marine Environmental Data Inventory (MEDI) pilot project and through its groups of experts,

The Internet and more specifically the World Wide Web (WWW) will provide much of the direction for IODE development in future years. While many centres do not have access to the Internet, the technology that is used by the WWW provides an opportunity to create applications that operate on many different computer systems. For the first time we are in a position to create applications such as the IODE Tool Kit, that will operate *via* web browsers on almost any computer. Centres without Internet connections will still be able to use the same software as used by those with Internet access, reducing the need for IODE to create different versions.

The challenge for IODE in the next millennium is to use the new technologies such as the World Wide Web to support the development of marine data management in developing countries and to effectively exploit the technological advances that have been made over recent years in the information technology industry.

THE IODE SYSTEM

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.

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 1997, seven Member States joined the System, bringing the total number of DNAs and NODCs to 56 (Fig.1 and 2).

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 (Fig. 3).

Users can approach the data centres of the IODE System with requests for data as well as information or advice regarding data or information management. The data and services are provided either as an exchange or at a cost not exceeding that of processing and shipping.

In the light of emerging regulations designed to protect intellectual property rights for electronic and other type of databases, there were a series of consultations with WIPO and WMO in 1998 to better protect and preserve free and open access to data. This is the basis of the IODE policy on data exchange.

IODE PROGRAMMES AND ACTIVITIES

IODE operates a number of programmes and projects including OceanPC, the Global Ocean Data Archaeology and Rescue (GODAR), Marine Information Management (MIM) and, in conjunction with IGOSS, the Global Temperature and Salinity Profile Programme (GTSPP).

GODAR

The GODAR Project is aimed at recovering historical data in danger of being lost to the international community. It has completed the first five-year phase by the development and distribution of the updated World Ocean Database '98 (WOD98) (Fig. 4 and 5). This set of CD-ROMs expands on the World Ocean Atlas '94 by including nitrite, pH, alkalinity, chlorophyll and plankton, as well as all available metadata on meteorology and atlases of data distribution. The World Ocean Database '98 is a contribution of IODE to the 1998 International Year of the Ocean. The table below shows a comparison of the number of temperature profiles in the WOD98 database

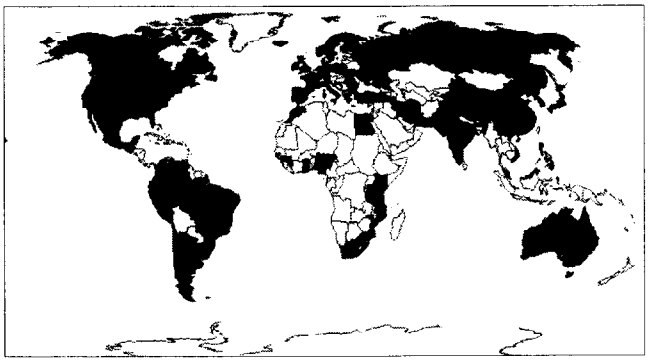
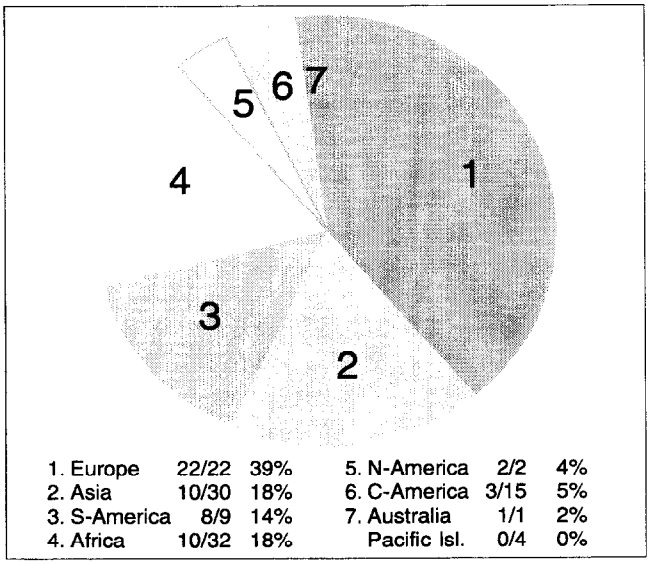
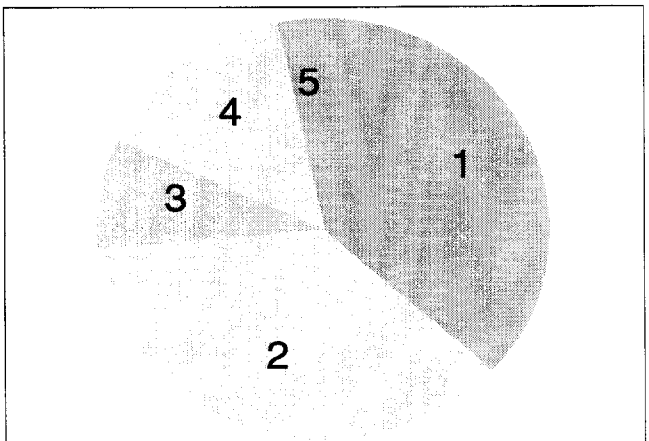


Fig. 1: IODE Data Centres around the World.
Countries marked in dark have established a DNA or NODC



1. Europe	22/22	39%	5. N-America	2/2	4%
2. Asia	10/30	18%	6. C-America	3/15	5%
3. S-America	8/9	14%	7. Australia	1/1	2%
4. Africa	10/32	18%	Pacific Isl.	0/4	0%

Fig. 2: IODE Data Centres/Member States distribution



1. Bathythermograph Data: 40.9% (2,092,840 obs)
2. Oceanographic Station Data: 39.1% (1,998,592 obs)
3. Biological Data: 5.9% (304,173 obs)
4. Current Data: 13.6% (697,600 obs)
5. Other: 0.5% (25,329 obs)

Fig. 3: International Marine Data Base of WDC-A, Oceanography
(Source: based on WDC-A Report of Data Exchange – WDCA-OC-98-1)

Comparison of the number of temperature profiles in the WOD98 database compared to the WOA94 database and the database used in *Climatological Atlas of the World Ocean* (1982)

Data type	*Climatological Atlas of the World Ocean (1982)*	*World Ocean Atlas 1994*	*World Ocean Database 1998*
STATION DATA and LOW RESOLUTION C/STD temperature profiles	425,000	1,194,407	1,373,440
HIGH RESOLUTION CTD temperature profiles	N/a	89,000	189,555
MBT temperature profiles	775,000	1,922,170	2,077,200
XBT temperature profiles	290,000	1,281,942	1,537,203
TAO moored buoy (fixed platform) temperature profiles (these are found in the XBT files)	N/a	N/a	69,941
FIXED PLATFORM temperature profiles other than the TAO buoys (these are found in the XBT files)	N/a	N/a	37,774
Total number of temperature profiles	1,490,000	4,487,519	5,285,113
"SURFACE ONLY" TEMPERATURE DATA (these are ship-of-opportunity data found in the SD files)			159,794

with those in the WOA94 and the database used in the *Climatological Atlas of the World Ocean* (1982).

In 1998 the publication of all Regional GODAR Workshop Reports was completed with the distribution of the Workshop Report No. 136 of the IOC Regional Workshop for Member States of Western Africa: GODAR-VI, held in Accra, Ghana, April 1997. Below shows the full series of GODAR Workshop Reports:

- IOC Workshop Report No. 88: GODAR-I, Obninsk, Russia, 17-20 May 1993
- IOC Workshop Report No. 100: GODAR-II, Tianjin, China, 8-11 March 1994
- IOC Workshop Report No. 107: GODAR-III, Goa, India, 6-9 December 1994
- IOC Workshop Report No. 110: GODAR-IV, Valetta, Malta, 25-28 April, 1995
- IOC Workshop Report No. 127: GODAR-V, Cartagena, Colombia, 8-11 October 1996
- IOC Workshop Report No. 136: GODAR-VI, Accra, Ghana, 22-25 April 1997

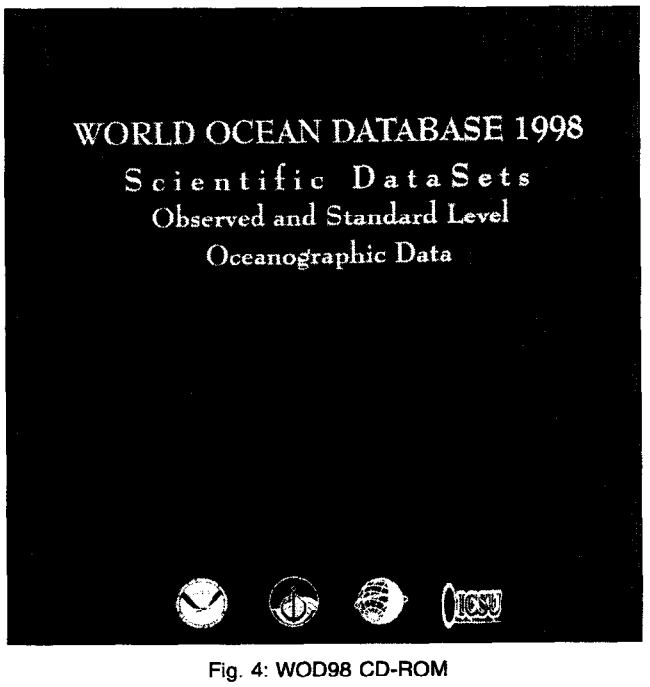


Fig. 4: WOD98 CD-ROM

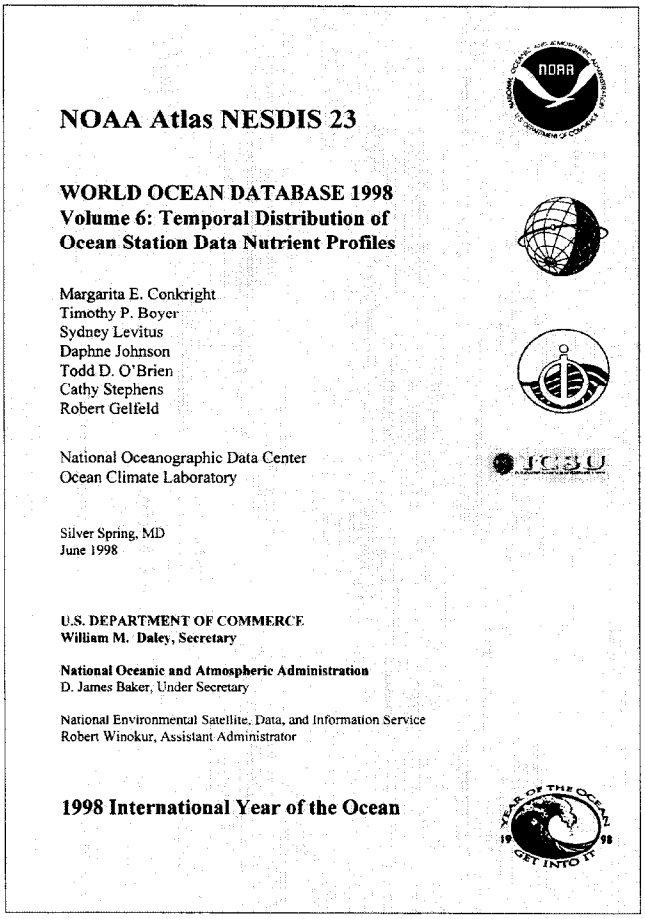
Almost 50 Member States took part in the workshops with over 200 experts taking part. The workshops helped to identify millions of observations that are still not available to the international community. The continuation of GODAR activities is seen as a high priority within IODE since it is well recognized that comprehensive global data sets providing long-term time series are essential to determine the decadal and inter-decadal variability. Implementation takes a regional approach. The European Union approved in 1998 funding of Euro 1.3 M for the MEDAR/MEDATLAS project. Other regional components of GODAR are being carried out or are planned within the ODINEA/ODINAFRICA projects. Figure 6 shows the MEDAR/MEDATLAS information sheet.

Global Temperature-Salinity Pilot Project (GTSPP)

IGOSS and IODE recognize the need to bring a wider range of data types into the established data management systems to support the full range of user requirements. IGOSS and IODE are being built on the philosophy of an "End-to-End Data Management" (ETEDM) scheme. IOC demonstrated this new concept at EXPO'98 in the Pavilion of the Future. The IGOSS/IODE Brochure published jointly by IOC and WMO to commemorate the 1998 International Year of the Ocean also highlights this approach (Fig. 21).

The GTSPP uses the ETEDM concept by having a "*continuously managed (or updated) database*" (CMD) to enable the integration of the real-time data stream with the delayed-mode data stream. The IGOSS/IODE XBT/CTD data flow diagram shows clearly the place of CMD (Fig. 7). Figure 11 illustrates the IGOSS/IODE real-time/delayed mode exchange mechanism.

The Paper *GTSPP – Overview and Future* prepared by the GTSPP Project Leader Dr. J. R. Wilson was published in the IOC Technical Series No. 49 (Figure 10). This technical document is intended for the scientific research community and users of operational ocean data, as well as for the Member States of the IOC. It discusses how Member States can make contributions and how they can benefit from the GTSPP. It provides an overview of the Programme Plan



NOAA Atlas NESDIS 23

WORLD OCEAN DATABASE 1998
Volume 6: Temporal Distribution of Ocean Station Data Nutrient Profiles

Margarita E. Conkright
Timothy P. Boyer
Sydney Levitus
Daphne Johnson
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National Oceanographic Data Center
Ocean Climate Laboratory

Silver Spring, MD
June 1998

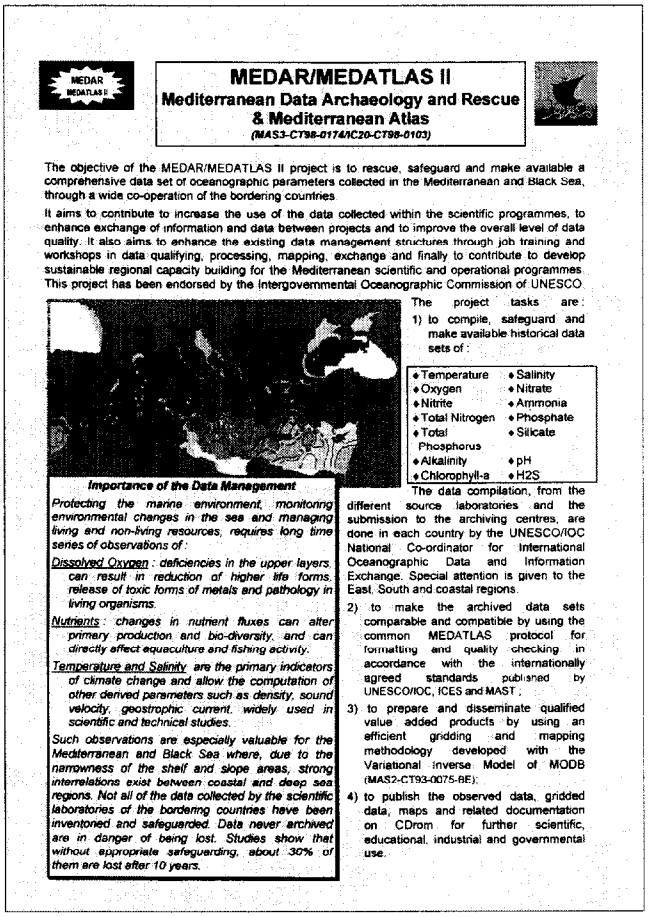
U.S. DEPARTMENT OF COMMERCE
William M. Daley, Secretary

National Oceanic and Atmospheric Administration
D. James Baker, Under Secretary

National Environmental Satellite, Data, and Information Service
Robert Winokur, Assistant Administrator

1998 International Year of the Ocean

Fig. 5: Atlas (1 out of 7 volumes)



MEDAR/MEDATLAS II
Mediterranean Data Archaeology and Rescue & Mediterranean Atlas
(MAS3-CT98-0174/C20-CT98-0103)

The objective of the MEDAR/MEDATLAS II project is to rescue, safeguard and make available a comprehensive data set of oceanographic parameters collected in the Mediterranean and Black Sea, through a wide co-operation of the bordering countries.

It aims to contribute to increase the use of the data collected within the scientific programmes, to enhance exchange of information and data between projects and to improve the overall level of data quality. It also aims to enhance the existing data management structures through job training and workshops in data qualifying, processing, mapping, exchange and finally to contribute to develop sustainable regional capacity building for the Mediterranean scientific and operational programmes. This project has been endorsed by the Intergovernmental Oceanographic Commission of UNESCO.

The project tasks are:

1) to compile, safeguard and make available historical data sets of:

- Temperature
- Salinity
- Oxygen
- Nitrate
- Nitrite
- Ammonia
- Total Nitrogen
- Phosphate
- Total Phosphorus
- Silicate
- Alkalinity
- pH
- Chlorophyll-a
- H2S

Importance of the Data Management

Protecting the marine environment, monitoring environmental changes in the sea and managing living and non-living resources, requires long time series of observations of:

Dissolved Oxygen: deficiencies in the upper layers, can result in reduction of higher life forms, release of toxic forms of metals and pathology in living organisms.

Nutrients: changes in nutrient fluxes can alter primary production and bio-diversity, and can directly effect aquaculture and fishing activity.

Temperature and Salinity are the primary indicators of climate change and allow the computation of other derived parameters such as density, sound velocity, geostrophic current, widely used in scientific and technical studies.

Such observations are especially valuable for the Mediterranean and Black Sea where, due to the narrowness of the shelf and slope areas, strong interrelations exist between coastal and deep sea regions. Not all of the data collected by the scientific laboratories of the bordering countries have been inventoried and safeguarded. Data never archived are in danger of being lost. Studies show that without appropriate safeguarding, about 30% of them are lost after 10 years.

The data compilation, from the different source laboratories and the submission to the archiving centres, are done in each country by the UNESCO/IOC National Co-ordinator for International Oceanographic Data and Information Exchange. Special attention is given to the East, South and coastal regions.

2) to make the archived data sets comparable and compatible by using the common MEDATLAS protocol for formatting and quality checking in accordance with the internationally agreed standards published by UNESCO/IOC, ICES and MAST;

3) to prepare and disseminate qualified value added products by using an efficient gridding and mapping methodology developed with the Variational Inverse Model of MODB (MAS2-CT93-0075-BE);

4) to publish the observed data, gridded data, maps and related documentation on CDrom for further scientific, educational, industrial and governmental use.

Fig. 6: MEDAR/MEDATLAS info sheet

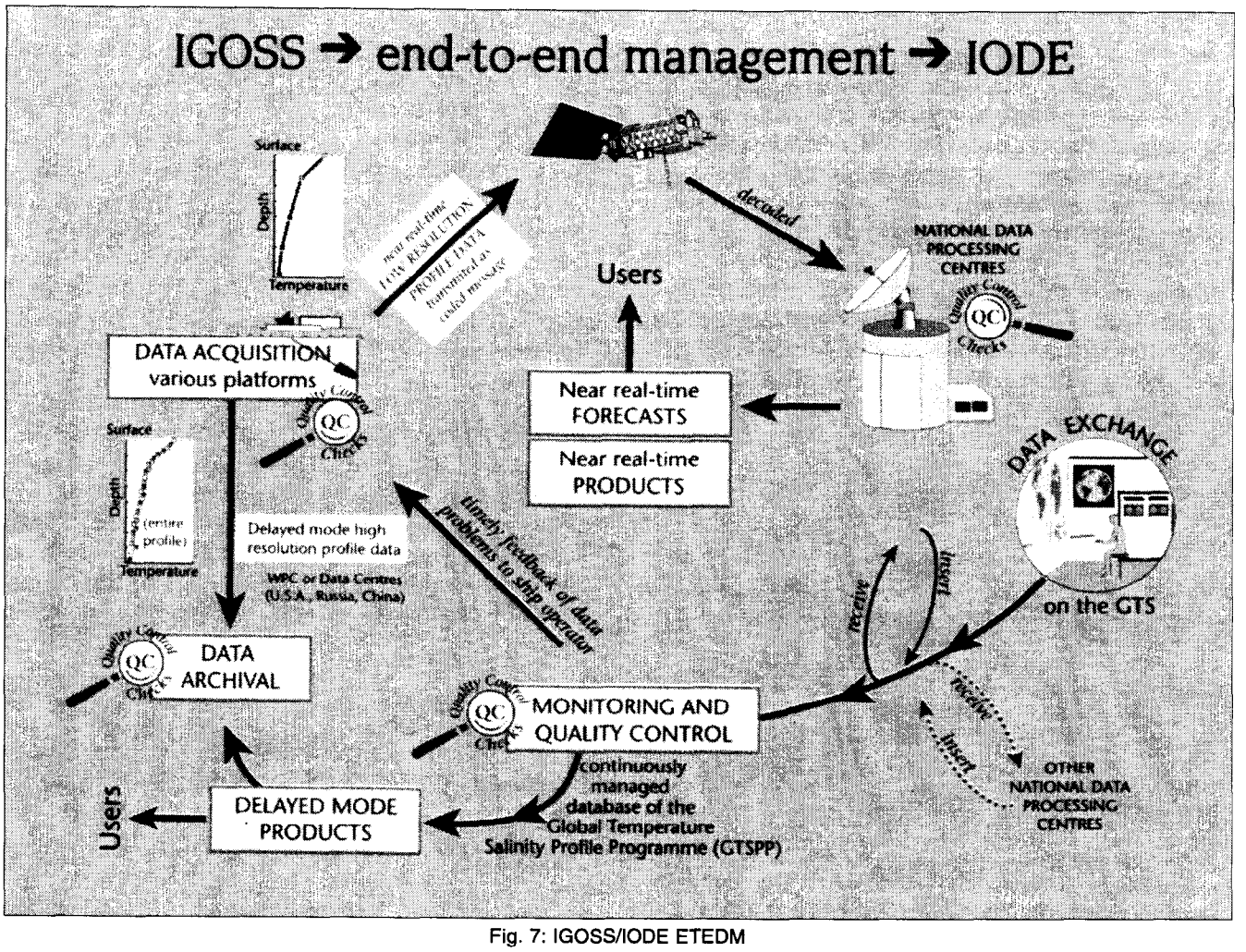


Fig. 7: IGOSS/IODE ETEDM

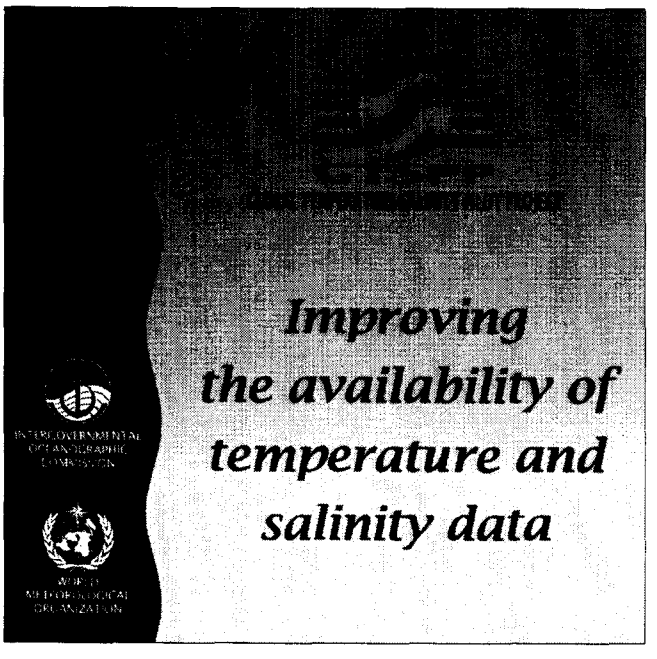


Fig. 8: GTSPP CD-ROM

and details the most important initiatives that GTSPP is undertaking to improve the existing elements of the programme and to address implemented. It contains a concise presentation of the plan for the way forward.

OceanPC

OceanPC is undergoing a considerable revision with an aim of creating a fully integrated system for data entry, analysis, management, visualisation and dissemination of oceanographic data, as well as a (self) training tool. Unfortunately, the problems in implementing the Group of Experts on Technical Aspects of Data Exchange (GETADE) Terms of Reference have not been overcome and many technical issues of ocean data management are still waiting to be resolved. These include the development of quality control (QC) procedures, formats and distributed system capabilities. We may expect that the nomination of a new GETADE Chairman in 1998, Dr. Nickolay Mikhailov will facilitate the progress in helping the user community to resolve technical issues.

Despite these difficulties substantial progress was achieved in the development of a region-based "IODE Resource Kit" within the framework of the ODINEA project: the ODINEA CD-ROM (see also under regional approach) which is shown in Figure 11.

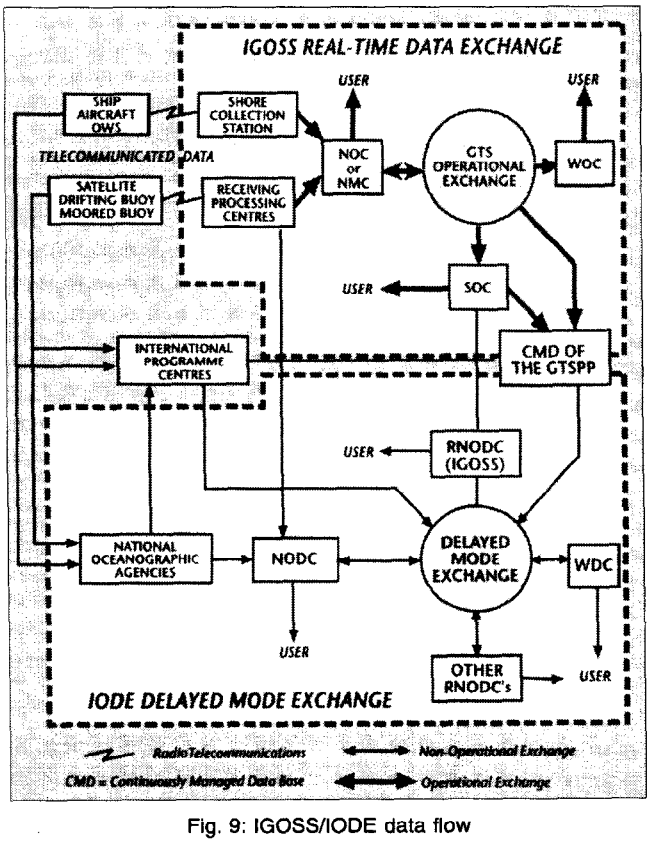


Fig. 9: IGOSS/IODE data flow

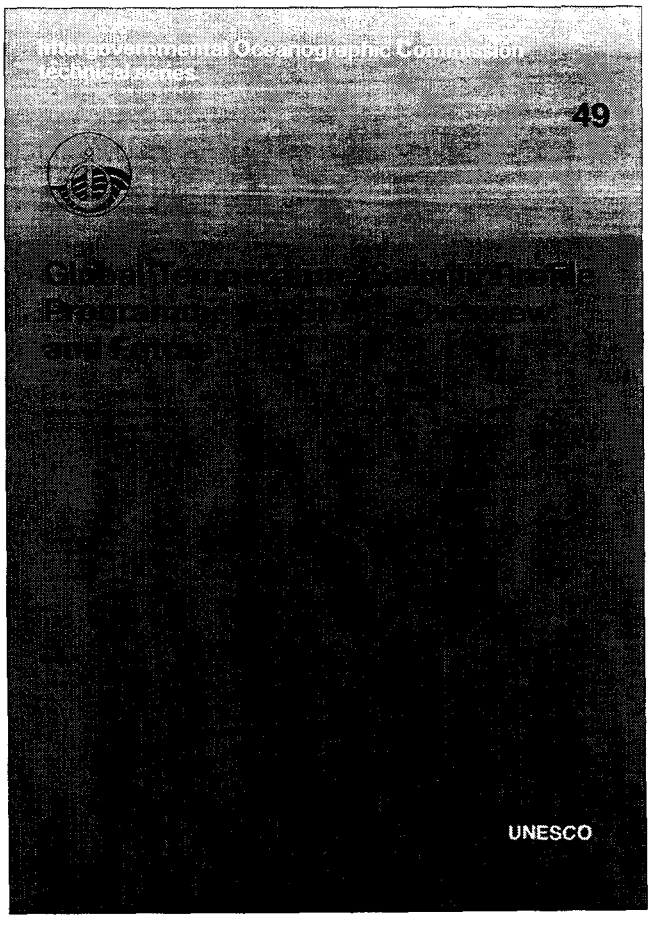


Fig. 10: IOC Technical Series 49

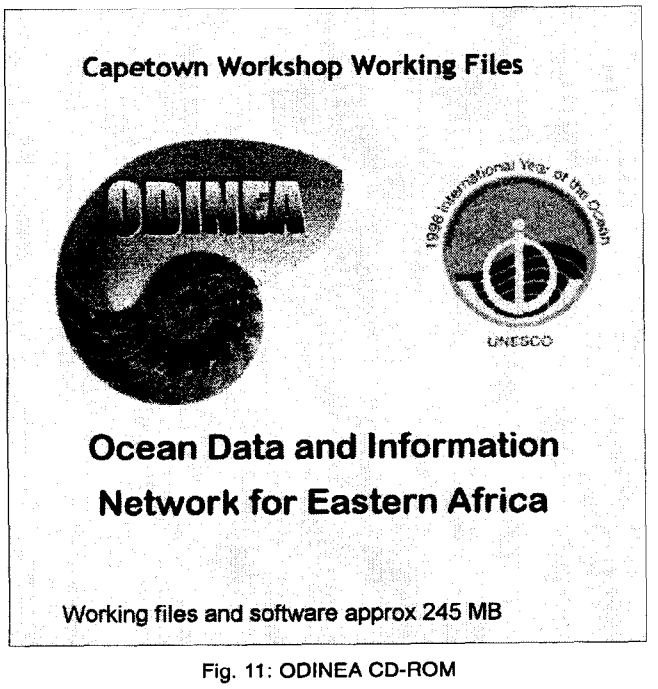


Fig. 11: ODINEA CD-ROM

Marine Information Management (MIM)

The MIM programme has progressed steadily in 1998 with emphasis on Internet based products and services, as well as on capacity building related to MIM in developing countries (see also under regional approach).

The IODE website

In May 1998 the IODE website was completely redesigned and it was assigned a new URL:
http://ioc.unesco.org/iode
It is intended as a kiosk of information on IODE for the IODE community.

MEDI Pilot Project software Version 1.0

The MEDI Pilot Project (meta database development tool) was developed (Fig. 12).

Global Directory of Marine (and Freshwater) Professionals (GLODIR)

The GLODIR homepage is shown in Figure 13.
http://ioc.unesco.org:591/glodir

- 1204 records were added in 1998;
- Support was provided to RECOSCIX-CEA for development of IOCEA Directory;
- Contractor was hired to develop directory for the Russian Federation.

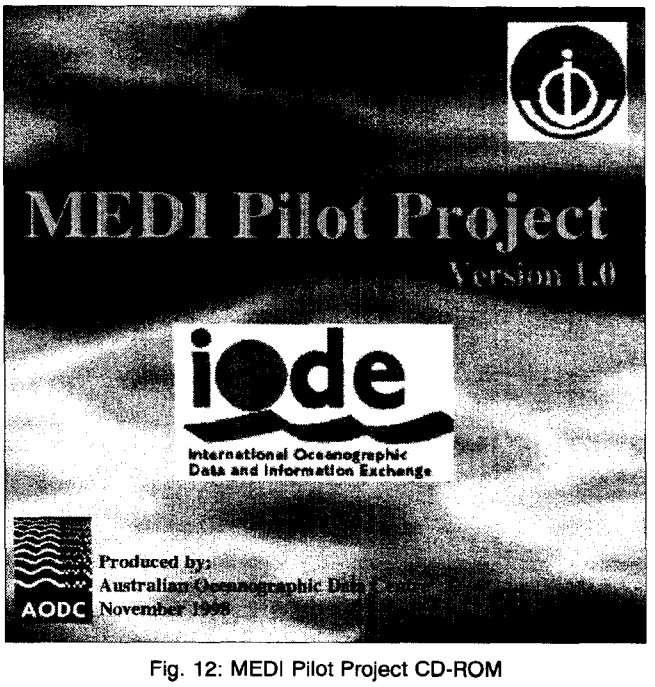


Fig. 12: MEDI Pilot Project CD-ROM

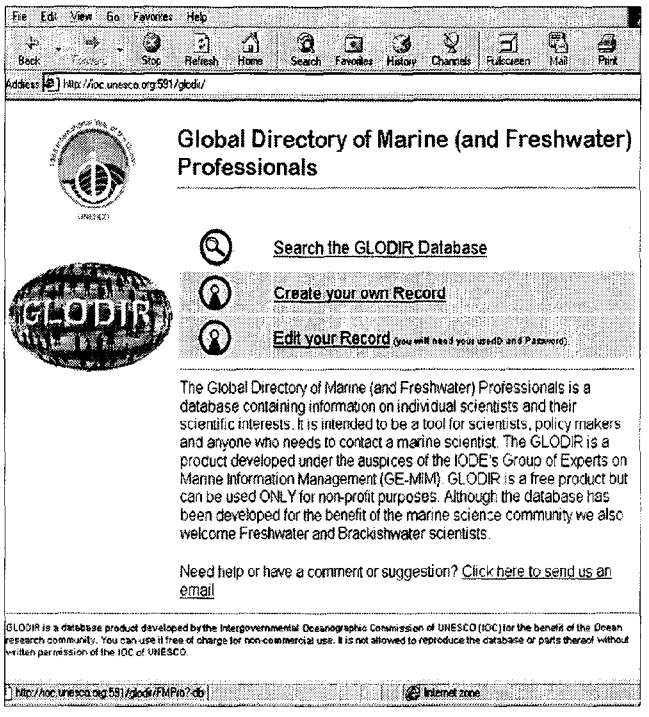


Fig. 13: GLODIR homepage

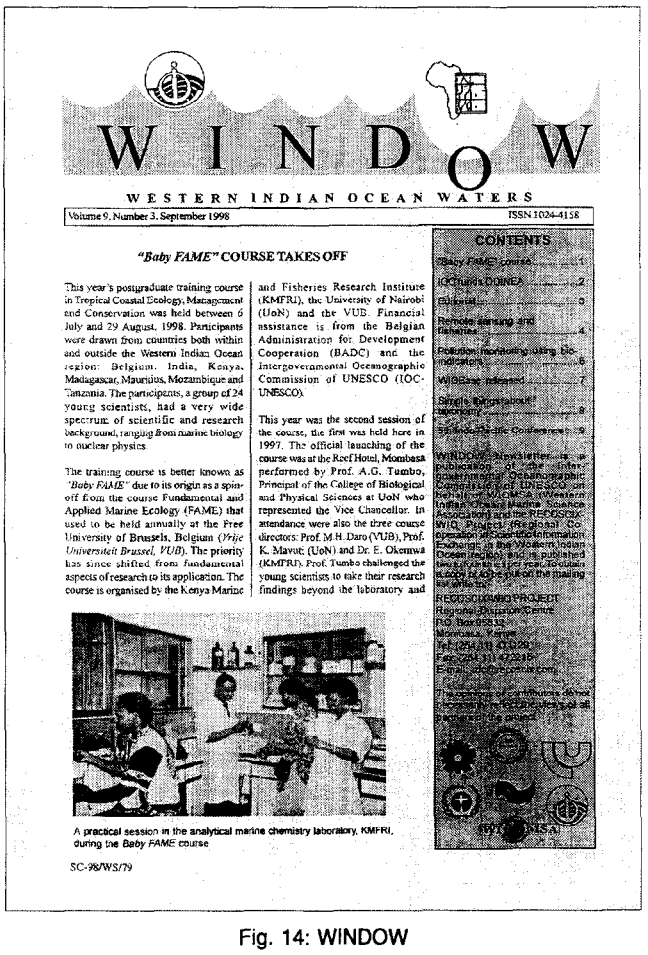


Fig. 14: WINDOW

EURASLIC Directory of European Aquatic Science Libraries and Information Centres

http://ioc.unesco.org:591/euraslic

IOC provided technical assistance and hosts directory including detailed information on 527 European libraries.

Window (Western Indian Ocean Waters)

Support was provided by IOC to the RECOSCIX-WIO Regional Dispatch Centre, Mombassa, Kenya to produce 3 issues of the Newsletter (Fig. 14).

THE REGIONAL APPROACH

A key element of the IOC Regional activities continued to be the need for improving ocean data and information management facilities and training. IODE is making enormous efforts in meeting this need.

The success story of IODE projects in the IOCINCWIO region shows that it is often more effective to address ocean data and information management problems at a regional than at a national or global level. This is because this approach helps define priorities and needs more effectively, while fostering regional sharing of capacity and data.

RECOSCIX-WIO

As early as 1987, the IOCINCWIO recognized the need for a regional approach to respond to the requirement of marine scientists for up-to-date (bibliographic) information, as well as a regional network to share information resources.

This led to the development of the RECOSCIX-WIO project (Regional Co-operation in Scientific Information Exchange in the Western Indian Ocean region), supported at different stages by IOC, Kenya, Sweden, Belgium and Flanders.

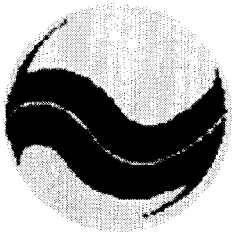


Fig. 15: the RECOSCIX logo

During its 10 years of operation, RECOSCIX-WIO has been able to:

- Provide marine scientists with access to essential scientific literature;
- Develop and maintain a regional directory of marine scientists providing information on indigenous expertise;
- Publish and distribute to over 100 countries, a regional newsletter *WINDOW* (Western Indian Ocean Waters), providing information on the RECOSCIX-WIO project as well as on institutions, projects and scientists working in the IOCINCWIO region. Within the region it is generally acknowledged that RECOSCIX-WIO has contributed to the promotion of intra- and inter-regional marine scientific Cupertino.

In 1999 a regional workshop will be held to define the future direction of RECOSCIX-WIO.

ODINEA (Ocean Data and Information Network for Eastern Africa)

In view of the success of the project in establishing a marine information exchange network, in 1997 the region requested the IOC to expand the scope of the project to include data exchange. Accordingly the ODINEA (Ocean Data and Information Network for Eastern Africa) project was conceived which combines data and information management. With extra-budgetary support from Sweden (SAREC of Sida) and Flanders, the project started in 1997. The main objectives include:

Fig. 16: the ODINEA logo

- Support to establish and operate the National Oceanographic Data Centres (NODCs) or Designated National Agencies (DNAs);
- Support to develop national and regional metadata bases.

The IOC provides various types of support to the ODINEA project:

- Workshops and training courses on ocean data management;
- Computer equipment for data centres;
- Support for operational expenses of data centres;
- Support for Internet access for data centres.

Since the start of ODINEA (including the preparatory phase) the IOCINCWIO region has seen the establishment of four new NODCs or DNAs: Kenya (1996-1997), Mozambique (1998), Seychelles (1997), and Tanzania (1996-1997). Madagascar and Mauritius are expected to establish centres in 1999 (Fig. 17).

ODINEA is funded as part of a more comprehensive project called ODINAFRICA (Ocean Data and Information Network for Africa), funded by the Government of Flanders: the RECOSCIX approach was also adopted in the IOCEA region and thus a RECOSCIX network is being implemented in that region as well.

Funding for RECOSCIX-WIO, RECOSCIX-CEA and ODINEA is currently assured until the end of 2000.

Building upon the experience and success of the RECOSCIX and ODINEA networks, and considering recommendations from IOCEA, IOCINCWIO and PACSICOM, a Pan-African data and information management project is now being planned. This will combine the objectives of the RECOSCIX and ODINEA projects as well expand these objectives to the development of data and information products to respond to the needs of a wide variety of users.

Steps are being taken to use the same approach in the IOCARIBE and WESTPAC regions.

TEMA/IODE/MIM – Training courses and Workshops on data and information management continued to be an important element of the IODE Capacity Building. In 1998 alone, five training courses and workshops were organized:

- Europe
  Training Course for Trainers, August 1997, Obninsk, Federation of Russia
- IOCINDIO
  IOC/IODE-NIO Training Course on Oceanographic Data and Information Management. National Institute of Oceanography, Goa, India, 17-27 October 1998 [available as IOC Training Course Report No. 50 from the IOC e-Library]
- IOCINCWIO
  IOC-Sida-Flanders-SFRI *Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA project)*. Capetown, South Africa, 30 November-11 December 1998 [available as IOC Workshop Report No. 154 from the IOC e-Library]
- WESTPAC
  IOC-JODC *Training Course on Oceanographic Data Management*, Tokyo, Japan, 1998

A briefing for the IODE Regional Co-ordinators was arranged in conjunction with the IODE Officers Meeting which took place in Goa, India between 10 and 13 February 1998.

IODE STRUCTURE AND POLICY

Within the IOC, guidance on data and information management on an international scale is the responsibility of the IOC Committee on IODE (C-IODE). The next meeting of the Committee (IODE-XVI) is planned for April 2000 in Istanbul, Turkey. The inter-session work of C-IODE is carried out by two groups of experts (GETADE and GEMIM), one joint IOC/WMO Steering Group on GTSPP and one Task Team (on Biological and Chemical Data).

Regular Meetings of the IODE Officers provide an opportunity for continuous review and evaluation of the programme, while providing guidance to the IODE Subsidiary Bodies and Member States. The last IODE Officers' meeting took place in Goa (India) in 1998 (Fig. 19).

The Summary Report is available as Document IOC/INF-1102. The meeting, *inter alia*, agreed on the need to review the entire system in order to identify ways effectively to

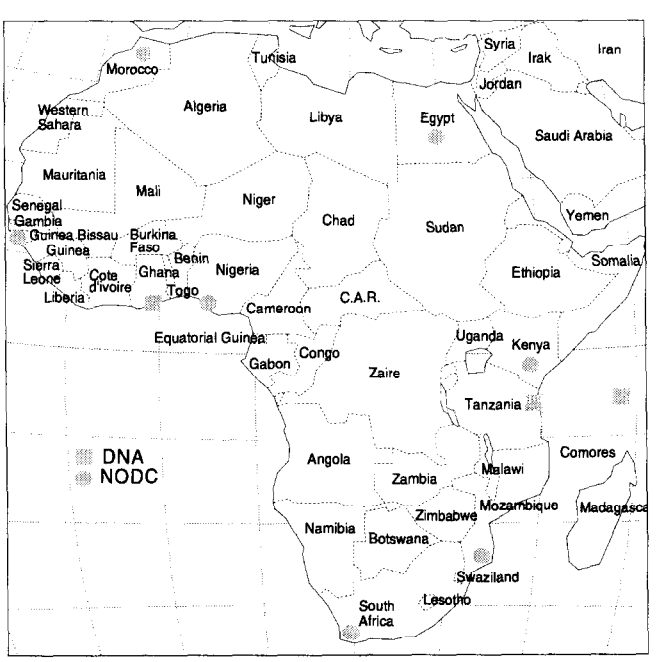


Fig. 17: IODE Data Centres in Africa

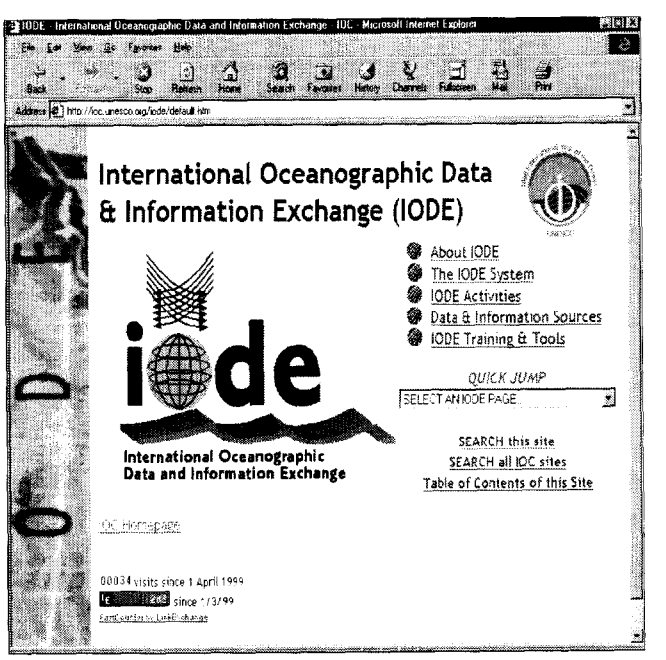


Fig. 18: The IODE homepage

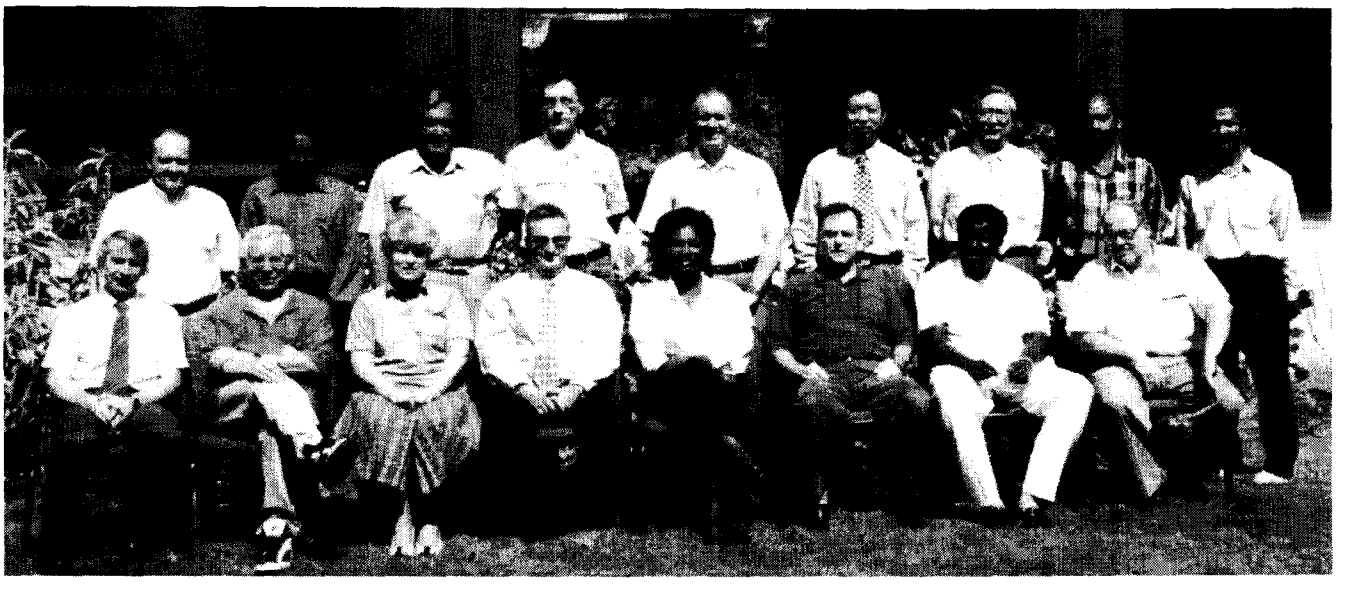


Fig. 19: IODE Officers meeting in Goa, 1998

meet the data requirements of emerging scientific and monitoring programmes such as GOOS, Climate Change and Biodiversity related activities, and to cope with technological developments. The Chairman of IODE is preparing a paper for the Twentieth Session of the IOC Assembly. This will lay the basis for a proposal for IODE-XVI on the revision and improvement of the system.

Between 1- 3 December 1998 in Paris, France, the IODE Strategy Sub-Committee meeting was held with, as objective, to broaden its focus while supporting its traditional customer base. Another aim was to provide a web link to the isolated "islands of data and information" which exist in many marine organizations and between global programmes.

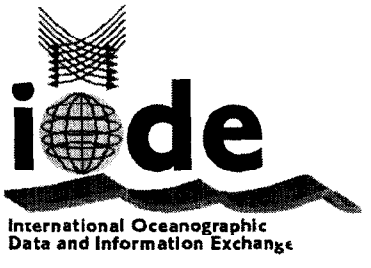


Fig. 20: The IODE logo

A number of actions were taken in 1998 to increase awareness of IODE activities including:

- Development of the *IODE website*: http://ioc.unesco.org/iode
- Publication of the *IGOSS/IODE brochure*
- Development of the *IODE logo* (Fig. 20)
- Demonstration of IODE products at *EXPO'98* and during the *IYO exhibition* in UNESCO, Paris in November 1998

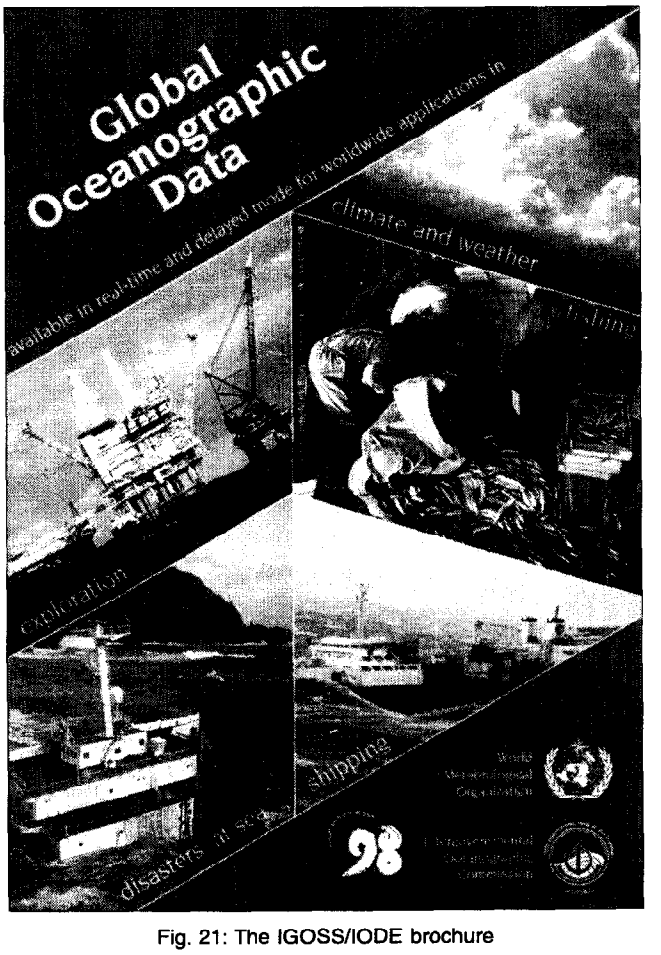


Fig. 21: The IGOSS/IODE brochure

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

The International Decade of Natural Disaster Reduction (IDNDR) was launched by the UN General Assembly in December 1989 with the objective of stimulating concerted international action, especially in developing countries, to reduce loss of life, property damage and economic and social disruption caused by natural disasters.

IOC has been engaged, since the early 1960's, in the assessment and mitigation of risks arising from natural hazards of geological origin, such as tsunamis. In the 1990's, attention was equally given to the study of hazards of hydrometeorological origin, such as storm surges and El Niño. The Pacific Tsunami Warning System (ITSU), established by IOC in 1965, today has more than 100 seismic and tide stations, operating in 24 Member States of the Pacific.

The primary activity of the ITSU is to issue timely warnings and watches following major earthquakes in or near the Pacific basin, that may result in tsunamis. These are tsunamis that could be destructive far away from the earthquake source area. The International Tsunami Information Centre (ITIC), sponsored by IOC, monitors the Tsunami Warning System and makes sure that the tsunami warning messages are received in a timely fashion and that message content is correctly understood.

In addition, the ITIC follows the actions taken by those countries or states that are warned, archiving all the information it obtains. This information includes data generated by the Pacific Tsunami Warning Centre and the Regional Tsunami Warning Centres throughout the system, as well as reports on the individual tsunami event itself, damage caused by the tsunami and evacuation and mitigation procedures taken. The ITIC maintains a library of nearly 100 linear metres of shelf space devoted to material on tsunamis and related phenomena. It is in the process of developing an annotated database of its documents, to be accessible via the Internet.

Looking ahead, ITSU intends to place more emphasis on assisting states, nations and regions with the establishment of more responsive warning systems for near-field tsunamis. "Systems" implies more than just warning centres. It includes ongoing tsunami awareness programmes, hazard mitigation programmes, such as tsunami run-up modelling and training programmes to develop local tsunami advisors.

The IOC is playing a leading role in the development of the joint IOC-IHP-WMO **Project Proposal on Storm Surges for the Northern Part of the Indian Ocean**. This proposal is for a five-year programme to develop the infrastructure necessary to provide effective and timely storm surge forecasts and warnings for the region, where the death toll associated with this type of events is in the hundreds of thousands.

A joint meeting of experts from IOC, WMO and UNESCO/IHP was held in New Delhi, India, 3-6 February 1998. During 1998, the governing bodies of IHP of UNESCO, WMO and IOC discussed and approved the project proposal.

Fig. 22: Damages caused by a Storm Surge in Bangladesh

Fig. 23: ITSU Officers, January 1999, ITIC, Honolulu, Hawaii, USA (Photo courtesy of Michael Blackford)

List of storm surges in the Bay of Bengal since 1990

The original record based on Jayanthi and Sarma (1986), Katsura *et al.* (1992), Taluder *et al.* (1992) and Father (1994), covers the period 1584 to 1998.

No.	*Date*	*Location*	*Damage*
140	4-10 May 1990	Mouth of Krishna River, Andhra Pradesh, India	600,000 house destroyed. 21,600 cattle killed. 3,500,000 poultry killed. 42,700 goats & sheep killed. Substantial damage to agriculture.
141	7-8 Oct. 1990	Barisal, Bangladesh	150 fishermen missing. Substantial damage
142	29 Apr. 1991	Chittagong, Cox'z Bazar, Bangladesh	4 to 8m surges. 150,000 deaths. 70,000 cattle killed. Great damage
143	2 Jun. 1991	Bangladesh	1.2m surge
144	11-17 Nov. 1992	Sri Lanka & Tutikorin, India	1-2 m surge at Tuticorin, 170 killed, 160 missing
145	15-21 Nov. 1992	Teknoff, Myanmar, Bangladesh Coast	Damage estimation not available
146	1-4 Dec. 1993	Near Karaikal	1-1.5 m surge, 111 killed
147	29 Apr.–3 May 1994	North Myanmar coast	200 people killed
148	29-31 Oct. 1994	Madras, India	1-2 m surge, 304 killed, 100 000 huts damaged, 60,000 hectares crops damaged
149	7-10 Nov. 1995	Gopalpur , Orissa, India	1.5 m, 96 killed, 2,84,253 hectares crops damaged
150	21-25 Nov. 1995	Coxbazar, Bangladesh	Damage estimation not available
151	12-16 Jun. 1996	Visakhapatnam, India	179 killed, 13,378 hectares of crops damaged
152	5-7 Nov. 1996	Kakinada, India	2-3 m surge, 978 killed, 1375 missing, 647554 houses damaged, 1.74 lakh hectares crops damaged
153	15-20 May 1997	Chittogong, Bangladesh	Damage estimation not available

As a follow-up to the 1997-1998 **El Niño**, the IDNDR Task Force on El Niño was established. This was part of a co-ordinated UN approach to develop a strategy for the prevention, mitigation and rehabilitation of the damage caused by the El Niño phenomenon. IOC plays a unique role in the technical and scientific issues and is involved in integrating the socio-economic and cultural aspects.

The IOC has continued to respond effectively to the IDNDR objectives by improving ITSU and sharing the experience gained in the ITSU operations to other geographic areas, such as the Mediterranean or Caribbean, where there is a high probability of underwater earthquakes and tsunamis. An advanced proposal for establishing such a system has been developed in IOCARIBE and will be discussed in the next session of the Sub-Commission in April 1999.

The installation of TREMORS (Tsunami Risk Evaluation through Seismic Moment from a Real-time System) a system developed by France, has continued. It is an ideal tool for identifying the precise location of an earthquake and to make tsunami analysis. ITSU water level gauges installed along the coastline cover all parts of the Pacific (Fig. 25). The Tsunami Real-time Reporting System was designed recently by the USA to record tsunamis in the deep ocean with a bottom pressure gauge and to relay that signal back to a warning centre through a buoy and satellite.

Although we have not experienced a truly Pacific-wide destructive tsunami since the establishment of ITSU, we feel that the system will respond well and that there will be adequate warning for a distant tsunami event. **Over the last 30 years however, thousands of lives have been lost to tsunamis originating nearby. There is therefore an urgent need to prevent these losses by establishing local, national & regional tsunami warning systems and by improving all components of the ITSU system.**

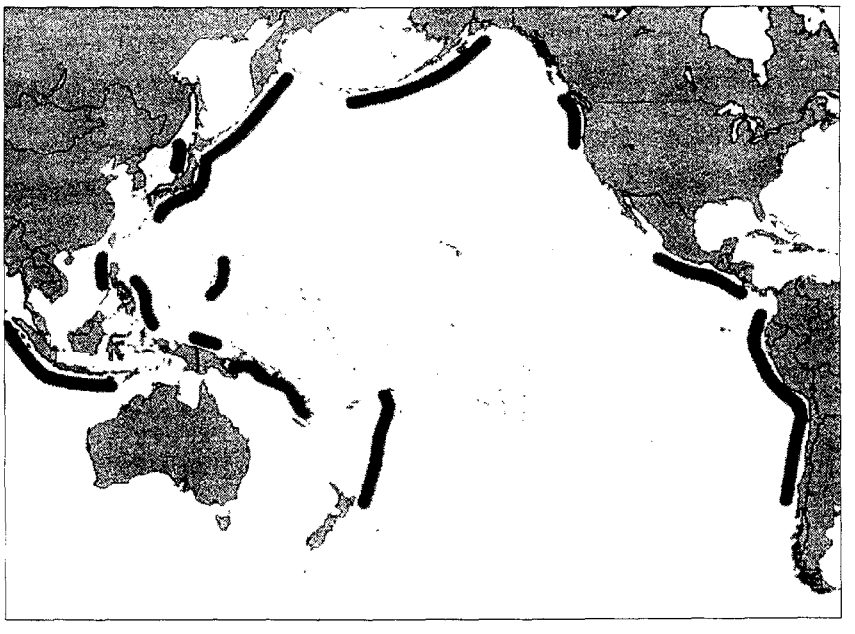


Fig. 24: Major tsunamigenic seismic zones in the Pacific region.
Most tsunamis are only destructive along the coasts near the generating earthquake.
However, a few each century are powerful enough
to cause destruction many thousands of kilometres away from the source.
(Source: ITSU Master Plan)

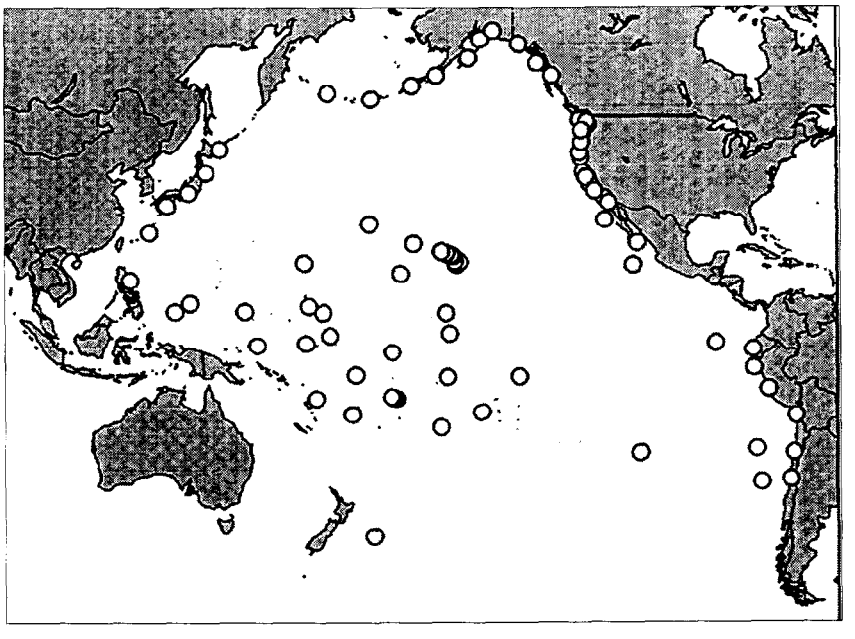


Fig. 25: The location of gauges in the Pacific.
Water level gauges are owned by many organizations and their data
are shared for a variety of purposes.
(Source: ITSU Master Plan)

Destructive Local or Regional Tsunami Since 1992

Date	*Source Location*	*Estimated Lives Lost*
02 Sep.'92	Nicaragua	168
12 Dec.'92	Flores Is., Indonesia	1,000
12 Jul.'93	Okushiri Is., Japan	230
03 Jun.'94	Java, Indonesia	222
04 Oct.'94	Shikotan Is., Russia	11
14 Nov.'94	Philippines	74
09 Oct.'95	Manzanillo, Mexico	1
01 Jan.'96	Sulawesi, Indonesia	9
17 Feb.'96	Irian Jaya, Indonesia	110
23 Feb.'96	Peru	12
17 Jul.'98	Papua New Guinea	2,500

The location and configuration of gauges changes from time to time, with the most up-to-date information to be found in the *Communications Plan for the Tsunami Warning System*. The last update was published in 1998. Efforts continued to re-establish gauges in the Kuril-Kamchatka region. In December 1998, consultations were carried out with the Russian authorities. The results lead us to believe that the project will be finalized in 1999.

The tsunami-related research was carried out in co-operation with the Tsunami Commission of the International Union of Geodesy and Geophysics. In May 1998, an international conference "*Tsunamis – Observations and Instrumentation, Predictions and Simulations, Tsunami Warning Systems, Tsunami Mitigation*" took place in Paris. The conference brought together almost 100 experts; with 50 papers presented for discussion.

Numerical modelling is needed to determine the potential run-ups and inundation from a local or distant tsunami. The IOC/IUGG Tsunami Inundation Modelling Exchange (TIME) programme helps to address this problem. The IOC Manual on TIME was published in 1998 in English, while training in the use of the model was arranged for Chile, Mexico and Japan. Meanwhile, historical data is needed to help assess the tsunami hazard and to verify tsunami models. The Expert Tsunami Data Base (ETDB) programme, that can be run on a personal computer, was developed by Russia with encouragement and partial support from IOC. This programme helps rapidly to access and view historical tsunami data in a wide variety of useful graphical formats (Fig. 26).

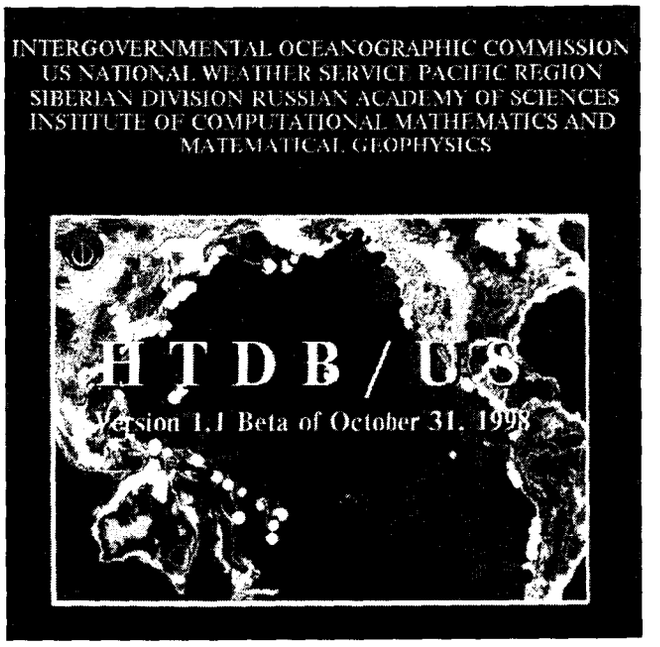


Fig. 26: ETDB project, CD-ROM

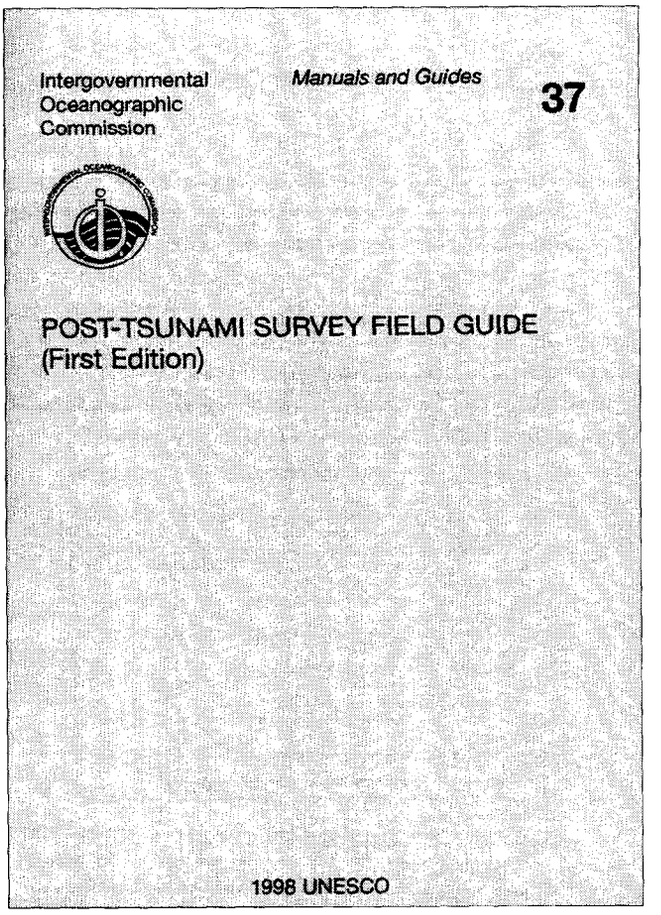


Fig. 27: A post-tsunami field guide published in four languages by IOC

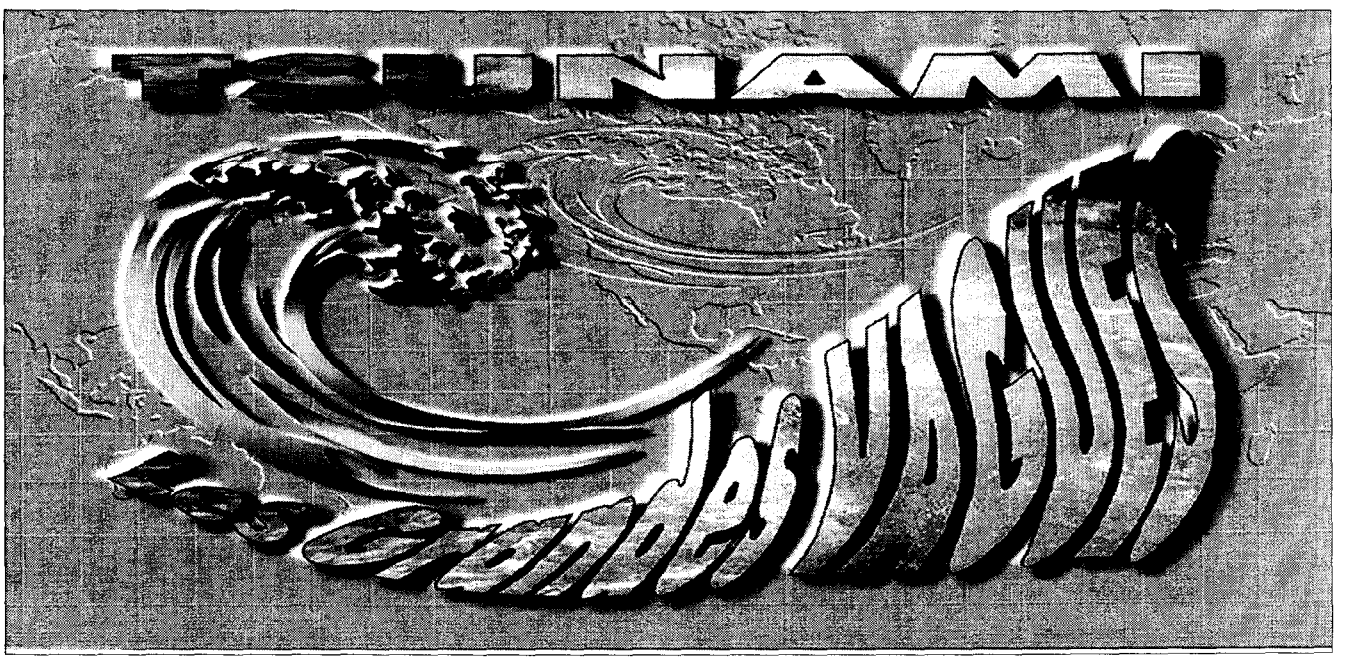


Fig. 28: "Tsunami – Les grandes vagues "

Following a destructive tsunami, a standard post-tsunami reconnaissance survey needs to be conducted to make measurements of run-ups and inundation limits and to collect associated data. IOC has published a post-tsunami field guide in four languages, to help with survey preparations, to identify the measurements and observations that should be taken and to standardize data collection methods.

As a contribution to the IYO, tsunami experts helped in designing an educational poster *Ocean – Coastal Hazards: Hurricanes, Tsunamis, Coastal Erosion* in English (Fig. 29) and an advertising brochure in French *Tsunami – Les grandes vagues* (the Great Waves) (Fig. 28).

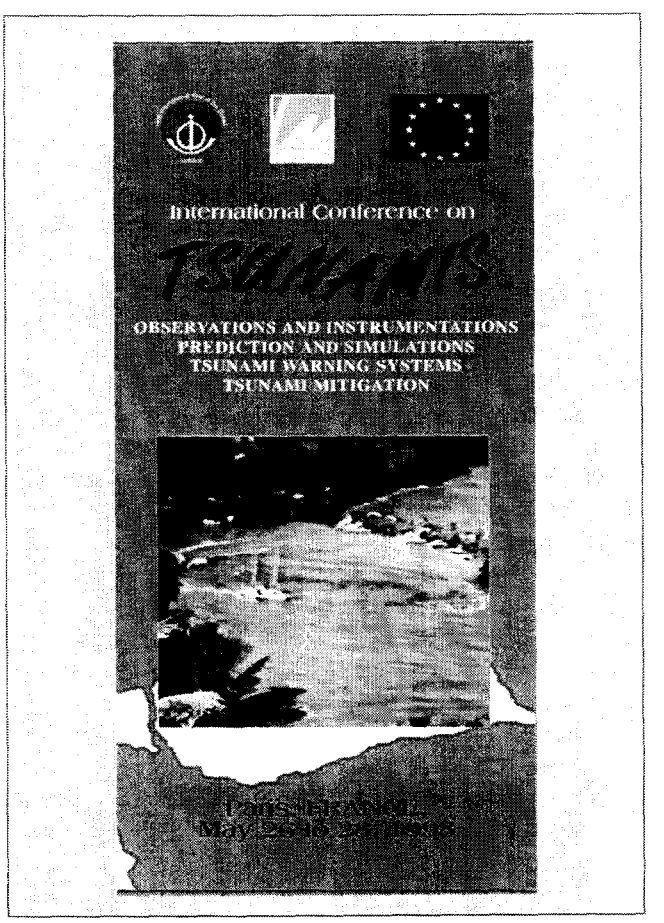


Fig. 29: Ocean-Coastal Hazards:
Hurricanes, Tsunamis, Coastal Erosion

THE PEOPLE BEHIND THE OCEAN SERVICES PROGRAMME

Iouri Oliounine from Russia, has become the corporate memory of the IOC. He joined the IOC in 1980 to head the Ocean Services Unit and is the only one who still remembers the colour of Mario Ruivo's tie that year. Once upon a time the responsibility of his Unit was so wide that it covered all IOC data collection and management programmes. In 1992 the responsibilities were abridged and split with the GOOS programme Office. In 1996 he was appointed as the Deputy Executive Secretary of IOC. Before joining IOC he spent many years on board a Russian research fleet, being Chief of Expedition in the last years. He plied the waters of the ocean from 83 N to the coasts of Antarctica. He has a M.Sc. in oceanography and a Ph.D. in marine geophysics-wind waves and swell.

Peter Pissierssens was born in Belgium in 1960. After completing his studies and working as a marine researcher at the Free University of Brussels he left for Kenya in 1985 where he worked for the Government of Belgium, UNEP and IOC. In 1992 he joined the IOC Secretariat and was put in charge of IODE's Marine Information Management activities. He has also co-ordinated the IOC-SAREC co-operation in the IOCINCWIO region between 1992 and 1995, and acts as the IOC web administrator. Since 1998 he has added regional data management issues to his responsibilities with the start of the ODINE/ADINAFRICA project.

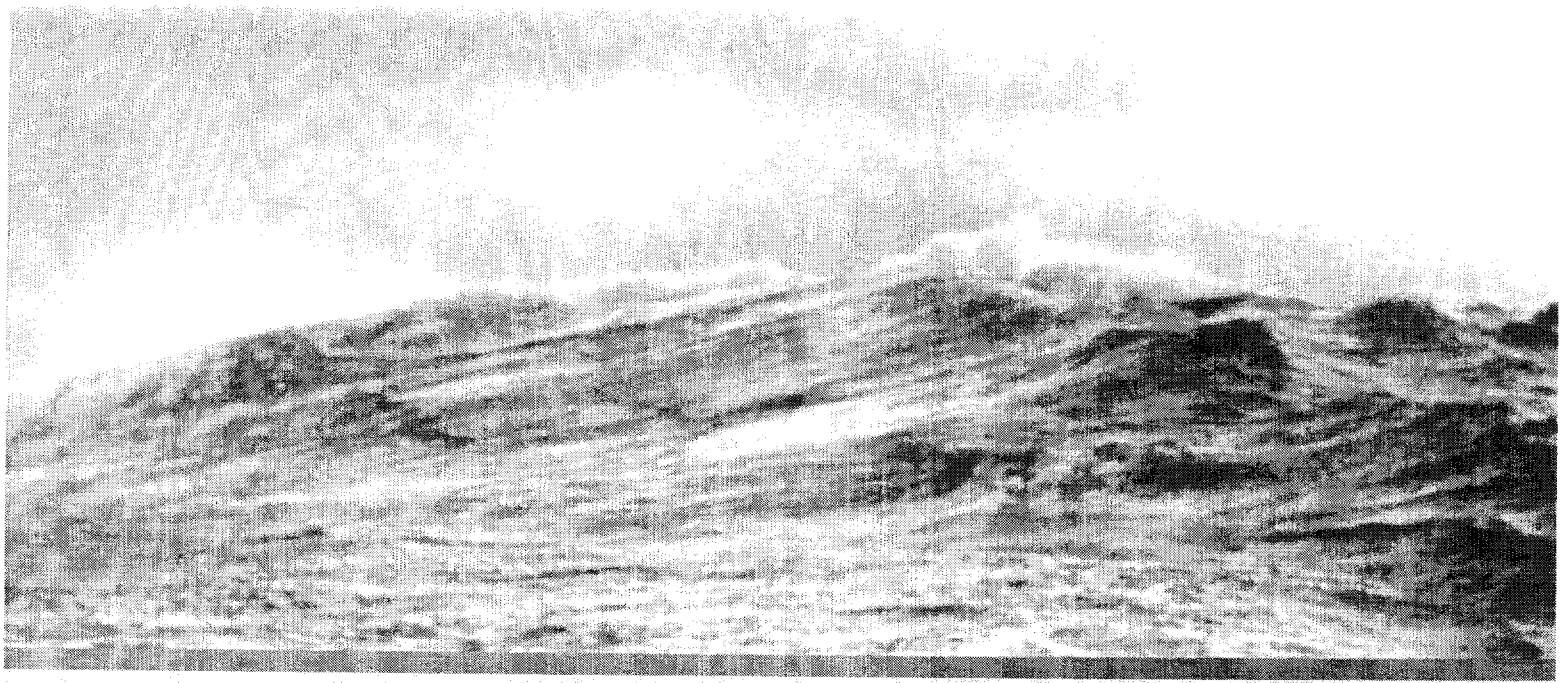
Dmitri Travin is our Russian consultant with a background in Engineering Hydrography and a M.Sc. in Navigation and Oceanography. He joined IOC in 1989 as a seconded staff member in charge of the International Bathymetric Chart of the Mediterranean Sea (IBCM) and its Geological/Geophysical Series in the IOC/ICSEM Operational Unit in Monaco. In 1992 he returned to Russia and for two years where he worked as Adviser in the Division of External Affairs of the Head Department of Navigation and Oceanography (RN) in St Petersburg. In 1994 he was seconded to IOC by the Russian Government as Senior Assistant to the IOC Executive Secretary for Ocean Mapping. Presently he is working as a full-time consultant for the above-mentioned programme, including seven regional mapping projects, GEBCO and GAPA. He is responsible also for implementation of the Black Sea Regional Committee Action Plan and for the IOC relationship with the International Hydrographic Organization (IHO).

Julian Robbins is from Canada and has completed an MA in Philosophy. Julian has worked on several projects with Environmental Networking Committees (governmental and non-governmental) concerning the ethics and ecology of sustainable development, waste management and other environmental issues occurring on First Nations (Indigenous) lands. After completing a six month internship with the Coastal Regions and Small Islands Programme and in the Department of Ecological Sciences at UNESCO headquarters, Julian joined the IOC team as a junior consultant in September of 1998. Julian Robbins develops and maintains the IOC programme web-sites in consultation with IOC Programme Specialists and the IOC webmaster. His responsibilities also include the selection and editing of material form IOC's on-line IMS Newsletter, and to IOC's intern basketball competition in UNESCO.

Françoise Schiller (born in Madagascar, calls herself "Framboise" since Françoise is a very common name in France,) has been working in UNESCO for 20 years, 14 years with IOC. She first worked as a GLOSS and GOOS lady for many years and then worked on Marine Information Management and databases with Peter Pissierssens in the Ocean Services Unit.

Adrien Vannier (ex-Wanigesekera from Sri Lanka) has been connected with the Ocean Services Unit for 18 years and has worked closely with Dr. Iouri Oliounine on the IODE, ITSU and GODAR programmes.

Samia Mousli, Algerian, is in charge of the preparation, implementation and follow-up of all activities related to the celebration of the 1998 International Year of the Ocean (IYO). She is responsible for up-dating the IYO website and trying to field out all those questions we receive in our Ocean Forum section.



Operational Observing Systems

3

3.1 The Global Ocean Observing System (GOOS)

One of IOC's four main objectives is *to ensure effective planning, establishment and co-ordination of an operational Global Ocean Observing System to provide the information needed for oceanic and atmospheric forecasting, for ocean and coastal zone management by coastal nations, and for global environmental change research.*

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;
- Provide forecasts of these for as far ahead as possible, for a wide range of users;
- Meet the needs of the Framework Convention on Climate Change by supporting forecasts of changes in climate.

GOOS is not solely operational, but includes doing the work needed to convert research understanding into operational tools. If designed and managed well, GOOS should provide IOC and its partners (WMO, UNEP and ICSU) with the ability to convert research results into useful products to meet societal needs.

GOOS is being designed by four design panels: Coastal; Living Marine Resources (LMR); Health of the Ocean (HOTO); and Climate (Ocean Observing Panel for Climate: OOPC). There is now a good balance of activity across these four sectors.

In November 1998, GOOS received additional intergovernmental support. The Fourth Conference of the Parties (COP-4) to the Framework Convention on Climate Change, Buenos Aires, agreed there is an urgent need to improve the quality, coverage and management of the global ocean observing system, and especially to support an increase in the number of ocean observations, particularly in remote locations. This underlines the need for implementing GODAE and ARGO. The COP-4 also urged Parties and GEF (the Global Environmental Facility) to help to build capacity in developing countries, to enable them to participate in and benefit from GOOS. The IOC now has an opportunity to meet this challenge. In doing so we will need to be sure that the resources are matched to the challenge. For details of the case made to the COP, and its resolutions, see:

http://www.wmo.ch/web/gcos/scVIII/gcos_sc.html

The new GOOS Steering Committee (GSC), whose emphasis is on implementation, had its first meeting in April 1998, in Paris. Thanks in no small part to the efforts of the GSC, the GOOS design has now emerged for application by Member States in the form of the *Strategic Plan and Principles* (Doc. IOC/INF-1091), and *The GOOS 1998, a Prospectus for GOOS*, which was published by the IOC in November as GOOS Publication No. 42.

The GOOS 1998 is a comprehensive statement on the sound scientific and technological basis for doing GOOS at this time. It describes GOOS components, along with examples of how the GOOS concept is already working in some places. It explains the real and potential value of GOOS to Member States, to encourage them to participate in and make commitments to GOOS development and implementation. It also encourages them to do the capacity building necessary to enable all Member States to contribute to and benefit from GOOS. Member States should find this document useful to gain a full understanding of the present dimension of ocean observing and its evolution into GOOS.

The GOOS paradigm, comprises an integrated, holistic and issue-driven approach to the development of operational products and services and the research necessary to implement them. From discussions at the 31st IOC Executive Council in November 1998 it was clear that, this paradigm is already influencing thinking and planning at the national level. Many Member States are now planning, or indeed collecting, their own coastal observations in line with the GOOS concept and principles.

This is exciting news, as implementation along GOOS lines at the national level will make it all the easier to integrate observations from neighbouring states as GOOS

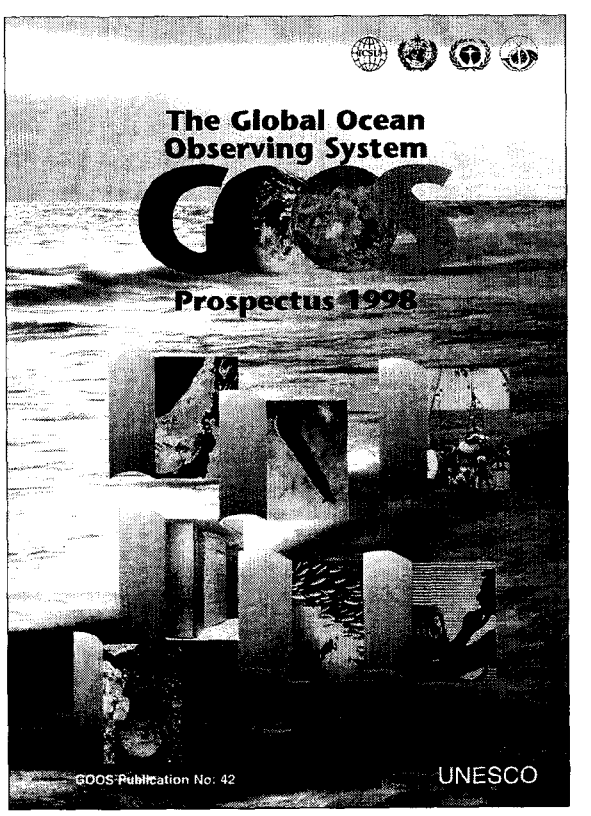


Figure 1: GOOS 1998 cover.
The Ministry of Education, Science, Sports and Culture of Japan, The European Union, Commission Directorate GENERAL XII, and the National Science Foundation of the USA met the costs of the production of the GOOS 1998 Prospectus, including meetings of the Drafting Review Group, printing and distribution.

develops. Indeed several delegations made it clear that they were now preparing to make commitments to GOOS, and would soon be in a position to list the systems that they proposed to make available as GOOS components.

For more information see the GOOS homepage at: http://ioc.unesco.org/goos

GOOS INITIAL OBSERVING SYSTEM

During the year a major achievement was the creation of the GOOS Initial Observing System, which unites the main global observing sub-systems supported by the IOC, WMO and (in the case of coral reefs) the IUCN, and includes measurements from ships, buoys, coastal stations and satellites. It includes:

- the Ship-of-Opportunity programme (SOOP) making upper ocean measurements;
- the Voluntary Observing Ship (VOS) programme of the WMO, making marine meteorological measurements;
- the Global Sea Level Observing System (GLOSS) and its network of tide-gauges;
- the Global Coral Reef Monitoring Network (GCRMN);
- the Global Temperature and Salinity Profile programme (GTSPP) for providing high quality data from the upper ocean;
- the Data Buoy Co-operation Panel (DBCP), for various kinds of data from buoys;
- the Tropical Atmosphere-Ocean (TAO) array of buoys for monitoring El Niño;
- US-NOAA's operational satellites;
- the Global Telecommunications System (GTS) of the WMO, for transmitting information.

This is the operating nucleus today on which GOOS will grow in the future. The managers of these systems, including a representative of the IOC's International Data and Information Exchange programme (IODE), now form an Interim Implementation Advisory Group, to make the GOOS Initial Observing System work. Creation of this group anticipates the creation of the Joint IOC-WMO Technical Commission for Oceanography and Marine Meteorology (J-COMM) (see below), which will provide the essential integrated infrastructure for cost effective operations in support of GOOS, GCOS and the World Weather Watch of the WMO.

The TAO array of 70 buoys in the tropical Pacific underpins El Niño forecasts. The Seventh Session of the TAO Implementation Panel (TIP-7) was held in Abidjan, Côte d'Ivoire, 11-13 November 1998, in conjunction with the Fifth Session of the Pilot Research Moored Array in the Tropical Atlantic (PIRATA), from 9-10 November 1998. Over 40 participants from 14 nations attended TIP-7 and PIRATA-5. Both meetings were hosted by the "Institut Francais de Recherche pour le Développement (IRD-ORSTOM)", and supported by Météo-France and IOC/UNESCO.

As well as reviewing the present status of the TAO and PIRATA arrays, there were several scientific presentations and important discussions concerning the present and future use of TAO and PIRATA data for research and operational activities. For the first time, data from the TAO array provided detailed and valuable information of the fast transition from El Niño to La Niña conditions in the upper Tropical Pacific Ocean. Three recommendations emerged from TIP-7, two of them calling for additional surface and subsurface salinity sensors to be added to selected moorings in the array, as a contribution to an emerging salinity monitoring effort.

A third recommendation called for UNESCO to promote a UN resolution to help alleviate loss of mooring data and oceanographic equipment due to vandalism and damage to the buoys. This seems to be jeopardising TAO, PIRATA and other climate-oriented mooring programmes (see below). In response to a recommendation from the Sixth Session of the TAO Implementation Panel (TIP-6), it was reported that surface meteorological data from Indian moored buoys in the Bay of Bengal and the Arabian Sea will be available on the GTS by the end of 1998.

Japan is taking over management of the western part of the TAO array, replacing the original ATLAS buoys with more TRITON buoys at 12 sites. The transition to TRITON should be completed by the end of 1999. For more information on TAO see the web site:

http://www.pmel.US-NOAA.gov/toga-tao

GOOS PILOT PROJECTS

The main GOOS pilot project continues to be **GODAE**, the Global Ocean Data Assimilation Experiment, designed to demonstrate three key features of state of the art capacities:

- The power of integrating satellite and *in situ* data;
- The power of model assimilation of data; and
- The value of a global system capable of working in real-time.

GODAE is needed for open ocean analysis and forecasts, and to establish boundary and forcing conditions for regional models to improve forecasting in coastal systems.

To feed the requirements of GODAE, and to provide global coverage for the first time of upper ocean temperature and salinity, the OOPC also began the development of the **ARGO Programme**, Array for Real-time Geostrophic Oceanography. ARGO will use 3000 profiling floats rising from 2000m to the surface every 14 days, each one collecting 100 CTD profiles over a 4-year period, for a total of 300,000 profiles that together provide 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.

VANDALISM

For both TAO and PIRATA, vandalising of buoys is a serious problem, which needs consideration by the international community. Photographs prove that equipment has been deliberately cut from buoys. The buoys vandalized most often in the TAO array are those towards the eastern and western ends, nearest to land, where fishing activity is concentrated (especially the western end, which is home to the world's largest tuna fishery). Clearly vandalism is a threat to moored devices for real-time observation. Recognizing this problem, the 31st IOC Executive Council (Paris, November 1727, 1998), passed a resolution about the need to act against vandalism.

One way to deal with the problem may be through education. The TAO Implementation Panel has issued leaflets in several languages to fishing organizations and fishing boats, but so far without any significant decrease in vandalism.

Funding is mostly from space agencies, including US-NOAA, and now supports a GODAE Office in Melbourne. Reports on GODAE and ARGO can be found on the web at:

http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/homepage.html

http://WWW.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/godae/Argo_Design.html

The past year has also seen the creation of **PIRATA**, the Pilot Research Moored Array in the Tropical Atlantic. PIRATA is an extension of the TAO Array concept into the Atlantic Ocean. PIRATA will monitor in real-time ocean and atmospheric variables and upper ocean thermal structure at key locations in the tropical Atlantic region to improve understanding of ocean-atmosphere processes, so leading to improved climate prediction for Africa and South America. Twelve ATLAS moorings are been deployed during 1997-2000, as part of a multinational effort involving Brazil, France and the United States of America. Initial PIRATA results and data are available on the PIRATA web sites at:

http://www.ifremer.fr/orstom/pirata

http://www.pmel.US-NOAA.gov/pirata

PIRATA is a 3-year pilot project, which, if successful, could become a permanent operational programme. At the end of the pilot phase of PIRATA (end 2000 beginning 2001), other nations are expected to join in the maintenance and possible expansion of PIRATA (and other types of *in situ* oceanic observations) to constitute a truly tropical Atlantic Ocean Observing System.

GOOS REGIONAL AND NATIONAL PROGRAMMES

The two main regional programmes of GOOS continue to be **EuroGOOS** in Europe, and **NEAR-GOOS** in the North-east Asian region. Highlights for EuroGOOS include the attraction of 15 million ECU's from the European Commission into pre-operational research projects to develop the skills and capabilities to implement GOOS. These projects include the Mediterranean Forecasting Project. Highlights for NEAR-GOOS include a doubling of its data holdings, a significant increase in contributors to NEAR-GOOS, and a significant increase in data exchange. Details of the EuroGOOS and NEAR-GOOS programmes can be found on the web at:

http://www.soc.soton.ac.uk/OTHERS/EUROGOOS/

http://ioc.unesco.org/goos/neargoos.htm

New regional GOOS programmes with a coastal focus include **MedGOOS**, **PacificGOOS**, **Black Sea-GOOS**, and **CaribbeanGOOS**. MedGOOS was initiated in November 1997, and its first substantial workshop is planned for Rabat, 9-12 June 1999, to address the benefits and costs of implementing GOOS in the Mediterranean Sea. PacificGOOS was initiated in February 1998, and its first substantial workshop is planned for Nouméa, in October 1999, to initiate planning for long term monitoring and observing in the region's coastal seas. The Black Sea Regional Committee of the IOC is proposing to launch Black Sea-GOOS in 1999. The Intra-American Seas Initiative meeting in Miami in October 1998 proposed developing CaribbeanGOOS to maximise the efficiency of observations for understanding complex processes in the region. This challenge will be addressed at the IOCARIBE meeting in April 1999, in association with a CaribbeanGOOS Capacity Building Workshop.

As all the other operational activities of IOC, GOOS is implemented through the concerted action of its Member States. Accordingly, adhering to the GOOS principles and strategy, several nations have developed GOOS committees; among these, the US national committee has been busily planning for a national integrated observing system that would make an important contribution to GOOS.

COASTAL GOOS

In this report we focus on developments by the Coastal Panel of GOOS, which meets twice a year, with the aim of publishing a strategic plan and implementation plan twelve months from now*.

The focus of The Coastal Panel of GOOS (or **C-GOOS**) is to:

- Determine the major issues and needs identified by the user community;
- Address those issues and needs, by designing an integrated, multi-disciplinary, coastal observing system for detecting and predicting change in coastal ecosystems and environments.

By providing long-term time series of standard measurements against which the effectiveness of management policies can be assessed, Coastal GOOS will specially serve the major Global convention and the 16 Regional conventions implementing the Global Plan of Action for the Protection of the Marine Environment from Land Based Activities (GPA/LBA). These management instruments need information on biological and chemical factors related to the recycling of bio-active substances, sediment quality and indicators of the state and response to stress and recovery of different habitats. The issues addressed so far include:

- Eutrophication due to nutrient enrichment;
- Toxic contamination;
- Habitat loss;
- Saltwater intrusion;
- Flooding and storm surges;
- Harmful algal blooms;
- Sea level rise; and
- Safe navigation.

At the heart of the C-GOOS design will be a Global Coastal Network comprising a minimal set of core measurements that should be made *in situ* on a global basis. The design will also include:

- A global view of coastal systems, based on remote sensing from satellites;

* Reports on the LMR Panel of GOOS appear in the section of this report on Ocean Science in Relation to Living Marine Resources. Reports on the Climate Panel of GOOS appear in the section on the IOC's Climate programme.

Fig. 2: Participants In the 2nd GOOS Coastal Panel meeting (Curitiba, 29 October-1 November 1998)

- A regional picture, from specific operations like the Mediterranean Forecasting System;
- Areas of local detail, from pilot projects like the S.E. Asia Harmful Algal Bloom (HAB) forecasting project;
- Site-specific information from a network of time series stations and selected transects across straits or between offshore Islands and the coast.

The Global Network will be kept minimal, simple, low/medium tech and cheap, to ensure that technical protocols do not transform themselves into a barrier to entry, particular to developing states. It must be global, to answer questions that are difficult to settle from the analysis of available, historical data sets (eg. are HABs increasing, or are sea-grasses declining?), and to calibrate remotely sensed data, such as those on ocean colour. In addition, the Global Network will link people and laboratories, providing them with interpretative power that they could not develop locally.

A first task is to determine which physical variables can easily be measured to meet users' needs in the short term. The second task is to determine the biological and chemical measurements needed to meet users' needs. A third task is to find out what is there, by making an inventory of present systems, together with the Land-Ocean Interaction in the Coastal Zone (LOICZ) study of the International Geosphere-Biosphere Programme (IGBP). Aside from LOICZ, C-GOOS is working closely with other programmes like the IOC's GLOSS, ICAM, IODE, GIPME, OSLR and HAB programmes, with other GOOS bodies, and with UNEP's Regional Seas programme.

C-GOOS will differ from other observing systems

- in having modelling and forecasting as part of its mandate, as well as the collection of data;
- in being holistic, integrated and interdisciplinary, rather than narrow and sectoral;
- in being designed to deliver useful products for both decision-makers and the scientific community.

C-GOOS is developing several pilot projects, addressing issues of concern to users in different areas of the world. The pilot projects will be nested in the Global Network to demonstrate how C-GOOS will work in practice. A technology demonstrator project is being considered to improve remote sensing algorithms for the use of colour as a tool in coastal management. To ensure the proper issues are addressed C-GOOS is holding a series of Coastal GOOS Users' Workshops.

Elements of a coastal GOOS are also being designed by the HOTO Panel, including pilot projects for the Red Sea, Southeast and Northeast Asia, the Black Sea, and the Caribbean. One pilot project has been started, in Brazil (RAMP: Rapid Assessment of Marine Pollution), to provide equipment and training for easy-to-use, cheap technologies to measure chemical and biological markers to assess environmental impacts and improve environmental management.

C-GOOS will provide an important part of the basic observing systems for ICAM needed by coastal zone managers. This concept was endorsed at the PACSICOM meeting in Maputo (July 1998), where a GOOS-AFRICA Committee was created to help develop GOOS in African coastal seas. The associative nature of regional networks, by pooling existing capacity and infrastructure, provides a very attractive and cost-effective strategy for developing countries.

In several aspects Coastal GOOS is already being implemented through the GLOSS network, the Coral Reef Monitoring Network (GCRMN), NEAR-GOOS, and the coastal seas programmes of EuroGOOS (e.g. Baltic GOOS, or BOOS).

In addition, all IOC Member States have coastal observing systems of some kind, many of which may in due course become contributions to C-GOOS. Although many of the elements are there, we lack, and are actively working towards, co-ordination, design guidance, and practical demonstration. C-GOOS will be taking lessons from BOOS and EuroGOOS in developing a generic design that can be applied to the coastal seas.

GOOS PROJECT OFFICE

Despite successes, there are some potential obstacles to progress. Since the GOOS budget was approved at the 19th IOC Assembly in June-July 1997, the GOOS Project Office (GPO) has been required to take on several new activities:

- Coastal GOOS (2 meetings/year);
- LMR GOOS;
- TAO-Implementation Panel;
- Global Observing Systems Space Panel (GOSSP);
- Joint Global Observing Systems Data and Information Panel (J-DIMP);
- The Implementation Advisory Group which is the precursor to J-COMM; and
- Assistance for the new regional GOOS groups.

To meet the requirement, the GPO is attracting additional resources on a case by case basis. However, both the staff and the budget are stretched. The GPO gratefully acknowledges the assistance provided by means of secondments from the USA, Japan and Brazil, but help from other Member States in secondments and finance is needed if the gained momentum is to continue.

3.2 GOOS and El Niño Forecasting

1997-98 saw the strongest El Niño this century. IOC's contribution to El Niño forecasting comes through its support of the TAO Implementation Panel, through which the design of the observing array of buoys in the tropical Pacific is improved. These buoys, which are part of the GOOS Initial Observing System, provided the first indication of the development of the El Niño, which was only evident initially from ocean subsurface data.

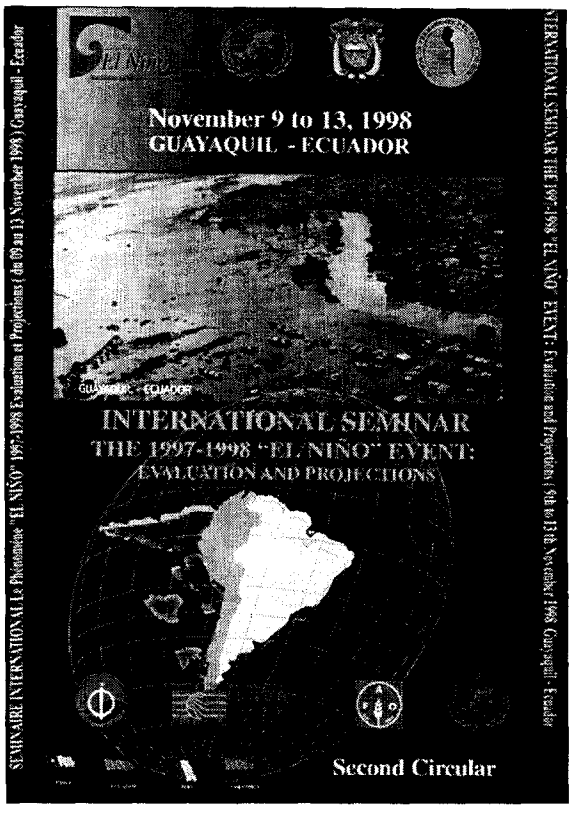


Figure 3: El Niño:
Evaluation and Projections, the First Governmental Meeting of Experts and its sponsors

Data from the buoy array are supplemented by information gained from Ships-of-Opportunity, tide gauges, satellites, drifting buoys and research vessels. The routine systematic, long-term measurements of relevant ocean properties made by these different parts of GOOS are essential to underpin accurate forecasts of the changes in ocean conditions. These conditions in turn provide essential input to the numerical models used to forecast El Niño and its impacts six to nine months ahead, thereby helping Member States to plan ahead to reduce the impact. Funding is needed to improve the system, not just to maintain it, but also to extend the observational network, to improve the numerical models used to process data, and to improve the methods by which the data are assimilated into models.

IOC, WMO the Government of Ecuador and the Permanent Commission for the South Pacific (CPPS) held the First Governmental Meeting of Experts International Seminar on the 1997-1998 El Niño Event:, in Guayaquil (9-13 November 1998) to evaluate the effects of this El Niño. The meeting also considered ways of improving our ability to forecast the occurrence of El Niños and to further mitigate their impacts.

The seminar showed that:

- Existing space based platforms and *in situ* observations are not adequate to monitor the key characteristics of the climate system;
- The future of these platforms and systems is not assured;
- More research is needed to further develop and improve the forecasting models;
- Regional co-operation and the sharing of many infrastructure resources at a recognised center are essential to enable countries in the region fully to exploit capabilities in climate prediction;
- More detailed regional observation networks, data collection and processing facilities are essential for sustainable management of climate sensitive resources;
- Capacity building over an extended period is essential to build up scientific skills and maintain operational infrastructure for the development of user-focussed services.

A proposal was made to create an International Research Centre on El Niño Phenomenon with Headquarters in Guayaquil, to develop strategies for the mitigation of disasters. In the Thirteenth Session of the IOC-WMO-CPPS* Joint Working Group on El Niño, the group of experts made a proposal to develop a buoy-array to be deployed parallel to the South American coast. This would measure oceanographic and meteorological parameters while contributing to the study of precursor signals of remote forcing in the Eastern Boundary Current, and to forecast El Niño and its effects. This proposal was presented to the CLIVAR Conference in December 1998, as a potential contribution of the CPPS countries.

These various contributions to the understanding and forecasting of El Niño make a contribution to the UN's International Decade on Natural Disaster reduction (IDNDR), which ends in 1999.

* CPPS is the Permanent Commission for the South Pacific, a Regional intergovernmental organism established in 1950. Today its members are Colombia, Ecuador, Perú and Chile.

3.3 Joint Technical Commission for Oceanography and Marine Meteorology (J-COMM)

The IOC and the WMO are considering forming a new Joint intergovernmental body to replace the existing WMO Commission on Marine Meteorology (CMM) and the IOC-WMO Joint Committee for the Integrated Global Ocean Services System (IGOSS). The new body will be the Joint Technical Commission for Oceanography and Marine Meteorology (J-COMM). The concept has been approved by the Executive Councils of both the IOC and the WMO, and the approval awaits endorsement from the WMO Congress and the IOC Assembly in 1999.

Under the guidance of the governing bodies of WMO and IOC, J-COMM will be responsible for the development, implementation, and maintenance of operational data collection and dissemination systems to meet the programme requirements of GOOS, GCOS, WOCE, CLIVAR, other global ocean science and the continuing needs of WWW, CMM and IGOSS.

This is an exciting development, in line with the general UN policy for inter-agency co-operation, that will improve the way in which oceanography is carried out. It is a step in the process of responding to new needs for marine meteorological and oceanographic data, as expressed in particular by the global observing systems (GOOS and GCOS). But it will also continue to serve the traditional users of such data and services. It reflects even closer co-operation in future between the IOC and the WMO, two organizations that have been successfully collaborating for over 30 years. Both are co-sponsors of GOOS and GCOS.

Under its terms of reference, J-COMM will be expected to:

- Further develop the observing networks;
- Implement data management systems;
- Deliver products and services;
- Provide capacity building to Member States of both organizations;
- Assist in the documentation and management of the data in international systems.

Combining the expertise and technological capabilities of the WMO and IOC systems should lead to better technology, better products and better communication at reduced developmental and operational costs. This innovative institutional arrangement should encourage greater collaboration and co-operation between the meteorological and oceanographic communities both within the international organizations, and also nationally. If a co-operative meteorological-oceanographic approach for data collection and sharing can be realized, based on an international model, WMO Members and IOC Member States would have a better chance of demonstrating efficiencies and convincing managers to continue to devote resources to their programmes.

To start the process moving, an Interim Implementation Advisory Group was formed at a meeting on GOOS/GCOS implementation, in Sydney, Australia, in March 1998, and an Action plan is being developed. A transition meeting to discuss the development of J-COMM will be held in St. Petersburg, Russia, from July 19-23, 1999.

3.4 Integrated Global Observing Strategy (IGOS)

In the drive towards increasing efficiency and effectiveness within the UN system, the IOC and its fellow sponsors of global observing systems must make it plain to governments that there is coherence, synergy, and integration between the different bodies undertaking global scale observations of the land, sea, and air. We are working together to provide the most cost-effective and efficient response to the increasing demand for the observations of the whole Earth system that provide the basis for understanding and forecasting environmental change.

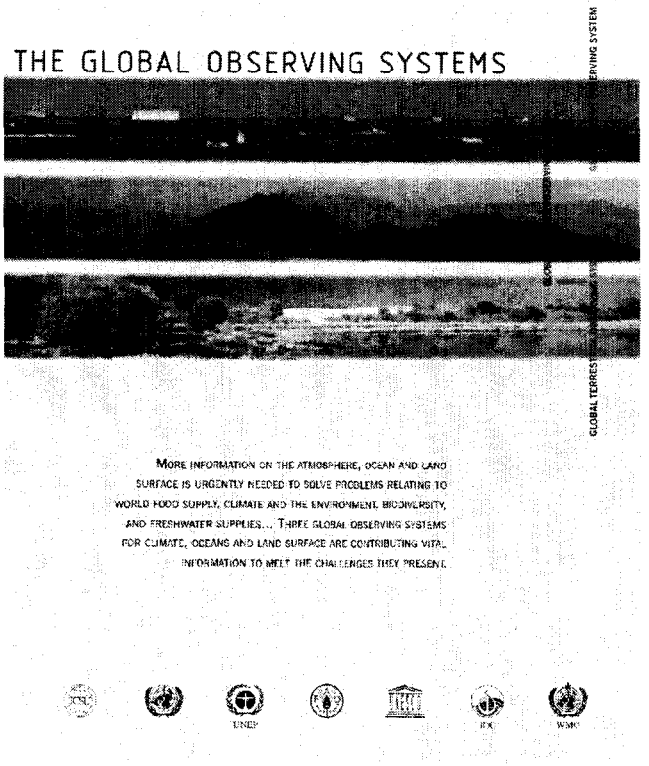


Fig. 4: The G3OS Brochure

To respond to this charge, the sponsors of the global observing systems (GOOS, GTOS, GCOS; otherwise known as the G3OS) have agreed to an Integrated Strategic Plan for the Global Observing Systems, for which there is now a published brochure. This strategy integrates the activities of the three observing systems under one over-arching umbrella. In parallel, the Committee on Earth Observation Satellites (CEOS) and its affiliates (including IOC and GOOS) have developed an Integrated Global Observing Strategy to integrate satellite and *in situ* measurements of the Earth. After a series of consultations, during the International Year of the Ocean, the G3OS sponsors and CEOS agreed to unite their two strategies into a common Integrated Global Observing Strategy (IGOS), concept that has now been endorsed by the Executive Councils of the IOC and WMO.

IGOS involves the major space-based and *in situ* systems for global observations of the Earth, including, in particular, the climate and atmosphere, oceans, land surface and Earth interior, in an integrated framework. IGOS aims at enabling better observations to be derived in a more cost-effective and timelier fashion. It strives to build on the strategies of existing international global observing programmes, and on current achievements, with additional integrated efforts being directed to focus on those areas where satisfactory international arrangements and structures do not currently exist.

IGOS should improve governments' understanding of global observing plans; provide a framework for decisions on the continuity of observation of key variables; reduce duplication; help to improve resource allocation; and assist the transition from research to operations.

IGOS is a unifying strategy that will not affect the functional autonomy of its partners. The IGOS Partners' Forum, will further the definition, development and implementation of IGOS as needed. Indeed, IGOS forms a necessary mechanism to enable each partner to work to best effect by co-ordinating its efforts with others. The IGOS Partners are facilitating the development of six pilot projects, designed to demonstrate the benefits of integration. One of these agreed projects is GODAE (see above).

3.5 Global Sea-Level Observing System (GLOSS)

The Global Sea Level Observing System (GLOSS) is an international programme co-ordinated by the Intergovernmental Oceanographic Commission (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 important component of GOOS. The web site of GLOSS can be accessed at:
http://www.pol.ac.uk/psmsl/gloss.info.html

Since 1933, the Permanent Service for Mean Sea Level (PSMSL) has been responsible for the collection, publication, analysis and interpretation of sea level data from the global network of tide gauges. All **PSMSL** data, including those from GLOSS stations can be obtained from PSMSL *via*: ftp://bisag.nbi.ac.uk/pub/psmsl/

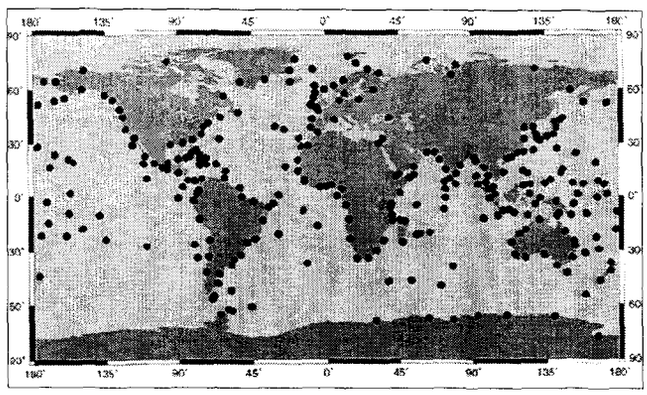


Figure 5: GLOSS Core Network defined by Gloss 97.
Initiated by IOC in 1985,
countries participating in Gloss collect and share data
according to established standard procedure

or on CD-ROM. A contract between IOC and PSMSL was signed in 1998, as in previous years, to keep continuity of sea level data availability to all Member States participating in GLOSS.

The key activity for the Global Sea Level Observing System (GLOSS) during 1998 was the GLOSS Training Course at the University of Cape Town. This was made possible by the dedicated help of Prof. Geoff Brundritt and his staff from the University of Cape Town. During two weeks of hard work, participants from 17 African countries carried out tasks associated with the analysis of sea level data. The course covered background knowledge on sea level science and the relation of sea level to climate change and oceanography; the need for related geodetic measurements; and hands-on training sessions (HOTS), which, collectively, should enable the participants to improve the operation and use of GLOSS in their own countries. Course results were excellent and lay a strong foundation for continuing the involvement of African countries in GLOSS, and for building GOOS in Africa.

IOC funds for GLOSS are extremely limited and tend to be devoted to covering the costs of meetings, training courses and sea level products. There have been virtually no funds for new gauges or geodetic equipment.

Information on GLOSS publications (GLOSS Bulletin, Afro-America News, GLOSS Implementation Plan-1997, etc.) and its links with other IOC activities can be obtained at:
http://www.pol.ac.uk/psmsl/gloss.info.html

Planning is now underway for the Sixth Meeting of the GLOSS Group of Experts, in Toulouse, France, 10-14 May 1999, preceded by a special workshop on *Ocean Circulation Science derived from the Atlantic, Indian and Arctic Sea Level Networks* on May 10-11 and a GPS workshop on May 11. Planning is also underway for a training course in Sao Paulo, tentatively scheduled for the August/September 1999.

The GLOSS Group of Experts is now working to follow the *GLOSS Implementation Plan*. Regional Co-ordinators are increasingly being relied upon to ensure the necessary actions are taken. East Africa is working well, West Africa less so.

It has been possible to equip most Atlantic island tide gauge sites with GPS receivers, now that their cost has fallen, improving the use of the sites for calibrating altimetric data. Adding GPS receivers doubles the cost of equipping a site, so may not be feasible at all GLOSS tide gauge sites, especially in developing countries. Recognizing this, GLOSS is now looking for external sponsorship from industry.

Training materials such as CD-ROMs and Web-based materials are now needed for training courses, in order to make training more widely available at lower cost. Developing countries favour the use of study-grants and fellowships to develop skills.

3.6 IGOSS, SOOP and DBCP

INTEGRATED GLOBAL OCEAN SERVICES SYSTEM (IGOSS)

Besides carrying out the routine tasks needed by an operational system such as **IGOSS**, 1998 was devoted to implementing the specific decisions taken at the Seventh Session of the Joint IOC-WMO Committee for IGOSS (IGOSS-VII, Paris, November 1995) – most specifically those dealing with the international co-ordination and management of an operational Ship-of-Opportunity Programme (SOOP).

The Second Session of the **SOOP** Implementation Panel (SOOPIP) was held in Nouméa, New Caledonia, from 26-30 October 1998. The Panel analysed current programme status and identified data availability. Upper ocean thermal data are collected along approximately 50-60 lines by around 80-100 vessels. Although most measurements concern upper ocean temperature collected by Expendable Bathythermographs (XBTs), there are also increasing measurements of surface and sub-surface salinity along a number of lines. Proposals are in place for increased biological and chemical sampling. Extensive programme monitoring and data quality control activities continue to be implemented in conjunction with the Global Temperature-Salinity Profile Programme (GTSPP), while feedback mechanisms have been established to ensure data flow and quality.

Changes in the practice of shipping companies, in response to increasing competition and the drive for increased efficiency, mean that it has not been possible to maintain all the original SOOP lines. Several lines are now undersampled or not sampled at all due to the lack of shipping in some areas. SOOPIP is therefore trying to co-ordinate and focus resources to ensure that those well sampled lines are maintained to meet the OOPC recommendations and standards. The Pacific and North Atlantic remain relatively well sampled, whereas in the South Atlantic, many lines are not being sampled at all at present.

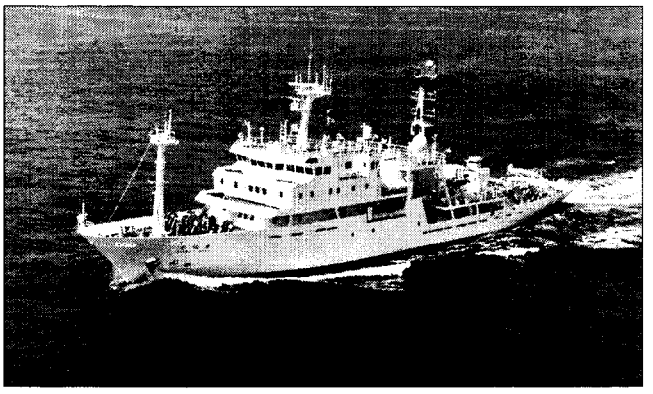


Fig. 6: Japanese Oceanic Research Vessel: *Rofumaru*

Some lines are beginning to disappear in the Indian Ocean, and all efforts are being made to correct the situation. Sampling in the Southern Ocean remains weak due to the obvious lack of regular shipping, although efforts are being made to ensure the optimal use of all existing shipping wherever possible.

The SOOPIP is developing a *Strategic Implementation Plan*, which will consider GOOS and GCOS requirements, with scientific input from OOPC. SOOPIP is participating in the GOOS-GCOS Interim Implementation Advisory Group, whose role is to prepare an *Implementation Action Plan for Global Ocean Observations for GOOS and GCOS*. A crucial part of this Plan will be the integration of existing

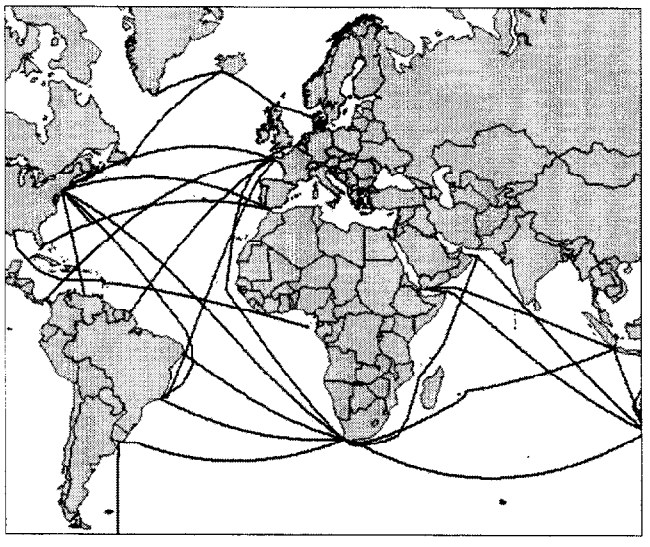


Fig. 7: 1998 SOOP Lines in the Atlantic

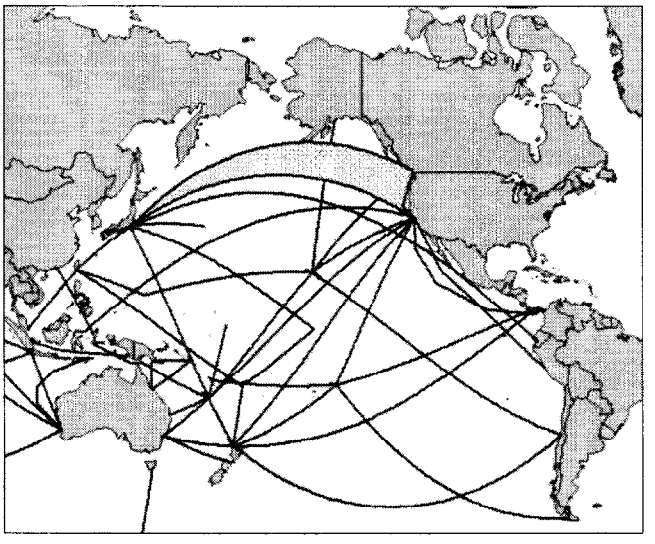


Fig. 7 bis: 1998 SOOP Lines in the Pacific

and proposed sub-surface monitoring systems, such as SOOP, TAO and the ARGO profiling float programme, into a co-ordinated programme to monitor sub-surface variables.

There are still some problems in the transition of SOOP from a research driven mode to an operational programme, since not all participating countries have yet been able to commit resources to maintain their activities on an operational basis. Other pending problems are those of improved co-ordination with the Voluntary Observing Ships scheme of WMO and persuading more Navies to contribute their sub-surface data.

After the withdrawal of support for the IGOSS Operations Co-ordinator position in 1997, interim arrangements made it possible to discharge a part of his duties during 1998. The SOOPIP had already stressed and reiterated the essential nature of the Operations Co-ordinator position to the operational SOOP. It therefore particularly welcomed the proposal by the Data Buoy Co-operation Panel that its Technical Co-ordinator be given, at least on a tentative basis, the additional responsibility to act as the Operations Co-ordinator for the SOOP. Those arrangements are to be reviewed at the next sessions of the DBCP and the SOOPIP.

The electronic IGOSS Products Bulletin (E-IPB) continued to develop, thanks to its editor, Dr Yves Tourre, the IGOSS Scientific Advisor. The excellent array of products in E-IPB, including the weekly update of SST, presented in single color images or in 6-month animations, can be consulted at the following URL:

http://rainbow.ldeo.columbia.edu/igoss/productsbulletin

Given the quality of this joint effort of IOC and WMO, the question is now raised whether the E-IPB (in its present form, or slightly amended) might be considered, in the foreseeable future, as a GOOS product.

DATA BUOY CO-OPERATION PANEL (DBCP)

With regard to the DBCP, the role of the IOC Secretariat (together with the WMO Secretariat) is two-fold:

- Serve the annual session of the Panel and the following annual meeting on Argos Joint Tariff Agreement (usually by the end of October);
- Assist the Panel's Chair to implement Panel's decisions during the rest of the year.

The second item encompasses chiefly the running of all administrative issues related to the employment and the work of the Panel's Technical Co-ordinator, *viz* essentially:

- The management of the special trust fund on which the voluntary contributions of the donor Member States are deposited;
- Supervising the Technical Co-ordinator's missions;
- Preparing for his annual employment contract as a "*UNESCO Fund-in-Trust Expert*";
- Preparing for the annual contract for his logistic support by Collecte-Localisation-Satellites (CLS)/Service Argos.

The annual meetings referred to above were held in October 1998 near Marathon, in the Florida Keys, at the kind invitation of the Atlantic Oceanographic and Meteorological Laboratory of the US National Oceanographic and Atmospheric Organization. As has been the case since its eleventh session (Pretoria, October 1995), the fourteenth session of the DBCP included a scientific and technical workshop that lasted one and a half days. Some 20 presentations were made, covering subjects such as:

- Innovative concepts in moored and drifting buoy design and application;
- Applications of and scientific results deriving from buoy data in research or operations; and
- Buoy data as a complement to remote sensing, modelling, and other disciplines.

More than 50 scientists attended the workshop.

One very important issue facing the session was the adoption of an implementation strategy, to become, at a later stage, part of a comprehensive global *in situ* oceanographic measurement strategy, in the context of GOOS. Indeed, the Panel will participate, through its Technical Co-ordinator, in the work of the GOOS Interim Implementation Advisory Group, which has as a major task to finalize the *GOOS Implementation Action Plan.*

The Panel's Technical Co-ordinator was given, at least on a tentative basis, the additional responsibility of acting as Operations Co-ordinator for the Ship-of-Opportunity Programme established by the IOC-WMO Integrated Global Ocean Services System (IGOSS). If these arrangements prove workable, the Technical Co-ordinator will have in hand two of the major *in situ* operational global observing systems for the upper ocean, which would ensure good co-ordination among those systems and would greatly assist in implementing GOOS.

At its thirteenth session, the Panel comprised six *action groups**: the European Group on Ocean Stations; the International Arctic Buoy Programme; the International Programme for Antarctic Buoys, the International South Atlantic Buoy Programme; the International Buoy Programme for the Indian Ocean; and the Global Drifter Programme (successor of the Surface Velocity Programme of TOGA and WOCE). At its fourteenth session, it welcomed the acceptance of the Tropical Atmosphere Ocean (TAO) array Implementation Panel as a new action group. Currently developing data buoy programmes (such as in the North-East

* An *action group* of the DBCP is an independant self-funded body that maintains, as a significant element of its responsibilities, an observational buoy programme providing meteorological and oceanographic data for real-time and/or research purposes in support of the World Weather Watch, the World Climate Research Programme, the Global Climate Observing System, the Global Ocean Observing System and the other relevant WMO and IOC programmes.

Pacific) are already considering becoming action groups in due time.

As usual, the meeting on Argos Joint Tariff Agreement (JTA) followed immediately the Panel session. The meeting approved *inter alia* recommendations submitted by the preceding Panel session. It is worth noting the attention provided to processing sub-surface profile data (as a consequence of likely changes to the mooring design of some ATLAS (TAO array) buoys, and to enabling the Argos GTS sub-system to process PALACE float data.

The "bonus system" decided at the previous meeting for a 2-year experimental period was maintained. The principle of the system is that each country has essentially a fixed amount of money to pay to Argos for one year (beginning in 1998), based on unchanged cost *per* platform Transmitter Terminal (PTT)-year. For this amount, each country is allowed a certain percentage increase (bonus) in PTT-year usage during that year, nominally 35%, without further charge or penalty. This increase can be compounded over two years (namely 1998 and 1999). Some 50% of the countries were able to take advantage of the bonus in 1998, with the total bonus usage being around 16%. The fact that the bonus is compounded over two years may lead to a possible increased usage of some 82% in 1999.

A mechanism was set up to try to compensate for the operating deficit that CLS/Service Argos is experiencing and also to account for inflation. This deficit has accumulated because of a shortfall of PTT-years in the base figure used at the previous JTA meeting for the implementation of the above principles. It was agreed that, for each country, the guaranteed minimum of platform-years shall encompass a 1% surcharge to be levied on the 1999 platform-years submitted by the country for signature.

In November 1998 there were 695 buoys distributing about 6000 observations/day onto the GTS. Nearly every buoy measures SST. About 250 buoys measure air pressure.

By the end of 1998 the meteorological data from Indian moored buoys (NIOT) should be distributed on the GTS (however, the sub-surface data from those buoys remain embargoed by the Indian Navy).

Thanks to improvement of numerical models and through the comparison of observed data with the first guess field (e.g. ECMWF, NCEP, Météo France, UKMO) it was shown that the quality of drifting buoy data is excellent for SST (65% RMS (Obs. FG) < 1C with NCEP model), air pressure (55% RMS (Obs. FG) <1 hPa with ECMWF model), and wind speed (65% RMS (Obs. FG) < 2m/s with ECMWF model).

Since the establishment of the DBCP, co-operation has increased between meteorologists and oceanographers. The so-called SVP Barometer drifter (SVPB) was developed under WOCE at Scripps Institution of Oceanography and was tested by a number of meteorological agencies. The SVPB drifter is useful to oceanographers because it is a Lagrangian drifter, and to meteorologists because it is equipped with a barometer and transmits its data onto the GTS. SVPB drifters, which are low cost, are now deployed in large quantities in the world oceans and are an excellent source of *in situ* SST and air pressure data. New developments are being conducted to produce Lagrangian drifters also capable of measuring wind, thanks to the WOTAN technique (Wind Observation Through Ambient Noise). Early results are very promising.

Météo France is producing so-called Data Availability Index Maps (DAIM) for the DBCP. For basic variables (air pressure, SST, wind speed, air temperature) these show how well requirements of eight observations *per* day for an area of 500Km*500Km are being met (index 100). These maps also show the percentage of buoy data compared to total ship-plus-buoy data that contribute to the displayed index value. The maps are very useful for identifying data-sparse areas for given variables, and consequently help in the adaptive adjustment of deployment plans.

The DBCP has recently completed an Implementation Plan and is defining its deployment strategy to optimize deployments according to defined WWW, GOOS and GCOS requirements. The DBCP *Implementation Plan* will be integrated within the GOOS/GCOS Action Plan.

3.7 The global Climate Observing System (GCOS)

In September 1998 the IOC renewed its commitment to be a sponsor of the Global Climate Observing System (GCOS), by signing the revised Memorandum of Understanding that governs its operation. The other partners are: WMO (the lead agency), UNESCO, UNEP and ICSU. Late in 1998 the GCOS Steering Committee acquired a new Chairman, Dr. Kirk Dawson.

GOOS and GCOS are intimately linked, as the ocean component of GCOS is the climate component of GOOS. It is expected that GCOS will continue to assist GOOS with *design*, *implementation*, and *resources*.

To assist in *design* means jointly working through OOPC, J-DIMP and GOSSP. To assist in *implementation* means

- Assisting in the development of GODAE and ARGO;
- Helping to expand the GOOS Initial Observing System, and gaining commitments from nations to make their sustained systems part of GOOS/GCOS;
- Working with GOOS to get J-COMM established and successful;
- Jointly supporting the proposed conference on Global Ocean Observations for Climate (St Raphaël, Oct 18-22); and
- Providing strong links between GOOS, the IPCC and the FCCC.

Assist with *resources* means working together to find new sources of fund for the G3OS.

Like GOOS, GCOS has already influenced the design of national plans for observations. GCOS now needs to emphasize implementation. It must ensure that the right mix of observing systems is in place. It must show the importance to policy making of what is collected (e.g. the relation to the needs set by the FCCC). It also has a role in defining inputs, by identifying missing pieces, including aspects currently not covered by the World Weather Watch and geographic gaps.

The IPCC needs GCOS to ensure availability of long term data sets. GCOS should help national agencies gain additional resources for implementation at national level. It must also demonstrate that progress has been made, and a set of performance measures will be designed to facilitate this and to enable GCOS to work towards improving the performance of the system. GCOS should be working to make research observing systems operational. It should also work on the El Niño retrospective as a response to UN Resolution 200. The research community needs GCOS to encourage national planning, and to identify measurement criteria that nations can use to assess their performance in meeting FCCC objectives.

COP-4 of FCCC encouraged countries to develop national climate observing plans every 3-4 years with the first set appearing in 2000. These national plans should constitute commitments to an integrated long term observing system. In this sense the FCCC with respect to monitoring climate is in a similar position than the Nuclear Disarmament Treaty, under which nations commit to seismic monitoring to insure compliance with the treaty. COP-4 asked partners in The Climate Agenda to work with the FCCC Secretariat to:

- Help synthesize national plans and programmes for climate system observations; and
- Initiate an intergovernmental process for GCOS so that its programmes could be drawn directly to the attention of nations.

The GEF is now required by the COP of the FCCC, to:

- Help developing countries *build capacity for participation in systematic observational networks to reduce scientific uncertainties relating to the causes, effects, magnitude and timing of climate change*; and
- Support capacity building for developing countries to facilitate their access to information relating to climate;
- GCOS and GOOS should work with developing countries and with the GEF Secretariat and the GEF's SBSTA to move this process forward, e.g. by helping to design proposals, guidelines and protocols to implement this important new development;
- For the future, GCOS and GOOS jointly need to guide countries on how to record their contributions for COP-5, *via* status reports. GCOS will be required to work with GOOS and others to provide a *quantitative update report on the adequacy of observing systems to COP-5*, which takes place in Bonn (October 25-November 5, 1999).

GCOS continues to take the lead in GOSSP, whose functions are to:

- Facilitate communication from the global observing system users to the space agencies;
- Establish clear and transparent need and goals;
- Identify major issues for action; to build on and improve the existing CEOS/WMO database of requirements and capabilities;
- Make the database more accessible;
- Liase with other user groups.

Major issues include sea surface height, vector winds, sea surface temperature, colour and salinity.

GCOS also takes the lead in J-DIMP, the Joint Data and Information Management Panel of the three global observing systems, which has now produced a data and information management plan.

3.8 GOOS Summary of Training, Workshops and Meetings in 1998

Title	*Place & Date*	*Number of Attendants*	*Number of countries*	*Budget*	*US$*
Training Courses					
NEAR-GOOS Data Management Training Course	Tokyo Oct. 12-23	6	4	EX	20,000
GLOSS Methods of Sea Level Analysis	Cape Town Nov. 16-27	19	11	RP EX	15,600 20,000
Conferences & Meetings					
NEAR-GOOS programme review meeting	Okinawa Feb. 4	8	4	-	-
GOOS Capacity Building Workshop for the Pacific	Suva, Fiji Feb. 13-17	34	8	RP EX	13,000 20,000
Implementation of Global Ocean Observations for GOOS/GCOS, 1st session	Sydney March 4-7	22	11	RP EX	13,000 33,500
Oceanology International 98 Conference	Brighton March 10	500 +	50 +	RP	800
EuroGOOS Science Advisory Working Group Meeting	Brighton March 11	20	6	-	-
Joint Scientific Committee for WCRP	Cape Town March 16-21	43	15	RP	2,200
Council of Europe Parliamentary Meeting	Paris March 19	100 +	14	-	-
GOOS Living Marine Resources Panel Meeting	Paris March 23-25	21	15	RP	10,000 10,000
CEOS-G3OS Meeting on an Integrated Global Observing Strategy	Paris March 25-26	40	25	-	-
GOOS Coastal Panel Meeting	Paris March 30-April 1	34	15	RP EX	15,000 20,000
UN Earthwatch Meeting	Geneva April 2-3	15	10	RP	800
Ocean Observation Panel for the Climate Agenda	Grasse April 6-8	16	10	RP EX	19,000 10,000
Inter-Agency Committee for the Climate Agenda	Geneva April 16-17	33	8	RP	800

Title	*Place & Date*	*Number of Attendants*	*Number of countries*	*Budget*	*US$*
GOOS Steering Committee Meeting	Paris April 20-23	37	11	RP EX	25,000 15,000
CLIVAR Scientific Steering Group	Santiago April 27-May 1	28	11	RP	2,000
G3OS Joint Data & Information Management Panel	Honolulu April 28-May 1	28	14	RP TF	10,000 4,000
2nd Biennial Meeting of the International Programme of Antarctic Buoys	Naples May 11-13	13	8	-	-
CEOS Working Group on Information Systems & Services	Frascati May 11-15	20	10	TF	1,800
WOCE Conference	Halifax May 24-29	400	26	RP	12,000
Mediterranean Coastal Management	Genoa May 28	600	30	RP	1,500
The Oceanographic Society (TOS) Meeting GOOS Seminar	Paris June 1-4	300	25	RP	7,000
G3OS Sponsors Meeting and IGOS Meeting	Paris June 5-6	12	6	-	-
Global Terrestrial Observing System (GTOS) Steering Committee	Santander June 17	27	16	RP	1,100
GODAE Workshop	Tokyo July 6-10	30	14	RP	11,400
3rd Meeting of the International Buoy Programme for the Indian Ocean	Kuala Lumpur July 7-9	20	6	-	-
Pan-African Conf. on Sustainable Integrated Coastal Management (PASICOM)+GOSS AFRICA Workshop	Maputo July 18-24	300	60	RP	18,200
8th Session of the international South Atlantic Buoy Programme & Conf. on The Artic Buoy Programme: Scientific Achievements from the first 20 Years	Seattle August 3-4	22	6	-	-
3rd Session of the co-ordinating Committee for the NEAR-GOOS	Beijing August 3-6	21	4	EX	12,000
5th Session of the International South Atlantic Buoy Programme	Buenos Aires August 10-14	34	6	-	-
GOOS Living Marine Resources Panel Executive Committee Meeting	Paris August 17-19	5	3	RP	9,000

Title	*Place & Date*	*Number of Attendants*	*Number of countries*	*Budget*	*US$*
The role of the Ocean Science and Geography in Facing Ocean Management for the 21st Century, Seminar	Lisbon September 3-5	35	12	RP	1,100
COST-WMO-IOC Conf. on Provision & Engineering/Operational Applications of Ocean Wave Spectra	Paris September 21-25	120+	25+	-	-
SOPAC-STAR Scientific Conf.	Fiji Sept. 28-Oct. 2	40	20	-	-
Coastal Conference	Noumea October 5-8	60	25	RP	1,350
WOCE Scientific Steering Group Meeting	Brest October 5-9	22	9	RP	2,000
Data Buoy co-operation Panel XIVth Meeting & Workshop	Miami October 12-16	45	11	-	-
ARGOS Joint Tariff Agreement XVIIIth Meeting	Miami October 19-21	29	12	RP	3,400
CEOS Working Group on Information Systems & Services Meeting	Kyoto October 19-23	30	12	RP	2,000
2nd Session of the Joint IOC-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel	Noumea October 26-30	20	7	RP	15,700
GOOS Coastal Panel Meeting, 2nd Session	Curitiba Oct. 29-Nov. 1	48	16	RP EX	7,000 35,000
4th Conf. of the Parties to the Framework Convention on Climate Change	Buenos Aires November 2-13	300+	120+	RP	2,000
7th Session of the Tropical Atmosphere Ocean Implementation Panel & 5th Meeting of PIRATA	Abidjan November 10-12	40	16	RP EX	27,000 10,000
Committee on Earth Observation Satellites, Plenary Meeting	Bengalore November 10-12	70	25	RP	2,800
Implementation of Global Ocean Observations for GOOS/GCOS, 2nd Session	Paris November 30	10	5	RP	10,900
IPCC Working Group Meeting	Paris Nov. 30-Dec. 2	105	28	-	-
CLIVAR International Implementation Conf.	Paris December 2-4	250	63	RP	25,000

** EX; Extrabudgetary: RP: Regular Programme; TF: IOC Trust Fund.*

THE PEOPLE BEHIND OPERATIONAL OBSERVING SYSTEMS PROGRAMME

Colin Summerhayes is the Director of the GOOS Project Office (GPO). This is the umbrella under which we co-ordinate the design, implementation and management of the operational observing systems for the Ocean. At year end he had been with the IOC for just over 18 months, having previously been Deputy Director of the Southampton Oceanography Centre and before that Director of the UK's Institute of Oceanographic Sciences at Wormley. Colin is the Technical Secretary for the GOOS Steering Committee and the Intergovernmental Committee for GOOS, and this year also for the Coastal GOOS Panel. He finds he works harder here than he did anywhere else, but has more fun doing it.

Art Alexiou is seconded from the USA, and has been with the IOC forever (well, anyway, a long time). Art is responsible for the climate side of operational affairs, working as technical Secretary for the Ocean Observations Panel for Climate. He is also responsible for IOC's investments in climate research, and represents IOC on the Joint Steering Committee for the World Climate Research Programme, and on bodies like IACCA (the Inter-Agency Committee for the Climate Agenda). He is also Technical Secretary for the JGOFS CO2 Panel. Art likes to cook, and when you can't find him he's likely to be at the US Marine Barracks watching American Football.

Yves Tréglos is a hybrid, having been seconded to IOC in 1980 to co-ordinate the joint IOC-WMO Integrated Global Ocean Services System (IGOSS). Yves provides the office link to such bodies as the Data Buoy Co-operation Panel, and System Argos, the French-USA firm through which information from buoys is relayed back to base by satellite. Yves is also the GOOS Web-master. A good Frenchman, Yves likes the finer things in life, like French cuisine and wines (Saint Marcelin....ora pro nobis). He smokes a very smelly pipe.

Etienne Charpentier is a part of the team working for the Data Buoy Co-operation Panel (DBCP) since 1989 and the Ship of Opportunity Programme Implementation Panel (SOOPIP) since 1999. He is based in the premises of CLS, Service Argos in Toulouse. Before, he used to work for the DBCP in Washington DC from1989 to 1993. He has been involved in the development of a dedicated subsystem of the Argos system for processing and distributing buoy data on the GTS and helped in setting up quality control guidelines for buoy data. He is also operating the DBCP web site. Being in Toulouse, (in fact X hours away by train from the IOC headquarters in Paris), he's glad to find opportunities to see IOC colleagues at meetings abroad.

Janice Trotte is our South American star. She is on secondment from the Brazilian Directorate of Hydrography and Navigation – yes – The Navy (to whom we are very much obliged for releasing her). Janice has been acting part time as the Technical Secretary for the Global Sea Level Observing System (GLOSS), and is the Technical Secretary for the TAO (Tropical Atmosphere-Ocean) Implementation Panel. The TAO buoys are used to forecast El Niño events. She has been much involved in the setting up of an equivalent programme in the Atlantic, PIRATA (Pilot Research Array of moored buoys in the Tropical Atlantic). And she is very interested in trying to develop a regional forecasting network for natural hazards warning in South America. Janice also edits the GOOS News, and has been responsible for office morale building events (parties and TGIF gatherings at Chez Evelynne's). She holds the record for telephone bills in the GPO.

Rimi Nakano, seconded from Japan as an Associate Expert, arrived in June 1998 from the Ministry of Education, Science, Sports and Culture in Tokyo. Rimi provides our main liaison point for NEAR-GOOS (Northeast Asian region GOOS), is in charge of the Japanese Fund in Trust, and recently became the IOC liaison point for WESTPAC, the IOC regional sub-commission in eastern Asia and the Pacific. She is responsible for assembling the GOOS Status Report. With her degree in law, she found us scientists a bit intimidating at first, but soon learned that oceanographers are as human as lawyers (maybe even more so!).

Naoko Ichiyama, Rimi's predecessor fulfilled similar functions until June 1998, when she returned to the Ministry in Tokyo. We were sad to see her go, but she was happy as she is planning to get married.

Bill Erb, who had been seconded to the IOC by the US State Department as a Senior Advisor, left after almost three years at the end of December 1998. Bill worked closely with the GPO in managing the GOOS Capacity Building Programme, in concert with its Chairman, Jan Stel, from The Hague, and through that was instrumental in building two new regional GOOS programmes – MedGOOS and PacificGOOS. Bill had the best view of Paris, from his 7th floor apartment opposite the Musee Rodin, where GPO people enjoyed some fine wine, fireworks during the 14th of July and Sandra's cooking.

John Withrow, who had been at the IOC for several years, and worked with the GPO on data and information management and on remote sensing, in a post shared with the IODE, left us in July to return to the USA. John played a key role in establishing the ground rules for a new IOC office that is to open in Perth during 1999. We miss his Far Side cartoons.

Some IOC staff are part of the GOOS team even thought they don't live right under the GOOS umbrella. **Umit Unluata**, from Turkey, and Head of Science Programmes, is the Technical Secretary of the GOOS Health of the Oceans Panel, and **George Grice**, from the USA, and Head of OSLR, is the Technical Secretary of the GOOS Living Marine Resources panel and coordinates the Global Coral Reef Monitoring Programme, which is part of the GOOS Initial Observing System.

At the very end of the year (actually on the first working day of 1999) we welcomed **Thorkild Aarup**, a Dane from the States, who will take on GLOSS and Coastal GOOS.

The GPO team could not function without its loyal and dedicated technical secretariats, four active and usuallyoverworked ladies, who make an international patchwork. **Yvonne Bouquet** left the United Kingdom in 1960 to marry a Frenchman with whom she shares a love of sailing. **Irene Gazagne** is a true Parisian born on an island in the heart of Paris; her main interests include computers, linguistics and intercultural matters (she has a degree in Russian and is studying Greek). **Ho Hien Ghalem** was a French teacher in South East Asia (Vietnam) before embarking on a boat ride that eventually took her to the centre of the French speaking world Paris. **Cigié Pinto Pontes**, a librarian by training, spent most of her life in Brazil at the University of Rio Grande do Sul, where she worked as chief of a metallurgy information centre, before finding her way to the city of culture. She is fluent in portuguese, Spanish, French and English.

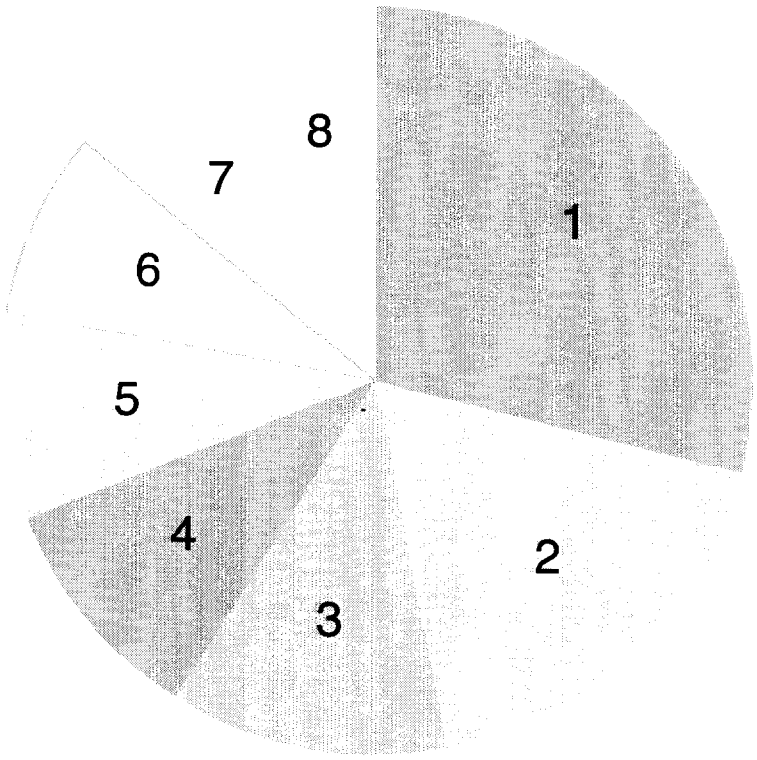
4 Capacity Building in Marine Sciences, Services and Observations: TEMA

The most relevant activities developed in the TEMA programme (Training, Education and Mutual Assistance in the Marine Sciences) concerned the follow-up of the marine science and technology networking pilot exercise between Latin America, the Caribbean, and Europe. This activity was carried out under the Standing Framework Agreement between the UNESCO and the European Federation of Networks (FER), and it is mostly funded by the European Union, in addition to other multi-lateral, bi-lateral and national agencies as well as the IOC. The development included four major planning workshops/meetings held in: Concepción, Chile (April 1996) for the Eastern Pacific; Rio Grande do Sul, Brazil (November 1997) for the Western Atlantic; an evaluation meeting (Alcalá de Henares, Spain, January 1998); and, Cartagena de Indias, Colombia for the Wider Caribbean (November 1998).

The methodology has been developed since 1995 by the TEMA-Capacity Building Unit, and endorsed by the governing bodies of the Commission, held between 1995 and 1998. It is considered as a successful pilot strategy for long term capacity building on marine science and technology. It enhances national, sub-regional and regional communication and co-ordination capacities, based on sub-regional or regional education and research initiatives/projects. Following recent evaluations and decisions by the European Union and UNESCO, it is expected that the capacity building networks that are emerging as a consequence of this pilot exercise for Latin America and the Caribbean, will consolidate around seven to nine projects. These will become the core elements of a new major European Union programme, to start during the year 2000.

During the International Year of the Ocean, the IOC supported 58 training, education and mutual assistance activities. Among these activities were training courses (59), workshops (12), research support (on the field and thesis research), education related activities (13), and publications (3). The courses, workshops and educational activities were related to programmes such as the Global Coral Reef Monitoring Network (GCRMN) and Global Ocean Observing System (GOOS) as well as to the Feasibility Study for the Implementation of a Network in Marine Science and Technology between Europe and Latin America. More than 1600 persons from over 100 countries were involved, of which 622 were supported by IOC. The major geographic areas represented were the Caribbean, East and West Africa, the Indian Ocean, South Asia and Mediterranean and Baltic Sea countries.

Funds to support TEMA amounted to approximately $ 800 000, of which over 60% were from extrabudgetary sources. A substantial part of those were related to the OSLR programme, notably on GCRMN and Harmful Algal Blooms programme (HAB). A major contribution from regular programme funds ($ 147 000) was for the support of the preparation and the participants in the Pan African Conference on Sustainable Integrated Coastal Management (PACSICOM) held in Mozambique in July 1998.



Graphic of TEMA component activities in IOC programmes

1. OSLR	29%
2. PACSICOM	18%
3. ICAM	12%
4. TEMA	10%
5. GOOS	9%
6. WESTPAC	8%
7. TTR	7%
8. other	7%

Regional Activities 5

5.1 IOC Regional Subsidiary Bodies

IOC regional subsidiary bodies have been established to ensure that IOC activities in the regions take into account the specific interests and needs of the Member States in that region. These bodies meet every 3-4 years and identify specific work plans relevant to the individual Member States within a regional framework.

The IOC has two types of Regional Subsidiary Body:

- Regional Sub-Commissions
- Regional Committees

Regional Sub-Commissions, according to the IOC Manual, Part I:

"*...are intergovernmental subsidiary bodies of the Commission, responsible for the promotion, development and co-ordination of the Commission's marine scientific research programmes, the ocean services, and related activities including TEMA, in their respective regions...*

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..."

Regional Sub-Committees, according to the IOC Manual, Part I:

"*...are intergovernmental subsidiary bodies of the Commission, responsible for the co-ordination and supervision of the scientific and service activities of the Commission at the regional level.*"

The IOC has established the following Regional Subsidiary Bodies:

IOC Sub-Regional 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 E. Brown, USA
Vice-Chairmen	Dr. Leonard A. Nurse, Barbados
	Dr. Marco Polo Bernal-Yarahuan, Mexico
	Orlando Malaver, Colombia (*ad hoc*)
Most recent Session:	IOCARIBE-V, Christ Church, Barbados 11-15 December 1995

IOC Sub-Commission for the Western Pacific (WESTPAC)

The Secretariat is based in Bangkok, Thailand

Head of the Office:	S. Mitsumoto
WESTPAC Officers:	
Chairman:	Dr. Keisuke Taira, Japan
Vice-Chairmen:	Prof. M. Hungspreugs, Thailand
	Dr. H. Tack Huh, Republic of Korea
Most recent Session:	WESTPAC-III, Tokyo, Japan 26 February-1 March 1996

IOC Regional Committee for the Co-operative 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, Mombasa, 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

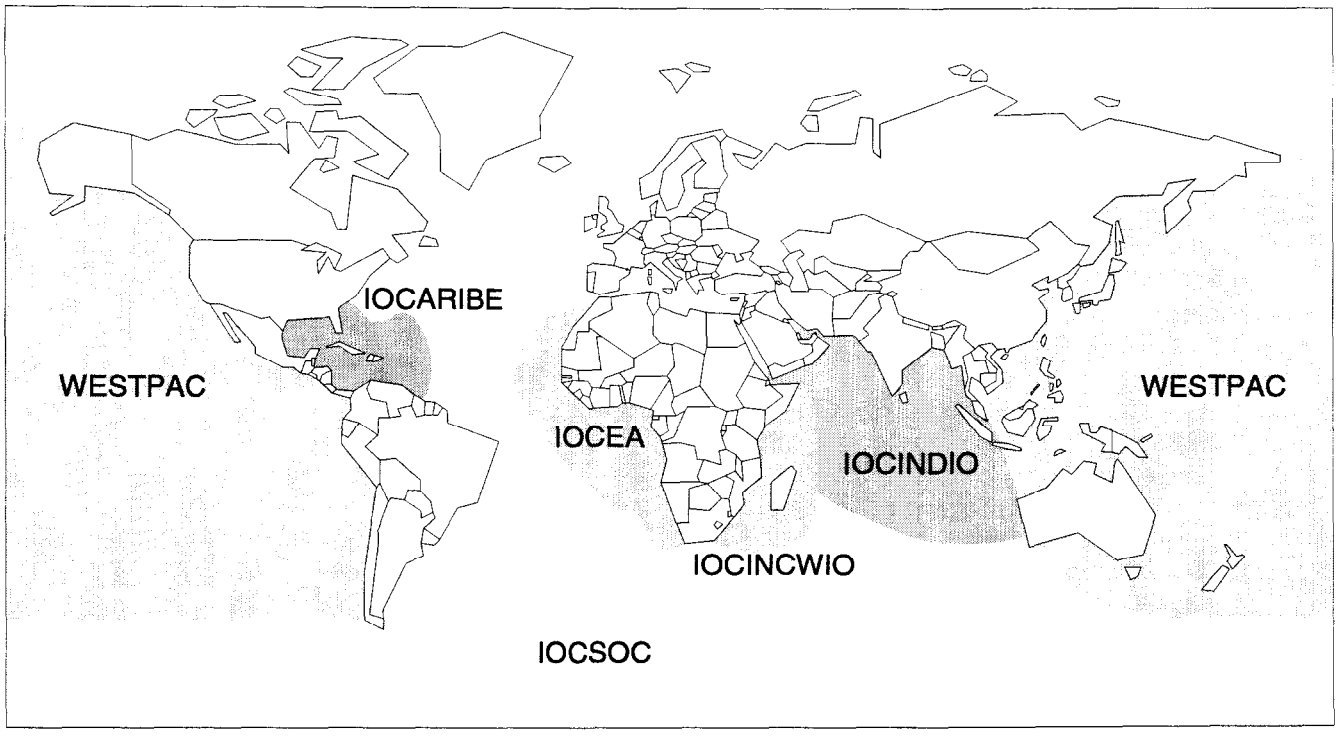


Figure 1: Map of IOC's Regional Subsidiary Bodies

IOC Regional Committee for the Central Indian Ocean (IOCINDIO)

IOCINCWIO Officers:

Chairman:	Dr. Muthunayagam, India
Vice-Chairman:	Dr. H. Zommorrodian, Islamic Republic of Iran
Most recent Session:	IOCINDIO-II, Goa, India, 20-22 November 1996

IOC Regional Committee for the Southern Ocean (IOCSOC)

IOCSOC Officers:

Chairman:	Dr. M. Tilzer, Germany
Vice-Chairman:	replaced by Advisory Group: Mr. C. Daniel Carbone, Argentina Dr. J. Chrurcj, Australia Dr. A. Klepikov, Russia Dr. E. Lindstrom, USA Dr. J. Priddle, United Kingdom
Most recent Session:	IOCSOC-VI, Bemerhaven, Germany 9-13 September 1996

IOC Black Sea Regional Committee (BSRG)

BSRG Officers

Executive Secretary	Dr. M. Ganchev, Bulgaria
Vice-Chairman	Dr. V.N. Eremeev, Ukraine
Most recent Session	BSRG-I, Varna. Bulgaria 10-13 September 1996

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

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

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

OVERVIEW

The activities of IOCARIBE have focused on the implementation of the instructions and guidelines adopted by the governing bodies of the Sub-Commission and IOC in the following documents:

- The IOCARIBE Evaluation 1996,
- The IOCARIBE Medium Term Strategy 1996-2000,
- The IOCARIBE Short Term Action Plan 1996-1998,
- The Recommendations from IOCARIBE-V Session,
- The Resolutions of the IOC Assembly and Executive Council.

Attention has been paid to assisting Member States, in particular SIDS, to assess their potential in Ocean Sciences and to plan their own capacity building in marine sciences. The first step was the creation of *Country Profiles* in marine science capacity. The basic profiles, *albeit* incomplete, were posted on the IOCARIBE web site:
http://www.ioc.unesco/iocweb/activities/regions/iocaribe

Significant progress has been made in the area of marine information management (MIM). Information is considered the most valuable asset of IOCARIBE, and its proper and more efficient use has become a major strategic target in the functioning of the Sub-Commission. Databases containing strategic information for the management of co-operation and promotion have continued to build up.

The decentralization of regional projects has continued slowly, but steadily. Regional projects are being promoted with a dual role: to contribute to global IOC programmes and to fulfil the interests and needs of countries in the region. Local initiatives are taken into consideration and matched to regional or global programmes.

With regards to the functioning of the Sub-Commission itself, a significant improvement was the new *modus operandi* of the regional Board of Officers. A long inter-sessional period has proven not to be favorable for the Sub-Commission's activities. The formal appointment of National Focal Points in most countries in the region is reinforcing the networking capacity for the Sub-Commission and its role as an intergovernmental organization.

IOCARIBE has started to provide better services by integrating information on marine science data and assessments, enhancing the capacities of Member States for accessing and using information, improving national and regional monitoring systems and, above all, designing user-defined sectored information products.

The implementation of recommendations adopted by the IOCARIBE intergovernmental sessions has been pursued with the available resources and delegated capacity.

PROGRAMME AND SERVICES

The IOCARIBE Secretariat is no longer implementing regional projects itself. Nowadays the regional Secretariat performs its duties as facilitator and promoter, delegating to regional institutions and encouraging experts to carry out operational components of regional projects and global programmes. The following projects are being carried out in the region, partly under the auspices of IOCARIBE and directly related to IOC Global programmes.

OCEAN PROCESSES AND CLIMATE (OPC)

The regional GOOS effort best demonstrates the activity of IOCARIBE in OPC. There has also been active co-operation with a regional project of the Organization of American States (OAS) called Caribbean Planning and Adaptation to Climate Change (CPACC), with assistance from the Regional Project Leader and Steering Group. A first draft of a Caribbean-GOOS initiative was discussed in the scientific meeting organized in Miami by the Intra-Americas Sea Initiative (IASI), in November 1998. Follow-up is underway and a proposal following the principles and strategy of GOOS will be further developed in the IOCARIBE GOOS workshop, to be held in San José, Costa Rica in April 1999.

The Intra-America Sea Initiative (IASI), has put forward a proposal related to the physical land-sea-air interaction, sponsored by IOCARIBE. The project is being drafted, with support from CATHALAC and the University of Miami, Rosenthiel School of Marine and Atmospheric Sciences.

OCEAN SCIENCE AND LIVING RESOURCES

A major endeavour during 1998 was the formulation of three Harmful Algae Bloom project proposals, and the creation of the ANCA (Algas Nocivas del Caribe) Group of Experts, under the leadership of Mr. Roberto Ruano (Guatemala) as Regional Project Co-ordinator.

Similarly, IOCARIBE is supporting ongoing projects on coral reefs, such as the Atlantic and Gulf Reef Rapid Assessment project (AGRRA), and the Caribbean Coastal Marine Productivity network (CARICOMP). Both have already constituted a group of experts, with the Sub-Commission providing networking capacity and facilitating intergovernmental co-operation.

Regarding the Large Marine Ecosystem, following a recommendation from IOCARIBE-V, the Sub-Commission has formulated a grant B proposal for GEF. This has been submitted and is under review.

With support from the regional Secretariat, a description of the LME of the Pacific Coast of Central America has been written. The document is being published and a project proposal will follow.

MARINE SCIENCE INPUTS TO ICAM

The IOCARIBE Framework Strategy on ICZM continues to be the reference in this area. A new project leader is being appointed for the regional framework strategy and co-ordination is sought with the intersectorial CSI programme of UNESCO.

Among the contributions from science to coastal zone management is the analysis, study, forecasting and management of hurricane effects on the coastlines in the region – an issue of great concern to the IOCARIBE region. This was specially obvious in 1998, with hurricanes George and Mitch affecting both the Eastern Caribbean islands and Central America. A regional project on this subject has been undertaken under the auspices of IOCARIBE.

MARINE POLLUTION, RESEARCH AND MONITORING

This project was sponsored mainly by the Swedish Agency SIDA/SAREC, with the aim of building capabilities, human resources and projects for planning and management. A report on the *Synthesis of Marine Pollution* in the Caribbean was produced. Baseline monitoring has continued, in order to provide countries and the region with an overview of the state of marine pollution.

The Marine Debris Inter-Comparison Working Group was convened at the Fifth Marine Debris Workshop in Curacao, 1996, to develop a plan for the Wider Caribbean. The project lasted one year, with the first survey conducted in July 1997 and the last in June 1998. The objectives of the project are to:

- Assess changes in the type and quantity of debris on coastlines;
- Identify sources of the debris;
- Quantify the mean and variance of common debris.

CARIBBEAN TSUNAMI WARNING SYSTEM

The threat of Tsunami continues to be present in the region. The Regional Project Co-ordinator (Dr. George Maul) and the Steering Group continue to be active in promoting the establishment of a warning system, supported by the regional GLOSS network and by its complementary activities in the region, such as the CPACC project of the OAS.

IODE-GODAR

A regional project to implement GODAR has been discussed by the regional Secretary and some experts. Dr. Paul Geerders was appointed *ad hoc* Regional Project Leader to pursue, design and draft such project proposal. The presentation of this project and the creation of a centre of excellence in the region for handling high tech information will be discussed at the IOCARIBE-VI Session.

EVENTS

IOCARIBE has participated and/or played an organizational role in the following events during 1998:

- Large Marine Ecosystems Consultative Meeting, IOC, Paris 15-16 March 1998
- 3rd Conference of the Caribbean Sea & Gulf of Mexico Hydrographic Commission, Martinique, 24-28 March 1998
- Wider Caribbean Workshop on Prevention of Pollution from Marinas, Yachting and Nautical Tourism. Cozumel, Mexico. 22-26 April 1998
- Caribbean Sea Forum, CARICOM, Trinidad & Tobago, 4-5 June 1998
- Taller IOCARIBE – ANCA (Harmful Algae of the Caribbean), La Habana, Cuba, 29 June-1 July 1998
- Workshop on New Directions on Management Capacity Building for Sustainable Coastal Management in the Wider Caribbean. La Habana, Cuba. 7-10 July 1998
- TEMA-ICAM Interdisciplinary Workshop, Cartagena, Colombia. 7-12 Sept 1998
- International Symposium on Marine Pollution, Monaco, 5-9 October 1998
- Intra-America Sea Initiative, Miami, USA. 21-23 October 1998
- 7th Session of the Editorial Board of the International Bathymetric Chart of the Caribbean, Aguascalientes, Mexico 27-29 November 1998
- Workshop on Fisheries and Marine Protected Areas. Gulf and Caribbean Fisheries Institute. St. Croix, A, 9-11 November 1998

5.3 IOC Sub-Commission for the Western Pacific (WESTPAC)

During 1998, the actions within the IOC Sub-Commission for WESTPAC concentrated on the implementation of the work plan approved during the Third Session of the Sub-Commission, Tokyo, 1996. In this work plan, WESTPAC programme activities are formulated as activities that contribute to solving global and regional problems, as a follow-up to UNCED. Collaboration with other agencies as well as within UNESCO has been strengthened.

Certain activities carried out in the region correspond to the global programmes of IOC. In this respect, the progress made in the GOOS regional component of NEAR-GOOS is noteworthy. ICAM is also increasingly becoming a focus of attention in the region, with many WESTPAC projects and activities contributing to the objectives of this programme. The web site of the WESTPAC Sub-Commission can be accessed at:
http://ioc.unesco.org/iocweb/activities/regions/westpac.htm

OCEAN SCIENCE PROGRAMMES IN WESTPAC

OSLR – Harmful Algal Blooms Programme

As one of the most active projects in the WESTPAC region, the Harmful Algal Bloom Programme is currently conducting a series of annual training courses for the WESTPAC Member States with the generous support from the Government of Japan. In 1998, the third course in that series was held at the School of Fisheries Sciences, Kitasato University, Japan, dedicated to PSP Toxin Monitoring.

The WESTPAC HAB group has also continued the preparation and distribution of reference materials and relevant documents to participating scientists in the region. HAB focal points have been established to facilitate the HAB network in the region.

International Year of the Ocean

A training course on *Operation Methods for Oceanographic Surveys* was held in Bali, Indonesia in conjunction with the arrival of the *T/V Kagoshima-maru* from Japan. The activity was a contribution of the Japanese National Commission for UNESCO as a contribution to the International Year of the Ocean.

Marine Pollution Research and Monitoring

Mussel Watch

The Asian-Pacific Mussel Watch Programme has taken off in the WESTPAC region through a training workshop hosted by the Environmental Research and Training Centre of Thailand. The participants in the workshop on *Marine Pollution Research and Monitoring Training on Toxic Contaminants* went through an intensive programme in which they were not only introduced to different methods used in the Mussel Watch, but also provided with ample opportunity for discussions. This ultimately led to drawing up a strategy for continuing the Mussel Watch Programme in Asia and the Pacific. The workshop was co-sponsored by the United Nations University.

Atmospheric Inputs of pollutants

IOC/WESTPAC organized a workshop on *Atmospheric Inputs of Pollutants to the Marine Environment – an Approach to GPA-LBA* in Qindao, China. This was the first attempt to bring together marine scientists from both the Northwest Pacific region and the Southeast Asian region to discuss atmospheric inputs. Atmospheric inputs are a much neglected pathway of contaminants to the marine environment, but the workshop demonstrated that the amounts of contaminants can be substantial.

Fourth International IOC/WESTPAC Scientific Symposium

The Fourth International IOC/WESTPAC Scientific Symposium was held in Okinawa, Japan. The University of Tokyo and the University of the Ryukyus played host to the Symposium. The Symposium brought together some 160 scientists from 14 countries. Six keynote addresses and 80 scientific papers were presented during the Symposium. In addition, a number of side meetings were convened on a variety of subjects, including Mathematical Modelling of the Gulf of Thailand, higher education for marine sciences, NEAR-GOOS and SEA-GOOS, OSNLR and ICAM. The Proceedings of the Symposium were published as a special publication by the organizers.

Integrated Coastal Area Management

Remote Sensing Applications for ICAM

In conjunction with the Fourth WESTPAC Scientific Symposium, IOC/WESTPAC organized a planning Workshop on *Remote Sensing Applications for ICAM* that brought together a number of remote sensing specialists from the region to discuss how remote sensing technology can be applied to support the process of integrated coastal area management and the need for follow-up networking.

Gulf of Thailand Collaborative Study

Considerable progress has been made in the Gulf of Thailand Collaborative Study, a regional pilot project under the IOC/ICAM programme of Interdisciplinary Studies of Coastal Processes. Apart from a small workshop convened during the WESTPAC Scientific Symposium in Okinawa on *Numerical Modelling of Physical Processes in the Gulf of Thailand*, the Gulf of Thailand Study network has been active in various related projects. For instance, the European funded CUU-LONG project on the Mekong Delta and adjacent sea, and through participation in different *fora* with regard to the future of the Gulf of Thailand, both from a scientific perspective as well as from a policy perspective. The Vietnamese Government conducted a scientific cruise in Vietnamese waters as a contribution to the Gulf of Thailand Collaborative Study.

The Gulf of Thailand Study has maintained and expanded an on-line data management information system on the Gulf of Thailand and attracted more participants in its e-mail discussion group. The WESTPAC Secretariat is preparing for a scientific cruise across the mouth of the Gulf of Thailand that will yield much needed data on the boundary conditions of this semi-enclosed sea.

OPERATIONAL OBSERVING SYSTEMS IN WESTPAC

The Northwest Pacific Action Plan (NOWPAP)

The Northwest Pacific Action Plan (NOWPAP) also known as the Action Plan for Protection, Management and Development of the Marine Coastal Environment of the Northwest Pacific Region, is one of UNEP's Regional Seas Programmes, adopted in Seoul, Republic of Korea, at the First Intergovernmental Meeting on **NOWPAP** in September 1994. Japan, the People's Republic of China, Republic of Korea and the Russian Federation are participating in the implementation of the five-component Action Plan.

In the spirit of inter-agency co-operation within the UN system, IOC was invited to be the implementing agency for NOWPAP/1 and NOWPAP/3. A number of activities were carried out in 1998. At the request of IOC/WESTPAC each Member State prepared a national report on the state of the marine environment and another on national monitoring activities. Two consultants were contracted through IOC/WESTPAC. IOC/WESTPAC Secretariat participated in a fact-finding mission by the consultants to the different countries in early 1998.

Two workshops were further organized by IOC/WESTPAC. One concerned the Expert Workshop on *the Establishment of a Comprehensive Database and Information Management System* (NOWPAP/1) held in Beijing, July 1998, and the other involved the Expert Workshop on *the Establishment of a Collaborative Regional Monitoring Programme* (NOWPAP/3).

Both workshops discussed the national reports and finalized the proposals for phase II that encompass the establishment of a regional monitoring system. In both proposals, reference is made to the existing NEAR-GOOS and the proposed NEAR-HOTO. IOC/WESTPAC is working closely with all these projects in order to ensure appropriate coordination.

COLLABORATION WITH OTHER AGENCIES

UNESCO-CSI

In 1996 UNESCO set up an inter-sectoral programme to facilitate co-operative and interdisciplinary work with Coast and Small Islands (CSI). Emphasis is on cross-sectoral and co-operative action within UNESCO and beyond. IOC is one of the supporting sectors of the CSI programme.

With support from the CSI programme, the Bangkok UNESCO Office in collaboration with IOC/WESTPAC Secretariat initiated a project in 1998 with the objective of providing indigenous people inhabiting protected natural and cultural heritage sites, with the knowledge, skills and tools to enable them to take shared responsibility for the management of those sites. The project is being implemented in Thailand's Ko Surin Marine National Park in the Andaman Sea. A stakeholder workshop was organized that identified the different actions that need to be taken to unite the goals of environmental protection with those of socio-economic development.

UNEP

In addition to participating in NOWPAP, IOC/WESTPAC has actively participated in meetings of the UNEP/COBSEA project preparatory phase for a Transboundary Diagnostic Analysis of the South China Sea. A project proposal has been prepared and revised for submission to the Global Environmental Facility. If awarded funding, IOC/WESTPAC will be one of the implementing agencies.

The Southeast Asian Programme on the Law of the Sea (SEAPOL)

IOC/WESTPAC continued to participate in the meetings of experts of the SEAPOL Gulf of Thailand Project. The SEAPOL project complements the activities carried out under the IOC/WESTPAC Gulf of Thailand Collaborative Study, putting emphasis on the policy issues of the Gulf of Thailand. IOC/WESTPAC Secretariat provided a keynote address in SEAPOL's Gulf of Thailand meeting in Hanoi, Viet Nam.

Carl Duisberg Foundation

IOC/WESTPAC participated in the Regional Training Course on *Integrated Coastal Zone Management* held in Hanoi, Viet Nam and organized by the German Carl Duisberg Foundation. IOC/WESTPAC Secretariat provided support for a series of lectures in the course.

ESCAP

IOC/WESTPAC participated in the Workshop on *Integrated Coastal Zone Management* and organized a Seminar on Water *Resources in the Asian-Pacific Region* organized by ESCAP.

Various

IOC/WESTPAC participated in various meetings and conferences of relevant organizations in the region, most notably the annual meetings of the CCOP and the GEF/UNDP/IMO Programme for the Prevention of Marine Pollution in the East Asian Seas. Possible collaboration between these organizations and IOC was discussed in these meetings.

RUNNING OF THE WESTPAC SECRETARIAT

The IOC/WESTPAC Secretariat has continued to receive excellent support from the Royal Thai Government through its National Research Council. Further support for the Secretariat was provided by the UNESCO Principal Regional Office for Asia and the Pacific.

The Secretariat had some staff changes. Mr. Jiang Yihang left after four years of working in the Regional Secretariat. With the arrival of Dr. Shigeki Mitsumoto and Mr. Maarten Kuijper the preceding year, it had been ensured that a smooth transfer of responsibilities was possible.

Overview of IOC/Westpac Activities

Title	*Place & Date*	*Number of Attendants*	*Number of countries*	*Budget**	*US$*
IOC/WESTPAC Workshop on Remote Sensing Applications for ICAM	Okinawa February 2-3	12	11	EX	20,000
Fourth WESTPAC Scientific Symposium	Okinawa February 2-7	160	14	EX	25,200
IOC/WESTPAC Workshop on Marine Pollution Research and Monitoring Training on Toxic Contaminants	Bangkok March 2-13	17	8	EX	25,000
IOC/WESTPAC Workshop on Atmospheric Inputs of Pollutants to the Marine Environment an Approach to GPA-LBA	Qingdao June 24-26	14	7	EX	21,370
UNEP-IOC/WESTPAC Expert Workshop on the Establishment of a Collaborative Regional Monitoring Programme (NOWPAP/3)	Vladivostok July 1-3	25	4	EX	15,160
UNEP-IOC/WESTPAC Expert Workshop on the Establishment of a Comprehensive Database and Information Management System (NOWPAP/1)	Beijing July 6-8	26	4	EX	11,000
IOC/WESTPAC Training Course on PSP Toxin Monitoring	Iwate August 24-30	9	6	EX	20,000
IOC/WESTPAC Training Course on NEARGOOS Data Management	Tokyo October 12-23	6	4	EX	20,000
IOC/KOICA/KORDI Training Course on Marine and Coastal Environmental Conservation	Ansan October 18-31	16	5	TF	2,800
IOC/WESTPAC Training Cruise on Operation Methods of Oceanographic Surveys on board T/V Kagoshima-maru	Bali October 28-30	11	7	PP	20,000 Participation Programme (Japan-NATCOM)

** EX; Extrabudgetary; TF: IOC Trust Fund; PP: Participation Programme*

5.4 IOC Regional Committee for Co-operation in the North and Central Western Indian Ocean (IOCINCWIO)

During the year of 1998, the IOC Sub-Committee for IOCINCWIO concentrated on the implementation of the work plan approved during the Fourth Session of IOCINCWIO which was held the year before. In this work plan, the IOCINCWIO programme activities are formulated as activities which contribute to solving global and regional problems, as a follow-up to UNCED. The web site of IOCINCWIO can be accessed at: http://ioc.unesco.org/iocweb/activities/regions/iocincwio.htm

OPERATIONAL PROGRAMMES

Ocean Science in Relation to Living Resources (OSLR)

Survey of Potentially Harmful Marine Microalgae in East African Waters

This project was adopted by the Regional Committee (IOCINCWIO-IV) in May 1997. It will make it possible to assess the potential risks of human intoxication by algal toxins, as well as the risks of economic losses to aquaculture and fisheries in the region.

The long-term objective is to provide the scientific basis for implementation of harmful algae monitoring programmes along the coasts of the countries involved, in order to control the safety of cultured and natural seafood resources for human consumption. This objective will be pursued through scientific and technical capacity building at the participating institutions.

A second objective is to prepare an identification guide to potentially harmful microalgae in East African Waters in English and/or local language(s). The guide will be an important tool for future monitoring and research purposes. The project is thus a training-through-research effort.

As a first step, IOC contracted five national institutions to initiate the sampling, identification and analysis of microalgae, their tasks are the following:

- Organize and implement the field sampling of phytoplankton samples in the coastal waters in three designated areas;
- Analyse the phytoplankton samples in collaboration with the IOC Science and Communication Centre on Harmful Algae in Copenhagen.

All results will be made available to the Project and for the planned publication of the *Guide to Potentially Harmful Microalgae of East Africa* – which will be a joint publication between all institutions involved in the project.

The five institutions are the following:

- Agence pour la Recherche et la Valorisation Marine, Ile de la Réunion, France
- Centre National de Recherche Océanographique, Nosy Be, Madagascar
- Institute of Marine Sciences, Zanzibar, Tanzania
- Kenya Marine and Fisheries Research Institute, Mombassa, Kenya
- Albion Fisheries Research Centre, Mauritius

In order to undertake the HAB Survey, IOC provided a camera and microscope to CNRO in Nosy Be, Madagascar.

Finally a first workshop is planned to take place in IMS (Zanzibar) from 8-12 February 1999.

Ocean Science in relation to Non Living Resources (OSNLR)

IOC-OSNLR Workshop on Guidelines for Assessment, Monitoring and Management of Physical Shoreline Changes of the West Indian Ocean region

Shoreline change is a widespread environmental problem in the West Indian Ocean Region (WIO Region) that affects all coastal countries (Somalia, Kenya, Tanzania, Mozambique, South Africa), and the Island States (Madagascar, Comoros, Mauritius, Réunion-France and Seychelles). As a consequence, during a workshop in 1994 on coastal erosion, countries of the region decided to adopt a common methodology. This was aimed at characterizing the shorelines and assessing vulnerability to coastal erosion as a short-term strategy to understand the process of shoreline change.

The methodological guidelines developed by scientists from the region with support from IOC-SIDA provide a general outline of a fundamental approach and techniques for assessing and monitoring coastal erosion using manpower and technology already available in the region. The draft *Guidelines* have been circulated within and outside the region.

In order to review and adopt the *Guidelines* prior to their publication, IOC organized a workshop in collaboration with the Ministry for Co-ordination of Environmental Affairs of Mozambique (MICOA) in Maputo, Mozambique (14-18 December 1998).

The objectives of the workshop were to:

- Introduce the guidelines for studying shoreline change;
- Review field experience by different scientists in studying shoreline change and their experience in applying the guidelines;
- Outline scientific equipment and their field application in shoreline change research.

- Apply the guidelines to a selected case study with respect to, shoreline characterisation, problem identification and management;
- Review the different options available for the management of physical shoreline change (their application, benefits, impacts and associated pitfalls);
- Establish collaborative working relationship between regional scientists working on shoreline change.

The final *Guidelines* will be ready for publishing in May/June 1999. Special attention has been given to the need to produce a document that is useful to both coastal practitioners and scientists. The Workshop was attended by participants from Kenya, Tanzania, Madagascar, Seychelles, United Kingdom, and Mozambique.

Integrated Coastal Area Management (ICAM)

In March 1998, IOC participated in the WIOMSA-SEACAM Workshop on *Experiences in Local and Community ICZM Projects*, which was held in Zanzibar (4-6 March). The main objective of the workshop was to discuss lessons learned from the most established local and community ICZM projects in Eastern Africa as a critical foundation on which to build successful new projects. The Workshop was attended by 55 participants representing each country of the region. IOC supported the participation of five scientists.

Developing and Sustaining Indigenous Human Capacity

Training Courses

- Global Sea Level Observing System (see GLOSS section);
- Postgraduate Course in Tropical Coastal Ecology, Management and Conservation;
- Nine fellowships were provided to regional students to attend the *Post-graduate Training Course in Tropical Coastal Ecology, Management and Conservation* (6 July-20 August 1999, Mombassa, Kenya) which was organized by the University of Nairobi, and the Kenya Marine and Fisheries Research Institute (KMFRI);
- Training Course in *Integrated Coastal Area Management for Practitioners in the Western Indian Ocean* (1-12 March 1999, Mombassa). IOC-SIDA sponsored the participation of five attendees. The Training Course is a regional initiative organized by WIOMSA in collaboration with the Coastal Resources Centre (CRC) of the University of Rhode Islands, with the support of USAID.

DATA AND INFORMATION

GLOSS Data Analysis Project (GLOSS-WIO)

The aim of this project is to bring together and analyse all sea level data which has been collected in the Western Indian ocean with a view to identifying gaps in observation that need to be filled, and assessing variability of sea level and long term trends in the region.

The study also includes preparation of a comprehensive report on the tide gauges which have operated in the region, the volumes and quality of data collected, bibliography of sea level literature from and on the region, and what needs to be done to complete and improve the GLOSS/Regional and National Networks.

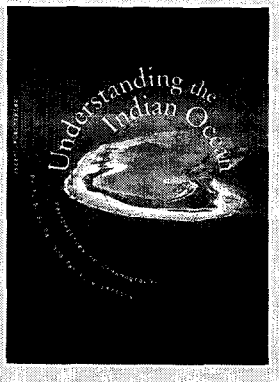
Specific tasks include:

- Collection of information on location of operational gauges, tide gauge bench marks, levelling information, sources of funding for installation and maintenance of gauges;
- Listing of GLOSS stations not installed or not operational and reasons for non-operation, cost of installation and maintenance, and possible funding sources;
- Identification of other gauges planned and justification of requirement for them;
- Identification of all locations where gauges have been installed before, their duration of operation, and where they are no longer in operation, the reasons for non-operation;
- Collection of information on capacity available for installation and maintenance of tide gauges and analysis of sea level data. Provide information on trained personnel, indicating where they were trained (e.g. PSMSL, Y);
- Collection of information on requirements for capacity development;
- Location and collection of all sea level data available from the region (both in local and international institutions);
- Assessment of the quality of data, analysis of the data for sea level variability at different time scales and long term trends in sea level change;
- Identification of sea level products that are prepared in the region and others that can be useful and possible users of the products.

The Member States of IOCINCWIO (Kenya, Madagascar, Mauritius, Mozambique, Seychelles, South Africa, Réunion, Tanzania) are participating in this study.

For each country an institution (normally the one taking part in the CMAS project) will be requested to prepare the national report The project/study should take 6-9 months to complete, national reports will be ready for publishing in the middle of 1999.

Main Publications



Understanding the Indian Ocean: Perspectives on Oceanography

Marking the thirtieth anniversary of the end of the International Indian Ocean Expedition, this book describes the oceanography of the Indian Ocean from earliest times to the present, and suggests a possible framework for its study and monitoring in the future. It summarizes the geology, hydrography, nutrient distribution and biology of this *Third Ocean* and provides a fascinating view of past lore as well as the present state of oceanographic knowledge.

Pilot project on the mapping of shallow water of Mahé (Seychelles)

The Indian Ocean Commission and the IOC completed the project. The main product is an Atlas which will contribute to the establishment of a sea use plan and a multi-user marine resources management plan. The production of the Atlas was supported by the EU, France and Sida-SAREC.

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

The second session of IOCINDIO held at Goa during November, 1996 has recommended a set of programmes for implementation in the IOCINDIO region. The programmes include five workshops and two projects to be taken up by the IOCINDIO. The workshop/training programmes are:

- Sub-regional Workshop on Storm Surges;
- Regional Workshop on Tropical Ocean Climate;
- Regional Workshop on Integrated Coastal Studies Including Coastal Marine Pollution;
- Sub-regional Workshop on Coral Reef Monitoring;
- Sub-regional Workshop on Oil-spill monitoring;

Out of these, two regional workshops (2 & 5) have been conducted so far. A regional workshop on *Tropical Ocean and Climate* during 3-6 November 1998 at Indian Institute of Science (IISc.), Bangalore, India was organized to discuss the issues relating to Tropical Ocean and Climate research particularly, in the Central Indian Ocean. During February 1998 a co-sponsored workshop with the Regional Organization for Protection of Marine Environment (ROPME) on *Trajectory Modelling on Oil Spills* was organized by Marine Emergency Mutual Aid Centre (MEMAC), Bahrain to address issues relating to oil spill in the region.

The projects recommended by IOCINDIO-II for implementation in this region are:

- Sea level monitoring; and
- Storm Surge forecasting.

In consultation with the Member States of IOCINDIO and GLOSS, a regional proposal was prepared for Indian Ocean Sea Level Observing Network (IOSLON) and circulated for comments from Member States. Based on responses a sub-regional proposal on IOSLON was prepared for implementation of the project in Bangladesh, Iran, Iraq, Sri Lanka and India at an estimated cost of US$ 174,000. The proposal is for installation, operation and maintenance of seven tide gauges at locations suggested by Member States of IOCINDIO. It was expected the entire work including procurement, installation of gauges and provide training to personnel would be completed over a period of one year. Confirmation of participation by providing local contributions, from some of the Member States is awaited.

A project proposal for the establishment of a *Storm Surge Prediction System* prepared by WMO-IOC-IHP was circulated among the countries of IOCINDIO for seeking their willingness to participate in the programme. A workshop and regional meeting scheduled for 21-27 April 1999 in India had to be postponed due to inadequate response. The workshop and regional meeting is proposed to be held in December 1999.

IOCINDIO office on behalf of IOC has participated in the 26th Session of WMO/ESCAP Panel on Tropical Cyclones held in Maldives from 2 to 8 March 1999 and highlighted the importance and need for implementation of storm surge project in the region. IOCINDIO officers also called for a very close co-operation between ocean and meteorological sectors.

1998 was the International Year of the Ocean. All the activities, including the two workshops, were dedicated to IYO.

Our understanding of the oceanographic processes of the Indian Ocean, as a water body, is still inadequate. There are huge gaps in data availability. Basin scale studies with the collaboration, co-operation and contribution from the Indian Ocean RIM countries are needed. Countrywide developments in the region are quite promising. Some countries have even attained global dimensions in oceanographic pursuits. Co-operation in the region needs to be intensified to bring the other countries to a suitable level in oceanographic science and services. The top priority of the area is for capacity building, both in terms of manpower and infrastructure. Marine Pollution, Coastal Zone Management, Storm Surge Studies, Climate Research are some of the priority areas in the region. Many countries in the region also need financial support from the developed countries for capacity building.

5.6 Black Sea

The decision of the International *Black Sea 1997* Conference, (Varna, May 1997), to declare 1998 "Year of the Black Sea" as part of the UN "Year of the Ocean" initiative oriented oceanographic activities in the Black Sea region during that year. The work was co-ordinated by the Black Sea Regional Committee (BSRC). The results were summarized at the first meeting of members of the Black Sea Regional Committee and representatives of the IOC Secretariat, held during the period of the 31st Session of the IOC Executive Council at UNESCO Headquarters (Paris, November 1998).

A considerable amount of work was carried out during the period in the framework of the Black Sea Regional Programme Pilot Projects 1 (Step Towards Operational Prediction System or Black Sea GOOS) and 2 (Black Sea Fluxes) of the BSRC. In particular, a scientific concept of the Black Sea GOOS has been formulated, as well as an inventory of the ongoing national programmes and monitoring systems. This will provide the basis for a regional level monitoring system. Joint field studies have been conducted and a general strategy for the investigation of ocean fluxes in the basin, as well as the informational basis for joint studies, have been developed in the framework of Pilot Project 2.

The Black Sea Regional Committee established close and enduring connections with the IOC Secretariat, as well as working contacts with the steering bodies of international programmes for the Black Sea of GEF, NATO, IAEA, and others. The most important activities during the year are listed below.

Scientific conferences and publications:

- A report on the Workshop *Black Sea Fluxes*, held in Istanbul and hosted by the Istanbul Institute of Marine Sciences and Management, is in print, and will soon become available for the scientific community;
- Black Sea scientists widely participated in international Symposia sponsored by IOC dedicated to studies of enclosed and marginal seas such as the TOS/IOC Symposium *Oceanography of Coastal and Marginal Seas* held in Paris, Symposium *Oceanic Fronts and Related Phenomena (Konstantin Fedorov Memorial Symposium)* held in St. Petersburg, etc.;
- Various results of regional studies in the framework of the Black Sea Regional Programme Pilot Projects 1 and 2 were presented at the Advanced Research Workshop sponsored by NATO, held in Kiev in March 1998. The results have been published as a NATO ASI series book.

Field studies:

- An international expedition on *Black Sea Fluxes 1998*, sponsored by IOC, was organized in the western part of the Black Sea (21 September-5 October 1998) on board the *S/V Admiral Ormanov* (Bulgaria);
- An international expedition of the IAEA, supported by IOC, was held in the north-western part of the Black Sea (9-23 September, 1998) on board the *R/V Prof. Vodianitsky* (Ukraine);
- Several oceanographic expeditions were carried out in the framework of national and CoMSBlack research programmes, as part of the initiative *Year of the Black Sea*, on board of *R/V Akvanavt* (Russia), *Bilim* (Turkey) and *Gorizont* (Ukraine).

Members of the Black Sea Regional Committee (V. Eremeev, U. Unluata, A. Bologa) and experts on Pilot Projects 1 and 2 took part in the NATO TU Black Sea Advisory Committee meeting held in Sebastopol in January, 1998. At the meeting major achievements of the NATO TU Black Sea programme, co-ordination of the BSRC with the NATO programme *Black Sea Ecosystem Processes, Prediction and Operational Data Management* and issues related to the CoMSBlack programme were discussed.

One of the major outcomes of the TU Black Sea project is the unique joint interdisciplinary *Database Management System for the Black Sea*, which now contains 13,000 data files (150MB of various information including metadata). A version of the DBMS was distributed to all data-contributing partner institutions. The DBMS inventory is now freely accessible from two Internet web sites. The results of regional studies obtained in the framework of the Project have been published in a two-volume ASI series book entitled *Ecosystem Modelling as a Management Tool for the Black Sea.*

The second meeting of the Black Sea Regional Committee will be held in Istanbul in May, 1999. This is in accordance with the decision of the first meeting of the Black Sea Regional Committee members and representatives of the IOC Secretariat, held during the period of the 31st Session of the IOC Executive Council at UNESCO Headquarters (Paris, November 1998). Among the most important issues for the near future that will be discussed at the meeting are:

- Preparation of the proposal of a common project for implementation of the Black Sea Regional Programme with support from the EC;
- Further development of co-operation between the ongoing projects of "Black Sea GOOS" (IOC) and "Black Sea Ecosystem Processes, Prediction and Operational Data Management" supported in the framework of the NATO SfP Programme. Also co-operation with the IAEA programme for the Black Sea;
- Organization of a scientific seminar and workshop to discuss the results of the joint cruise studies held in 1998;
- Organization of an international expedition in the eastern part of the Black Sea. Fulfilment of the plans will strengthen co-operation and links between the ongoing international programmes in the Black Sea region.

5.7 Priority Africa: PACSICOM and Follow-up

The *Pan-African Conference on Sustainable Integrated Coastal Management* (PACSICOM), held in Mozambique, was a major event in 1998. It also launched, for the years to come, an African process for the development and protection of the coastal and marine environment, particularly in sub-Saharan Africa.

THE PAN-AFRICAN CONFERENCE ON SUSTAINABLE INTEGRATED COASTAL MANAGEMENT (PACSICOM), Maputo, Mozambique, 18-24 July 1998

The Conference was convened as part of region-wide efforts to give greater impetus to the management of seas and the coasts in Africa. It brought together Ministers and senior officials from all over Africa, as well as from international agencies, non-governmental organizations and bilateral financial institutions. The Conference offered a unique opportunity for discussing the state of the coastal and marine environment in Africa, with special focus on the need for concerted intergovernmental dialogue.

The Government of Mozambique sponsored PACSICOM, in partnership with the Government of Finland, UNESCO, UNEP, and FAO. African Governments and institutions provided support and substantial assistance to the Conference.

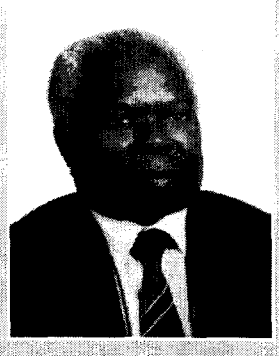
Main Objectives:

- Provide a major contribution by Africa to the United Nations International Year of Ocean and to EXPO'1998,
- Assess and review the efforts and experiences in sustainable integrated coastal management (SICOM) in Africa over the last two decades;
- Help to strengthen sustainable development in coastal zones and areas otherwise affected by marine processes in Africa, to raise awareness about the urgent need for well-coordinated global actions, and to help establish a strategic and integrated plan of action for the coastal management of Africa;
- Initiate the PACSICOM Process, comprising:
  (a) PACSICOM itself, whose main outputs include the Maputo Declaration, (see below);
  (b) a Pan-African Conference on Co-operation for the Development and Protection of the Coastal and Marine Environment in sub-Saharan Africa (Cape Town, South Africa, 30 November-4 December 1998) to promote intra-African co-operation in the implementation of regional conventions, programmes and action plans to protect, manage and develop Africa's marine and coastal environment;
  (c) a partnership Conference to be held in a year 2000, in close collaboration with Africa's development co-operation partners, to consider a set of proposals for funding

Figure 2: PACSICOM (18-24 July, 1998).
About 50 delegations including representatives from 47 African countries among which more than 20 coastal countries attended the Conference.
Showing here a cross-cutting session analysing African regional conventions

OPENING ADDRESS TO PACSICOM

by H. E. Mr. Bernardo Pedro Ferraz , Minister for Co-ordination of Environmental Affairs, Mozambique



If you were to ask me if the people of Mozambique understand coastal system phenomena, my answer, without hesitation, would be *no*. I think that it would be the same in your countries. This conference will discuss these phenomena. It is my hope that it can also find ways to enable our fellow countrymen to understand the benefit that coastal systems are able to bring them.

There is a proverb that states where *God gives happiness, the Devil and unhappiness will blossom*. To be a fortunate country with huge natural resources does not mean to be a prosperous nation. The continuous suffering of our people and the economic decline of our countries do not allow good management of our natural resources. As a result, we are now seeing the effects of over-exploited mangrove forests and fisheries, coral reef degradation, coastal erosion and so on.

Turning to pollution. Many people think that air pollution is the only threat to the environment. And generally speaking, we consider that our region is not affected. Coastal areas are considered as zones with an endless capacity for absorption. But this is not true. Pesticides and herbicides used in agriculture find their way into rivers. As a result, chemicals used to prevent disease in the agricultural sector can cause significant damage to coastal ecosystems.

Lack of planning of housing and development in coastal zones, the absence of policy on tourism, a real concern about the conservation of biodiversity – these are some other aspects to be considered in coastal management. But coastal management must be discussed from a regional point of view, because most of the above-mentioned problems do not respect national borders.

The systematic globalization of the world and the vulnerability of developing economies will make it more difficult to balance the preservation of coastal zones with economic development, at least to the level of the fulfilment of the basic needs of our people. That why strong regional collaboration is essential. I hope that this subject will be discussed in the PACSICOM meetings. But interest in them will not end here.

There is an important cause behind our diplomatic efforts to invite the United Nations agencies and organizations as well as the developed countries to help us to organize and implement the PACSICOM process. Africa is in danger. The African terrestrial natural resources (water, soil, forests) are in danger of disappearing. Yet, we believe that there is some hope in the coastal zones, in the sea. Consequently it is absolutely essential to manage the sea, to manage the coasts, to sustain Africa.

And it is not only a problem for countries with a coastline. A hinterland country also depends on the coastal system. We have to protect the sea. We have to protect the coast. The hinterland countries will have to negotiate, to encourage coastal countries not to abandon the struggle for coastal and sea management.

And developed countries, with your satellites, with your sophisticated equipment and techniques installed in our seas, you must help us to protect our coastal zones, our seas, because it is also your coast and your sea. Where else can you go to catch fish? Where are you going to pass with your oil and goods? These are our seas, ours and yours. So we have to protect them. Today we start a process that must be continuous and permanent.

It is a problem of our survival, and when I say *our*, I am not referring only to the African people, but to the non-Africans who also depend on Africa, as we depend on Europe, America and Asia. Consequently, this is an exercise that is forcing us to think, to feel, perhaps to have strong and hard discussions. But also to achieve a consensus to manage the African coastal zones and our African seas. We have to convince our politicians, our constituencies and the funding agencies to help us to save Africa.

Some people say that mankind began in Africa. It is not from here that will be forced to disappear.

in addressing major priorities for actions identified by the PACSICOM and Cape Town conferences. The emphasis and focus of the Partnership Conference will be on funding. These efforts will lay the ground for the African process for the development and protection of the coastal and marine environment, particularly in sub-Saharan Africa.

The Three Components of the Maputo Conference

- the *Technical Congress* (18-20 July), consisting primarily of a set of workshops on different aspects of the theme of Sustainable Integrated Coastal Management (SICOM);
- a *Cross-Cutting Workshop* (21 and 22 July) to integrate the output from the Technical Congress;
- a *Ministerial Conference* (23 and 24 July 1998) with high ranking decision makers (including Ministers) to review the output of the Technical Congress, to consider political implications and socio-economic factors, and to approve the *Maputo Declaration*, *PACSICOM Statement*, *PACSICOM Resolutions* on the principles of sustainable development for the coastal zones and areas of Africa related to marine influences.

IOC as the Co-ordinating Unit for the UNESCO task force for PACSICOM organized and sponsored two major workshops

1. GOOS-AFRICA:
Data for Sustainable Integrated Coastal Management (SICOM),
Global Ocean Observing System for SICOM in Africa.

Fifty-eight delegates to PACSICOM, including representatives from seventeen coastal countries in Africa, attended the Technical Workshop on *Data for Sustainable Integrated Coastal Management (SICOM) in Africa*. The discussions led to specific recommendations regarding marine data and information needs in Africa which were taken forward to the Ministerial Conference, the culmination of PACSICOM. The Workshop also laid the foundation for a supporting organizational framework for the Global Ocean Observing System in Africa (GOOS-AFRICA).

The overall objective of the Workshop was to outline a strategy and define an action plan to improve and strengthen the data acquisition, analysis and interpretation capabilities needed to support SICOM in Africa. Marine data and information, especially trends and forecasts, are essential aids in decision-making for coastal managers concerned with such basic human needs as the security of health, food, shelter, water, and energy, as well as with improving opportunities for the creation of wealth through offshore and coastal industry, marine trade, fishing, mariculture, aquaculture, and tourism.

Recommendations:

- The formation of an Africa-wide network of national ocean data centres that are properly equipped and staffed by trained personnel;
- Upgrading and expanding 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;
- To 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;
- To 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;
- Infrastructures and Capacity building for SICOM in Africa: National and Regional Capacities.

2. Infrastructures and Capacity Building for SICOM in Africa: National and Regional Capacities

The Workshop participants stressed that coastal area management, which is a multi-disciplinary methodological approach, should not be a substitute for the development of basic capacity in the marine sciences. This is considered to be a pre-requisite to the provision of a reliable database for sustainable use of coastal resources. It is the responsibility of governments to foster sustainable coastal management and ensure a stable environment conducive to the success of the process.

Follow up actions:

- Development of sub-regional pilot projects that can serve as a learning mechanism for Members States, for training and the exchange of experience;
- Establishment of national focal points and networking at the sub-regional level;
- Encourage the development of a formal university course in advanced marine and coastal zone management for professionals to enhance mutual understanding;
- Initiate action to identify and upgrade potential centres of excellence in Africa.

THE MAPUTO DECLARATION

We, the Governments represented by our ministers and senior officials responsible for the environment, meeting in Maputo from 18 to 24 July 1998, as part of the process of reinforcing and renewing our common resolve to effectively protect, manage and sustainably develop Africa's marine and coastal environment,

Noting with concern the continued deterioration of our coastal and marine environment and the threat that if poses to the well-being of present and future generations;

Recognizing the need to move towards more integrated policies and the practice of sustainable integrated coastal management to improve the quality of life for our peoples,

Also recognizing the increased impact of sedimentation and wastes on the environment due mainly to inappropriate agricultural activities upstream and inadequate waste management strategies,

Further recognizing the need for the protection, management and sustainable development of Africa's more than fifty significant international river basins,

Fully aware that Africa's environmental and economic problems are compounded by frequent occurrences of natural disasters, such as drought, floods and the El Niño phenomenon,

1. Affirm our commitment:

(a) To review our respective national policies and programmes with a view to incorporating the goals of chapter 17 of Agenda 21 of the United Nations Conference on Environment and Development, on sustainable integrated coastal areas management;

(b) To conduct periodic reviews of the legislative, substantive and institutional basis for action on the coastal and marine environment in Africa;

(c) To promote systematic intergovernmental dialogue on the priority issues identified at the Pan-African Conference on Sustainable Integrated Coastal Management, relating to sustainable integrated coastal management;

(d) To address issues identified in Statement of the Pan-African Conference on Sustainable Integrated Coastal Management, using existing regional conventions, protocols, action plans and intergovernmental programmes on the marine and coastal environment, as well as appropriate new initiatives;

(e) To update our existing regional agreements on Africa's marine and coastal environment in the light of recent developments, including the United Nations Conference on Environment and Development, the adoption of the Treaty Establishing the African Economic Community, the entry into force of the United Nations Convention on the Law of the Sea and the adoption of numerous regional and global conventions on the environment;

(f) To take stock of the potential hotspots in our region and to identify our continent's stakes in global ocean security debates considering, first, the crucial role of environmental security in our region's development efforts; second, the growing attention to ocean security issues; and, third, that international waters are increasingly becoming flashpoints for future conflicts;

(g) To promote concerted efforts, at the regional level, to monitor the impacts caused by climate change and to encourage regional and international co-operation to address the impacts;

(h) To take measures essential to the establishment and strengthening, at the regional level, of forecasting and early warning capabilities to deal with natural disasters;

(i) To ensure that effective intergovernmental agreements for the protection, management and development of shared water resources are put in place;

(j) To promote soil conservation measures to address the increasing impact of sedimentation.

2. *Request* the Organization of African Unity and the African Ministerial Conference on the Environment and other relevant United Nations agencies, in furtherance of the objectives of the Pan-African Conference on Sustainable Integrated Coastal Management, to consider the possibility of convening, in 1999, a regional summit of heads of State and Government to heighten awareness and to focus attention on the hotspots in Africa's aquatic environment, both marine and freshwater;

Affirm our commitment to the PACSICOM process.

Maputo, Mozambique, 24 July 1998

THE PAN-AFRICAN CONFERENCE ON CO-OPERATION FOR THE DEVELOPMENT AND PROTECTION OF THE COASTAL AND MARINE ENVIRONMENT IN SUB-SAHARAN AFRICA, Cape Town, South Africa, 30 November-4 December 1998

The Conference was attended by 236 participants (27 were at ministerial level) from 39 countries, including 30 African countries. Representatives from 39 international, intergovernmental (including IOC) and non-governmental organizations, as well as technical and scientific institutions also attended the Conference.

On the eve of the Conference, the IOC co-organized, in partnership with UNIDO, IUCN and US-NOAA, *a workshop on Coupling Science and Management: the LME Approach to Environmentally Sustainable Utilisation of Coastal and Marine Resources in Africa.*

Major outputs of the conference:

- the Cape-Town Declaration on an African Process for the Development and Protection of the Coastal and Marine Environment to reinforce the existing regional institutions and mechanisms, in particular the Abidjan and Nairobi conventions to ensure their full implementation;
- the establishment of a Preparatory Committee to convene, in 2001, the partnership Conference envisaged in the PACSICOM process.

6 Co-operation with other Organizations of the United Nations System and other Bodies

ICSPRO, GESAMP AND RELATED MATTERS

IOC is a specialised implementing mechanism for Ocean Science. Inter-agency co-operation, within and outside the UN system, is essential for the implementation of IOC's programme. IOC is a partner in many joint programmes: WCRP, GIPME, GOOS, ASFA/ASFIS, Ocean Mapping, GCRMN, OSLR-HAB, GLOBEC, GEOHAB.

Much of the co-ordination within the UN system is today carried out through the ACC-Subcommittee for Ocean and Coastal Areas (see below). However, there is now increased co-operation with UNEP through several of its Regional Seas Programmes, notably NOWPAP. IOC maintains close involvement in the GEF sponsored Projects in the Gulf of Thailand, co-ordinated by IMO. UNDP Projects in the Caspian Sea and the Yellow Sea are also considering IOC participation. Joint planning made during 1998 should result in increased co-operation and servicing between IOC and MEL/IAEA (see text above by MEL Director, Dr. Hugh Livingston).

CO-OPERATION WITH ICSU AND SCOR

The long partnership with ICSU and SCOR continues. In 1998 some new activities were added to those that are ongoing.

Ocean Assessment, identified by the 19th Session of IOC Assembly, is being planned and carried out in co-operation with SCOR and SCOPE of ICSU.

IOC hosted the first Science meeting of GLOBEC in Paris. In 1998 the new GEOHAB programme was endorsed both by SCOR and by IOC.

The International Ocean Colour Co-ordinating Group (IOCCG) continued its technical work under the direct stewardship of SCOR. At the 31st Executive Council, the Chairman of IOC, acknowledged the valuable work performed by IOCCG members in support of the development of operational ocean-colour observations. During 1998 the group published its Report No.1, reviewing background material and an inventory of current instruments and requirements for remote sensed ocean-colour observations. The activity of the group centred around the question: *Is it possible to satisfy the requirements for an operational ocean-colour mission at low cost based on simple sensors?* Support of IOCCG activities continues, insofar the group could become a very useful resource to the three GOOS panels that have identified ocean-colour monitoring as one of their priority: the LMR, Coastal and HOTO Panels.

OTHER BODIES AND PROGRAMMES

Training-Through-Research (TTR) in 1998

Since 1990, the Floating University programme has been continuing to benefit from the advantages provided by combining the training of students and young scientists with advanced research in the field of marine geosciences. Since 1996, the programme has been co-sponsored by IOC. Between 1991-1998, eight major Training-through-Research (TTR) cruises, five mid-cruise workshops and six post-cruise conferences were organized, in addition to a number of other field exercises, group and individual training activities, presentation and publication of the research results.

In 1998, the TTR-8 cruise was carried out from 14 June to 1 August. Sixty-eight (68) scientists, post- and undergraduate students, and technicians came from 18 institutions from 11 countries (Belgium, Denmark, France, Ireland, Italy, the Netherlands, Poland, Portugal, Russia, Switzerland and the UK).

The objectives of the cruise were to study geological processes on continental slopes and to train students in marine geological and geophysical research. The scientific programme of the cruise was focused on the following major issues: slope stability, modern analogues of hydrocarbon reservoirs, fluid venting, and mud volcanism and related gas and gas hydrate occurrences. The cruise data comprise more than 3000 km of seismic and long range sidescan sonar lines, 185 km of high resolution sidescan survey, about 20 km of bottom TV survey and 70 cores of bottom sediments.

During the cruise, a broad network of bifurcating downslope-running canyons was mapped with a long-range sidescan system on the Portuguese margin. Better understanding of seabed processes, relating marine geology and biology with bottom currents, was achieved in the Porcupine Seabight. A slump affecting the upper part of the sedimentary section was mapped on the eastern Faeroes margin. Recognition of bottom sliding can be crucial for determining potentially hazardous areas on the continental margins. Investigations on the south-eastern part of the Voring Plateau shed more light on this area known by its numerous fluid escape structures and the possible presence of gas hydrates. Studies with the bottom TV system revealed the presence of bottom biota activity possibly related to gas seepage, and direct observation of escaping fluids were recorded.

All the students were actively involved in data collection and processing. Lectures and seminars on various marine geoscience topics aimed to help extend the scientific out-

Fig. 1: Trainees on board

look of these young scientists. A geological excursion in the Faeroe Islands served the same purpose. Many lectures and seminars were given by students themselves, thus providing a good opportunity to develop their presentation skills and to discuss their research projects.

Geosphere-Biosphere Coupling: Carbonate Mud Mounds and Cold Water Reefs International Conference (7-11 February, Gent, Belgium) was part of the TTR programme activities for 1998, supported by IOC. The Conference highlighted the main results of the TTR-7 cruise (1997); these were also published in the IOC Technical Series No. 52 (1998). The results of the Conference were published as IOC Workshop Report No. 143 (1998). The meeting brought together over 90 participants from 11 countries (Belgium, Denmark, France, Germany, Ireland, Italy, the Netherlands, Norway, Russian Federation, United Kingdom and USA).

During the six scientific sessions an overview was given of the recent discoveries of reef and mound structures in the North Atlantic Ocean, with the results of the *Belgica* '97 and *Logachev* TTR-7 scientific cruises and some industrial cruises. The Conference made a special call for more co-operation between research and industry.

Modern seabed mound and reef features in the Porcupine Basin and their fossil counterparts – with examples in Morocco, Italy and Barbados – are often related to petroleum systems and hydrocarbon seepage. Either active or past fluid venting could have provided some of the energy basis and carbon source for ecosystems independent of photosynthesis (bacteria, corals, echinoids, etc.). Bacteria feeding on the hydrocarbon energy supply produce carbon dioxine as a metabolise, which is subsequently precipitated as calcium carbonate in seawater. Such carbonate precipitation may have led to the formation of a hardground, which could become a preferential site for colonization by reef-building organisms. Their spatial distribution is controlled by the bottom currents.

Starting with research and training in marine geology and geophysics, TTR aims at linking together the various oceanographic processes. In 1998, funds for the programme were provided by IOC, the Flemish Government, Russia, the CORSAIRES, PRISMED-II and ENAM projects of the European Commission, STATOIL Exploration (Ireland) Ltd., as well as counterpart institutions in Belgium, Denmark, Ireland, the Netherlands, Portugal and the UK. All the above contributions are sincerely acknowledged.

In 1998, the TTR strategy was also applied in a series of other research cruises: the *R/V Mstislav Keldysh* cruise, the CORSAIRES cruise of the *R/V Belgica*, the ENAM expedition of the *R/V Pelagia*, the PRISMED-II cruise of the *R/V l'Atalante*. The summer 1998 field activities contributed to the International Year of the Ocean. During the Lisbon port call, the *Logachev* took part in EXPO '98. A few thousand visitors became acquainted with this and other IOC training and research activities.

Follow-up UNCED and UNCLOS

7

7.1 Follow-up to UNCED

Following UNCED-92, a new *ACC-Subcommittee on Oceans and Coastal Areas* (ACC-SOCA) was established to assume the functions of Task Manager for Chapter 17 of Agenda 21.

Since a very early stage in their work, ACC-SOCA members expressed their concern that the *Reporting* function was taking precedence over that of ensuring effective *co-operation in programme implementation*. While a number of ongoing joint programmes continue to evolve, new major initiatives were not implemented as forecast. In general, there is dissatisfaction with the level of accomplishment in implementing the several tasks of Chapter 17 of Agenda 21, among Member States and among agencies.

This situation reflects some structural problems that have to be addressed. Specialized agencies, by definition, have their own sectoral mission, their own governing bodies, to define their sectoral mandate and priorities. The implementation of Chapter 17 of Agenda 21, implies a complete change in paradigm. It means adopting an integrated, cross sectoral approach to management. This extremely broad new mandate has been handed down to a group of agencies with sectoral missions and ever-decreasing budgets. Accordingly, some policy issues need to be addressed urgently:

- Interagency co-operation is best encouraged by defining the benefits derived from the respective mandates and by identifying specific areas where available expertise and institutional bases exist. This assumes that the political will of each agency (mandate generators) recognizes this expertise as being more effective in partnership than in individual agency programmes.
- Effective inter-agency co-operation requires investment of staff and programme resources that usually are not recognized within agency budgetary provisions as being a priority.
- Given the recurring austerity measures that have been applied throughout the UN system there is a growing trend within agencies to concentrate on their specific mandates, as determined by national representatives at their respective governing bodies (efficiency).
- Clear economic incentives for co-operation do not exist. This observation is applicable both in regard to major funding sources within the UN system (UNDP and the World Bank and GEF) as well as to international development commitments from national and regional sources.
- Cross-sectoral mandates for integration, are very often not recognized at the agency level, the corresponding governing body, and *vice versa*, *i.e.* sectoral technical mandates are not fully recognized at the integrative level – e.g. CSD – except at the political level. Cross-sectoral integrative mandates are also not easily recognized by national authorities, where the political will is often not accompanied by local capacity and adequate institutions.

These issues will be part of the discussion of CSD-7 in April 1999. Several proposals are being circulated among Member States to improve the level of reporting within the UN system on Ocean matters. However changing the level of reporting on the Oceans from the CSD to the UNGA or an UNGA-related body, might not solve the problems described, unless there is a clear and systemic view of the reporting structure and mechanism.

It is not so much an increased level of visibility that is needed but a clear delimitation of "jurisdictions" for reporting by the different agencies. In many areas, (i.e. ICM), capacity for measuring and observing resides in one agency, policy advice in other, science in other and the management of different sectors is spread over several. An integrated, objective (non self-serving) reporting will not emerge without some brokerage and auditing in the system, to arbitrate for conflict of interest between agencies. This will not happen without new resources.

In the meantime, in part as a result of the IYO, some new opportunities are emerging. After finalizing its re-organization, UNEP has adopted an interesting new functional structure and has received encouraging support to increase its budget by 20%. These changes could lead to increasing marginalization of UNEP in some of the joint activities (GESAMP, MEL).

The COP process in all the global conventions continues to provide useful guidance to GEF as their funding mechanism. Better communication of the activities of the different actors in the system has resulted in the development of new partnerships. GESAMP is now universally recognized as a valuable reporting mechanism on the state of the Ocean. During 1998-99, the Global International Waters Assessment (GIWA) should become operational as well as the GPA Office in The Hague. The PACSICOM process is opening new opportunities in Africa.

A 100% ACC-SOCA initiative, the UN Atlas, received financial support from the UN Foundation. The Atlas is conceived simultaneously as a book, a multimedia CD-ROM and as a permanently active series of interconnected Web sites. It is a user-driven, policy oriented management instrument. This calls for significant intra-agency re-structuring of the policy reporting function. Participating agencies are already committing resources to this task.

7.2 Follow-up to UNCLOS

In 1998 the IOC developed various actions following the orientation given by the IOC Assembly (Paris, 2-18 July 1997). An informal advisory consultation on implementation of IOC (Resolution XIX-19) establishing the Advisory Body of Experts on the Law of the Sea (ABE-LOS), was convened by the Executive Secretary of IOC in Paris, UNESCO, on 2-3 November 1998 (Doc. IOC/INF-1114). The consultation referred to the Summary Report of the first session of the open-ended intersessional working Group on the possible role of IOC in relation to the United Nations Convention on the Law of the Sea (Doc. IOC/INF-1035).

Many issues were studied, particularly the composition, working procedures and working programme for ABE-LOS. Priority will be given to implement the principles for the transfer of marine technologies according to Part XIV of UNCLOS (Doc. IOC/INF-1054), Article 247 (Doc. IOC/INF-1055), Article 251 on the nature and implications of marine scientific research, the role of the IOC Regional bodies (Doc.IOC/INF-1035), and the list of experts in marine science to be sent annually to the UN Secretary-General for the Special Arbitration and Compulsory Procedures.

As a contribution to the Annual Report of the UN Secretary-General, IOC drew up and sent*, a list of experts in the field of marine science in accordance with Paragraph 2 (2) of Annex VIII of the Convention. These experts can serve in compulsory procedures entailing decisions in light of Article 289 of the Law of the Sea Convention, or as arbitrators in a Special Arbitration Tribunal.

IOC also pursued activities with the International Seabed Authority (ISBA) and was therefore represented, in an observer capacity, at the two annual sessions held, respectively, from 16-27 March 1998 and from 17-28 August 1998 in Kingston (Jamaica). The agenda included the ISBA Assembly and Executive Council.

During the last meeting, IOC informed the ISBA Secretary-General that, in accordance with the recommendations given by the Twenty-eighth Session of GESAMP (Geneva, 20-24 April 1998), the outcome of the Seabed Authority Working Group should be available before a decision concerning the involvement of GESAMP on this issue could be made.

The IMO and IOC will inform GESAMP at its next session in 1999 on the state of this development. Concerning the procedure of a Memorandum of Understanding between IOC and ISBA, activities will be proposed to the next ISBA unique session to take place in Kingston from 9-27 August 1999.

At the Fifth Session of the *Ad-hoc* IHO/IAG/IOC Committee on the Law of the Sea, ABLOS (Fredericton, Canada, 2-3 September 1998), the following issues were examined:

- The Continental Shelf Book sponsored by IOC/IHO entitled *Continental Shelf Limits: The Scientific and Legal Interface* is in its final stages before publication. It will be published by Oxford University Press in New York during the latter half of 1999.
- IOC nominated 3 members to represent the Commission on the next ABLOS Conference on *Technical aspects of maritime boundary delineation and delimitation, including UNCLOS Article 76 issues*, which will take place in Monaco on 9-10 September, 1999.

It should be noted that Resolution 53/32 of the United Nations Assembly calls upon IOC to strengthen international technical co-operation (by providing advice and assistance), especially at the sub-regional and regional levels, in order to ensure the sustainable development of the uses and resources of the ocean. This resolution encourages the adoption of:

- Regulations on prospecting and exploration for polymetallic nodules (GIPME activities);
- Provisional scientific and technical guidelines of the CLCS amendment by IOC/IHO Editorial Board for assisting States to prepare their submissions regarding the outer limits of their continental shelf.

* *Erratum* in 1997 Annual Report N°4: in Section 7.2 Follow-up to UNCLOS. The 4th paragraph should read as follows: "Further to the list of experts in marine scientific research drawn up in the light of Annex VIII of the Convention and submitted to UN Secretary-General on 10 January 1995, an updated list composed of 65 members from 32 Member States (as of 10 February 1997) was also prepared and sent to the UN Secretary-General. In addition, IOC Member States who have not nominated their experts in accordance with Annex VIII of UNCLOS were once again urged to do so. In accordance with Resolution XIX-19 of its Assembly, IOC requested Member States through IOC Circular Letter N° 1555 dated 16 September 1997, to nominate two experts, preferably familiar with IOC activities and programmes within the framework of ABE-LOS, with training, one in the Law of the Sea and one in marine sciences".

8 The 1998 International Year of the Ocean

MESSAGE FROM THE DIRECTOR-GENERAL OF UNESCO

For modern science, the sea is the very source of life on Earth. It is, so to speak, the amniotic fluid from which all living forms spring. Throughout history, the oceans have been vital to human civilisation – as a resource base, as a route to other lands and other peoples or as an outlet for population overflow. Over 90 percent of the planet's living and non-living resources are found within a few hundred kilometres of the coasts. On or near these coasts live two-thirds of the world's people. Without the sea, life on Earth would be impossible. Our planet would be a barren desert like Mars – about which, paradoxically, we probably know more than we do about the oceans.

For the human imagination, the sea has always been a symbol of vastness and freedom. Now, at the close of the second millennium, competition for scarce resources is showing this freedom to have its limits. Growing demand is placing the marine environment and resources under increasing strain. History teaches that scarcity can be the cause of conflict and war. However, it may be hoped that the will today exists to shape our destinies otherwise.

In an historic speech on 1 November 1967, Malta's Ambassador to the United Nations, Arvid Pardo, called for international regulations to prevent the oceans from becoming a theatre for escalating conflict between nations, to halt the poisoning of our oceans through negligence, and to protect its resources from exhaustion. His words did not fall on deaf ears. The United Nations General Assembly adopted a declaration providing that all sea-bed resources beyond the limits of national jurisdiction constitute the common heritage of mankind. Fifteen years later, the United Nations Convention on the Law of the Sea – which attracted a record 159 signatures – provided the international community with an effective legal framework covering navigational rights, territorial sea limits, rights of passage, questions of economic jurisdiction, the conservation and management of living marine resources, and procedures for the peaceful settlement of disputes.

But the value of legal instruments is dependent on how far they are respected and enforced. This planet does not belong to the adults of today and should not be managed on the basis of short-term considerations of economic gain or political power. If the signatures of our children were needed to ratify decisions that affect their future, many of the destructive actions perpetrated today would certainly cease. Whatever we do, the ocean will survive in one way or another. What is more problematic is whether we shall preserve it in a state that ensures humanity's survival and well-being. Time is short, and the issue is in the balance.

The United Nations has declared 1998 the International Year of the Ocean as a celebration of this source of life and civilisation. But this international year is also a reminder of the need to protect this most precious of resources, an affirmation of our commitment to safeguard the rights of future generations, for whom we hold our planet – and its life-sustaining oceans – in trust.

Federico Mayor

In December 1994 the UN General Assembly declared *1998 the International Year of the Ocean* and requested UNESCO/IOC to take a lead role in its co-ordination. The International Year of the Ocean gave the IOC and the World Marine Community an opportunity to promote global concerns and to debate ocean issues. Many activities focussed on public awareness and education, both important in ensuring that the necessary future actions are taken. It was not easy for the Secretariat to co-ordinate the Year's activities because few resources were made available for this task.

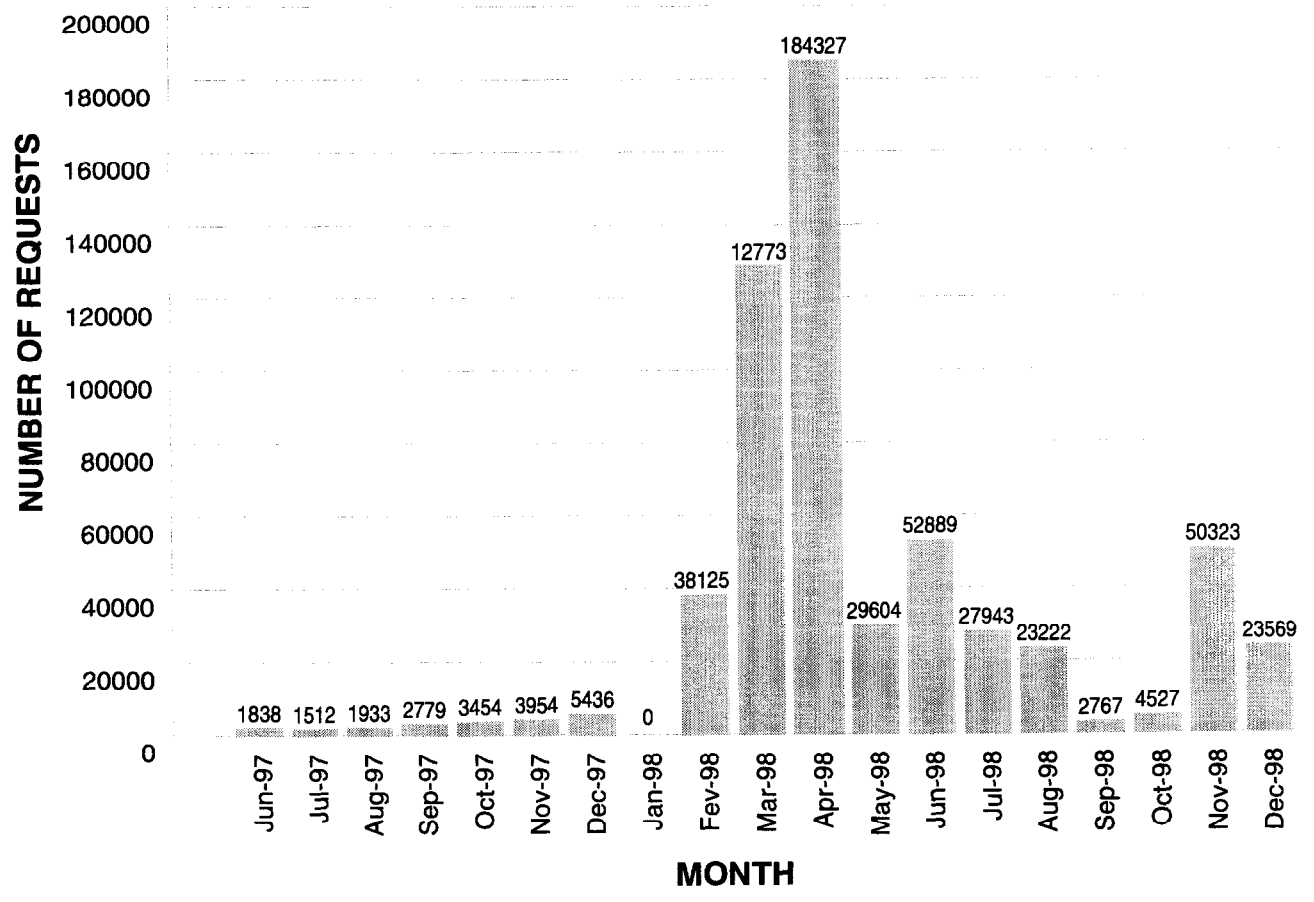
However, much has been achieved and the results were reported to the Thirty-first Session of the IOC Executive Council in 17-27 November 1998. The Executive Council noted with satisfaction the progress achieved by the IOC Member States in meeting the objectives of the International Year of the Ocean and acknowledged with appreciation the work done by the IOC Secretariat in co-ordinating the IYO activities.

A review of the implementation of IYO initiatives is presented in Document/EC-XXXI/13 and is available at the IOC/IYO Website: http://ioc.unesco.org/iyo

Participation in the IYO was wide-ranging, from varied sources, sectors and nations. This diversity was an asset, enabling a considerable exchange of information, and constructive co-operation, making the Year a genuinely global effort. An abbreviated description of selected IYO initiatives and their implementation is summarized below.

Ocean Charter	*My Ocean Charter* – produced in over 20 languages – more than 80 countries involved – over 1 million signatures
IYO website	More than 600,000 requests

IYO WWW server mid 1997-1998



Ocean Education

"This planet does not belong to the adults of today and should not be managed on the basis of short-term consideration of economic gain or political power".
Federico Mayor

- *The Ocean has told me*: a book by and for the boys and girls of the world (by Anna Kurtycs) UNESCO/Planet Society/IOC (Fig. 1);
- Three volumes of school text-books (by Sofia Gazza) IOC/Education Sector;
- *Lulie the Iceberg* (by Princess Takamado) (Fig. 2);
- Educational poster *Ocean Coastal Hazards: Hurricanes, Tsunamis, Coastal Erosion;*
- Educational Research Cruises in Caribbean, Asia and Europe;
- School Ocean Protection campaign in more than 15 countries.

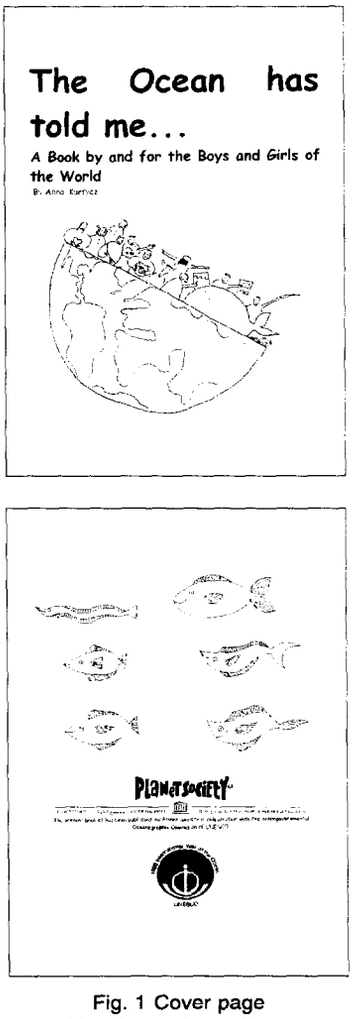


Fig. 1 Cover page
The Ocean has told me

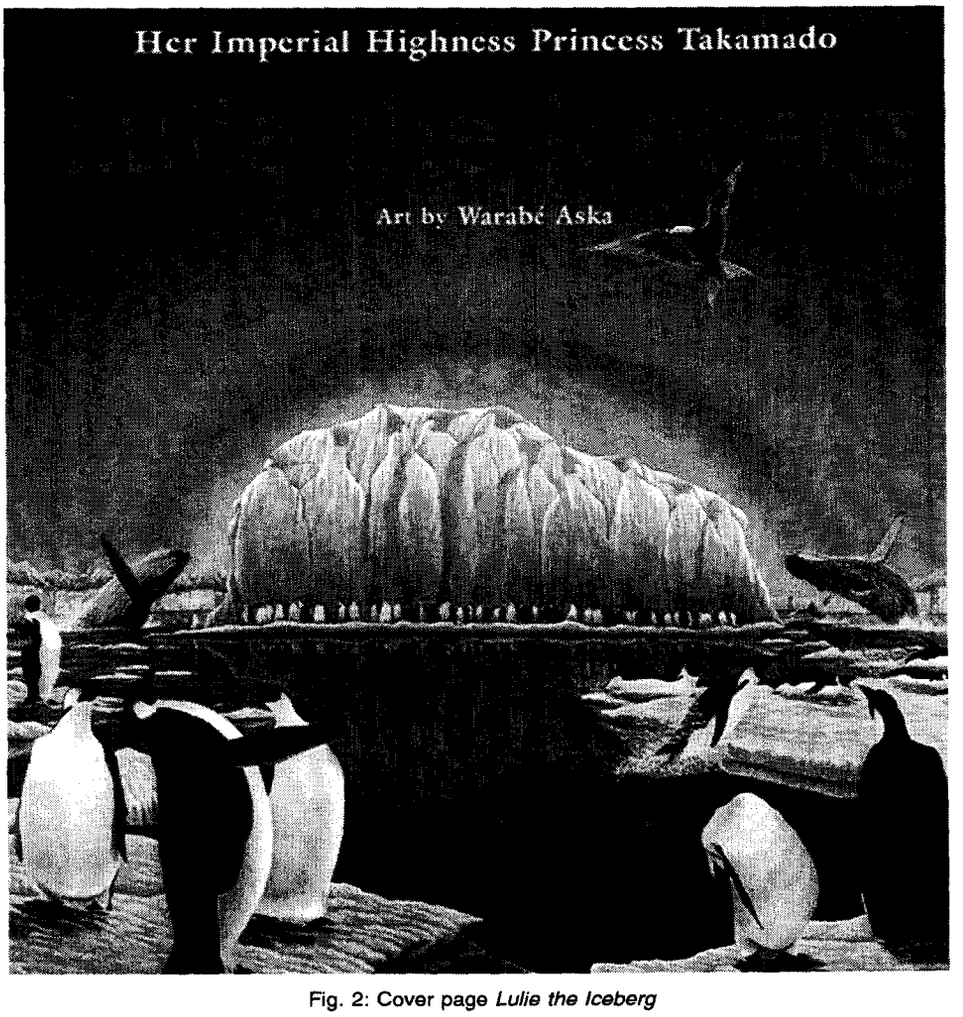


Fig. 2: Cover page *Lulie the Iceberg*

Cruises

Research and training cruises were arranged by dozens of countries.
The geographical areas covered by the cruises is truly global and ranges from trans-ocean voyages lasting many months, to coastal cruises of a few days. Many of the vessels involved in the cruises were showing the UNESCO/IOC/IYO flag as a sign of dedication by the ship owners to the principles of international co-operation in ocean research and protection.

Conferences Workshops Training Courses

More than 200 events dedicated to the IYO. A regional approach for these endeavours was actively encouraged as a way to analyse common problems, identify gaps and defines strategies. A few examples of regional conferences:

- Parliamentary Conference on the Oceans of the Council of Europe, 19 March, Paris, France
- The Atlantic: Past, Present and Future, 30 August-2 September, Lisbon, Portugal
- Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM), 18-25 July, Maputo, Mozambique
- IYO Asia-Pacific Conference, 25-26 September, Brisbane, Australia
- African Days of the Ocean, 26-28 October, Dakar, Senegal

Fig. 3: German young students on international cruise

Cultural Events

- The International Year of the Ocean was a great cultural event, a world show of international unity and celebration of cultural diversity. Film festivals, art exhibitions, musical festivals, with a focus on the ocean, represented the diversity of cultures from every continent of the world and highlighted the natural values of the ocean.
- The events included film festivals in Japan, the USA and France, art exhibitions in India, Thailand, St. Lucia and Lebanon, competitions on the best IYO slogan in India, and poems and essays about the sea in New Zealand and Corsica, France and many other events. UNEP and Brazil produced CD-ROMs with ocean songs, and by the musical group 'Metamorphose' of France. Maestro Mannino wrote an ocean symphony.

Fig. 5: Small sirens at a closing ceremony of one of the many cultural events

Fig. 4: Antibes Festival (France)

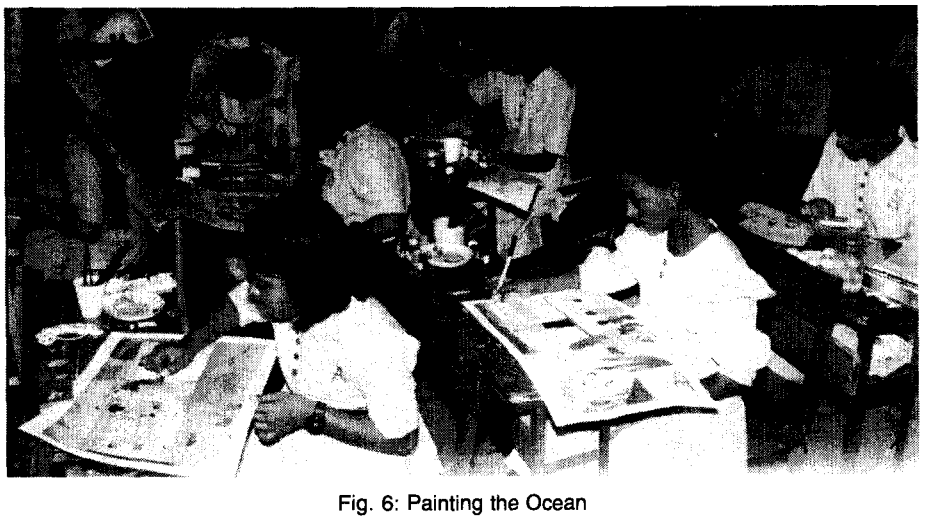


Fig. 6: Painting the Ocean

Public Information and Promotional Materials	• a comprehensive press kit in English, French, Spanish, (OPI/IOC) (Fig. 7) • regular press releases (OPI) • documentary films about IOC; a series of CNN World Reports • press conferences, briefings and radio programmes • special issues of UNEP, WMO and WWF journals and bulletins on the oceans • IYO flags, stickers, pins, T-shirts, calendars, etc.
Stamps	The Planet Society of UNESCO and the UN Postal Administration, initiated a project to issue stamps dedicated to the IYO on such topics as *Ocean and World Life*, *Ocean and Climate*, *Ocean and Technology*. More than 80 countries and the UN postal Administration released commemorative sets of stamps. A special celebratory stamp Album bearing a reference to the IYO was produced in a matching de luxe slipcase.
EXPO'98 and other exhibitions	• EXPO'98 was a focal point for IYO. EXPO'98 attracted almost 10 million visitors and provided a rare opportunity to increase awareness of the ocean's crucial role in sustaining life on this planet. The IOC used this occasion to highlight the role of the organization in ocean research and monitoring, by contributing photography, graphics, software, video and texts to two EXPO' 98 pavilions – the UN Pavilion and Pavilion of the Future. • Almost 50 countries reported on the organization of national exhibitions. In conjunction with the 31st Session of the IOC Executive Council an exhibition at UNESCO Headquarters was staged to demonstrate the range of IYO national and international activities taking place around the world (see *Ocean Day at UNESCO*).

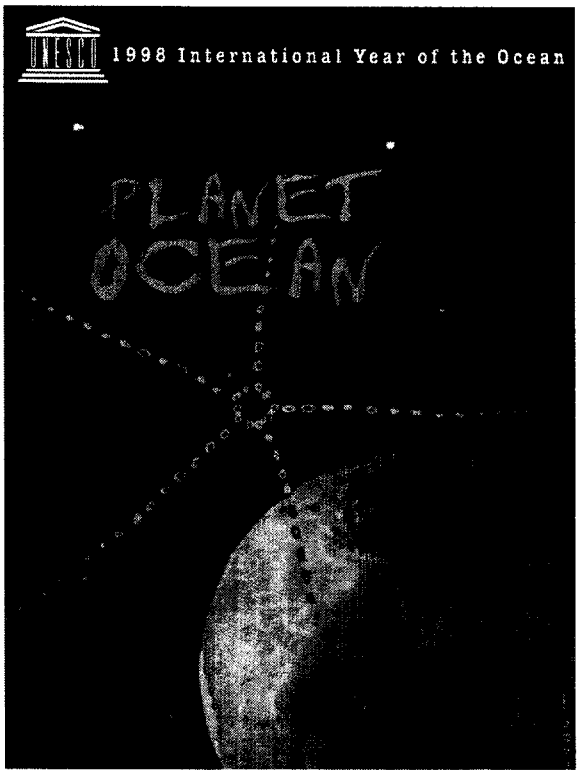


Fig. 7: IYO Press-kit

LISBOA
EXPO'98™

Fig. 8: EXPO' 98 logo

Fig. 9: A group of school children who took part in the Youth Forum during the Ocean Day on 28 November 1998

OCEAN DAY AT UNESCO, 23 November 1998

The complete programme of the Day included a press-briefing, inauguration of the IYO exhibition, the Ocean Panel and Youth Forum (Fig. 9). The participants of the Panel shared experiences gained during the IYO and identified ways and means for future co-operation. The Youth Forum was the first attempt to have the young generation bring their concerns and needs to the attention of the IOC governing bodies. More than fifty school children and college students took part in the discussion, co-chaired by the IOC Chairman and one of the youth participants. The Youth Forum formulated a statement with a commitment to the principles of the Ocean Charter.

The objectives of the IYO did not vanish at the end of 1998

The momentum gained during the IYO in increasing awareness should be maintained and extended in the coming years. It is important to focus on sustaining the relationships that have been established and continuing the momentum evident in public policies and private interests. The coming years should be used to attract government support and commitments for ocean research and protection issues, for making more people realise the importance of the ocean to the ecological balance of the earth and its potential for social and economic development.

Fig. 10: IYO logo

Development of IOC within UNESCO

9

The further development of IOC as an integral part of UNESCO is a major priority for the Commission. Mainly due to poor communication, but also due to the absence of a well-defined policy, the decentralised nature of the IOC – as a specialised mechanism – is poorly understood. This is also true for some other programmes in UNESCO. The fact that the definition of this mechanism rests on the declaration of the status of *Functional autonomy* approved for IOC by the Executive Board and the General Conference, has certainly complicated the issue with political overtones.

Until 1998, this functional autonomy had been assured by the delegation of authority from the Director-General, as senior Administrative Executive Officer of the organization, to the Executive Secretary of IOC. An interesting new development took place during 1997-98: During the Nineteenth Assembly of IOC, the Director-General announced the upgrading of the Post of Executive Secretary of IOC to the level of an Assistant Director-General. Following this decision, the recruitment process for the replacement of Dr. Gunnar Kullenberg, was re-opened.

The incumbent to the post was therefore recruited with a completely different mandate and authority. This decision means that many of the specific authorizations, previously delegated to the Executive Secretary of IOC, have been superseded, since they fall within the regular authority of any Assistant Director-General (ADG) of UNESCO. Furthermore, this new status is not attributed to the incumbent but to the post. At the same time, the DOSS-2 group incorporated this status permanently into the proposal for new Statutes for IOC. These events signal a new era in the relationships between IOC and the other sectors of UNESCO, in particular the Science sector.

The ADG/IOC has specific written instructions concerning his duty to report to the Director-General and to co-ordinate with ADG/SC and ADG/COR/ENV. Furthermore, the same administrative unit AO/SC services all the administrative procedures of IOC, that in all cases do not report to either of the two ADG's but rather to the ADG for Administration (ADG/ADM). Close co-ordination between both ADGs has enabled them to improve the implementation of joint programmes in CSI, PACSICOM, as well as the environmental programmes of UNESCO.

The financial regulations approved by the Executive Board and the General Assembly of UNESCO for IOC are being fully utilised. They have enabled the Commission to benefit from a very flexible mechanism to implement the Programme. The key to this efficiency has been the creation of a special account under article 6 of the UNESCO financial regulations. This mechanism is shared by many UNESCO bodies outside headquarters, but is restricted to only a few in headquarters itself.

The general administration of UNESCO, at the request of the Executive Board and under the lead of the Bureau of the Comptroller (BOC), will submit to the 156th Executive Board of UNESCO a single consolidated proposal for Financial Regulations.

In view of these positive developments, it is expected that the Executive Board of UNESCO will accept as final the report requested by its 154 Session, summarizing the administrative and financial regulations that apply to IOC, specifying the source of the authority on which they are based.

Restructuring of the Secretariat is now complete. The IOC Programme will be implemented in three *Sections*: Ocean Sciences (IOC/OSC), Operational Observing Systems (IOC/OOS) and Ocean services (IOC/OCS). These structures replace the previous *Units*. Personnel reporting, both professional and GS, has been streamlined, with decentralized reporting to the Head of each Section. General supervision of the Programme is the responsibility of the Office of the ADG/IOC, supported by the Deputy Executive Secretary and three special assistants. This ADG staff is co-ordinated by a Chief of Cabinet (P-3). The ADG Staff meets regularly with the heads of the three Sections to review the implementation of the Programme. Functional co-ordination across Sections is provided by Steering Committees for TEMA and for the Regions. A detailed list, assigning follow-up responsibilities, completes the organizational structure.

Finance 10

Support to IOC programmes

A wide spectrum of activities is described within the body of this report, highlighting the relevant 1998 implementation phases of the IOC programmes. In concertation with national and non-governmental initiatives, implementation of IOC programmes and related staff costs during 1998 was financed through income from UNESCO as part of its regular programme allocation as approved by the UNESCO General Conference and from extrabudgetary resources, notably that provided by IOC Member States through their contributions to the IOC Trust Fund.

Table 1: 1998 Income (US$)

	IOC Trust Fund		*UNESCO Regular Programme*	*Total*
	Earmarked	General		
Programme funding	908,380	556,262	1,380,000	2,844,642
Extrabudgetary staff posts and consultancies	766,240			766,240
Regular Programme staff Posts			1,830,850	1,830,850
Total	1,674,620	556,262		
Grand Total	**2,230,882**		**3,210,850**	**5,441,732**

With regard to the funding of $3,210,850 provided by UNESCO, $1,830,850 was distributed to staff costs and $1,380,000 to programme implementation. Of the $2,230,882 contributed through the IOC Trust Fund, $766,240 was attributed to staff costs (either through established posts or consultancy contracts).

Table 2: 1998 Contributions to the IOC Trust Fund (US$)

Contributor	*Total*	*Component*	*Purpose*
Argentina	5,000		OSNLR
Canada	9,523		General
China	20,000		ICAM (Coastal Large Cities)
Denmark	242,000		OSLR/HAB
FAO	42,245	34,745	OSLR Panel
		7,500	GOOS
France	64,843	21,739	General
		33,333	UNCED follow-up/IYO
		9,771	GOOS Capacity workshop in Fiji
ICSU	20,000		GOOS Steering Committee
Netherlands	9,708		GOOS
Portugal	30,000	20,000	GOOS
		10,000	IODE
Republic of Korea	92,178		Seconded personnel for OSNLR
Spain	56,112	27,448	OSLR/HAB
		28,664	OSLR/HAB
Sweden	376,000	256,850	IOCINCWIO
		53,727	IOCARIBE
		65,423	WESTPAC
United Kingdom	319,000	60,000	GOOS/Data information management
		10,000	GOOS brochure
		25,000	GLOSS (10) OSLR(15)
		224,000	GCRMN
United States of America	753,783	60,000	Seconded personnel for GOOS
		62,500	Seconded personnel for GCRMN
		525,000	General
		10,283	GLOSS
		30,000	GOOS/Data information management
		10,000	Coastal GOOS
		6,000	Ocean Mapping
		50,000	GODAE
WMO	190,298	5,298	GOOS Steering Committee
WMO		185,000	GOOS/DBCP
Miscellaneous	192		
TOTAL	**2,230,882**		

In addition, through Funds-in-Trust arrangements, Japan provided $80,000 ($72,000 after deduction of UNESCO over-heads) and Belgium/Government of Flanders provided $67,800 ($60,000 after deduction of UNESCO over-heads) in support of ODINAFRICA. Other significant contributions were provided by Member States for programme implementation, either direct or in-kind, which do not enter the UNESCO/IOC accounting system. Contributions of Member States, such as seconded personnel, do not appear in table 2.

Annexes 11

11.1 List of Publications

This list covers main IOC Series publications published during 1998. It completes and updates Document IOC/INF-700 rev.12, *List of IOC Publications (as of October 1998).*

TECHNICAL SERIES

Global Temperature Salinity Profile Programme (GTSPP) – Overview and Future. 1998. 28 pp. (Technical Series, 49). (English)

Global Sea Level Observing System (GLOSS) Implementation Plan – 1997. 1998. 91 pp. (Technical Series, 50). (English)

Cold Water Carbonate Mounds and Sediment Transport on the Northeast Atlantic Margin. 1988. 178 pp. (Technical Series, 52). (English)

The Baltic Gloating University: Training Through Research in the Baltic, Barents and White Seas – 1997. 1988. 60 pp. (Technical Series, 53). (English)

IOC MANUALS AND GUIDES

Post-Tsunami Survey Field Guide. 1998. 61 pp. (Manuals and Guides, 37). (English, French, Russian) (Spanish under preparation)

WORKSHOP REPORTS

IOC Regional Workshop for Member States of Western Africa (GODAR-VI). Accra, Ghana. 1997. 1998. 87 pp. (Workshop Report, 136). (English)

GOOS Planning Workshop for Living Marine Resources. Dartmouth, USA, 1996. 1998. (Workshop Report, 137). 63 pp. (English)

Gestión de Sistemas Oceanográficos del Pacifico Oriental. Conception, Chile. 1996. 1998. 40 pp. (Workshop Report, 138). (Spanish)

Sistemas Oceanográficos del Atlántico Sudoccidental-Taller TEMA. Rio Grande, RS, Brasil, 1997. 1998. 65 pp. (Workshop Report, 139). (Spanish)

IOC Workshop on GOOS Capacity Building for the Mediterranean Region. Valletta, Malta, 1997. 1998. 26 pp. (Workshop Report, 140). (English)

IOC/WESTPAC Workshop in Co-operative Study in the Gulf of Thailand: A Science Plan. Bangkok, Thailand, 1997. 1998. 34 pp. (Workshop Report, 141). (English)

Pelagic Biogeography ICoPB II. Proceedings of the 2nd International Conference. Final Report of SCOR/IOC Working Group 93. Noordwijkerhout, The Netherlands, 1995. 1998. 392 pp. (Workshop Report, 142). (English)

Geosphere-Biosphere coupling: Carbonate Mud Mounds and Cold Water Reefs. Gent, Belgium, 1998. 1998. 76 pp. (Workshop Report, 143). (English)

IOC-SOPAC Workshop Report on Pacific Regional Global Ocean Observing Systems. Suva, Fiji, 1998. 1998. 43 pp. (Workshop Report, 144). (English)

IOC-Black Sea Regional Committee Workshop: Black Sea Fluxes. Istanbul, Turkey, 1997. (Workshop Report, 145). (English) (Under preparation)

International Workshop on Management Capacity-Building for Coasts and Oceans in the Wider Caribbean. La Havana, Cuba, 1998. (Workshop Report, 146). (English) (*Under preparation*)

IOC/SOA International Training Workshop on the Integration of Marine Sciences into the Process of Integrated Coastal Management (ICM). Dalian, China, 1997. 1998. 31 pp. (Workshop Report, 147). (English)

IOC/WESTPAC International Scientific Symposium – Role of Ocean Sciences for Sustainable Development Okinawa, Japan, 1998. 109 pp. (Workshop Report, 148). (English)

TRAINING COURSE REPORTS

IOC-INCO-ROPME Training Course on Oceanographic Data and Information Management. Tehran, Iran. 1997. 1998. 26 pp. (Training Course Reports, 44). (English)

IOC-ICSU-IAEA-EU Training Course on Marine Geological and Geophysical Data Management for the Countries of the Black and Caspian Seas Regions. Gelendzhik, Russian Federation. 1997. 1998. 17 pp. (Training Course Reports, 45). (English)

SZN-IOC Advanced Phytoplankton Course on Taxonomy and Systematics; Marine Botany Laboratory, Stazione Zoologica "A. Dohrn" di Napoli, Vico Equense (Naples), Italy, 10-30 May 1998. 1998. 25 pp. (Training Course Reports, 48). (English)

IOC/WESTPAC Training Course. 1st: Monitoring of PSP Plankton and Shellfish toxicity, Kitasato Japan, 1995; 2nd: Species Identification of Harmful Microalgae, Tokyo, Japan, 1997; 3rd: Species Identification of Harmful Microalgae, Tokyo, Japan, 1997. 1998. 49 pp. (Training Course Reports, 49). (English)

IOC ANNUAL REPORT

IOC Annual Report 1997. 1998. 88 pp. (IOC Annual Report Series, 4). (English, French, Spanish, Russian)

11.2 List of Acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea (IOC)
ACC	Administrative Committee on Co-ordination (UN) [*CAC*]
ACC-SOCA	ACC Subcommittee on Oceans and Coastal Areas
ADG/IOC	Assistant Director-General IOC
AGRRA	Atlantic and Gulf Reef Rapid Assessment
AIMS	Australian Institute for Marine Sciences
ANCA	Algas Nocivas del Caribe
AOD'98	The African Ocean Days 1998
Argo	Array for Real-time Geostrophic Oceanography (CLIVAR-GODAE)
ASFA	Aquatic Sciences and Fisheries Abstracts
ASFIS	Aquatic Sciences and Fisheries Information System
BOC/UNESCO	Bureau of Comptroller Unesco
BOOS	Baltic GOOS
BSRC	Black Sea Regional Committee
CARICOMP	Caribbean Coastal Marine Productivity Programme
CATHALAC	Water Centre for the Humid Tropics of Latin America and the Caribbean
CGOM	IOC Consultative Group on Ocean Mapping
C-GOOS	Coastal GOOS
CLIVAR	Climate Variability and Predictability (WCRP)
CLS	CollecteLocalisationSatellites [*see Argos*]
CMAS	World Underwater Federation
CMD	Continuously Managed Data Base (GTSPP)
CMM	Centre de météorologie maritime (Météo-France)
COASTS	Programme on Coastal Ocean Advanced Science and Technology Study (IOC)
COBSEA	Coordinating Body on the Seas of East Asia (UNEP)
COP(or CP)	Conference of the Parties (to the UN FCCC)
COST	European Co-operation in the Field of Scientific and Technical Research
CPACC	Caribbean Planning and Adaptation to Climate Change
CPPS	Permanent Commission for the South Pacific
CPR	Continuous Plankton Recorder
CRC	Cyclic Redundancy Check
CSD	Commission on Sustainable Development (UN)
CSI	Coastal Regions and Small Island States
CTD	Conductivity-Temperature-Depth (profiler)
DAIM	Data Availability Index Maps
DANIDA	Danish Agency for International Development
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DNA	Designated National Agency
ECMWF	European Centre for Medium-Range Weather Forecasts
EEZ	Exclusive Economic Zone [*ZEE*]
ENSO	*El-Niño* – Southern Oscillation
ESCAP	Economic and Social Commission for Asia and the Pacific (UN) [*CESAP*]
ETDB	Expert Tsunami Data Base
ETEDM	End-to-End Data Management
EU	European Union
EURASLIC	European Aquatic Sciences and Libraries and Information Centres
EuroGOOS	European GOOS
FAO	Food and Agriculture Organization (UN)
FCCC	Framework Convention on Climate Change (UN)
G3OS	Global Observing Systems (GCOS-GOOS-GTOS)
GAPA	Geophysical Atlases of the Atlantic and Pacific Oceans (IOC)
GCOS	Global Climate Observing System
GCRMN	Global Coral Reef Monitoring Network

GDA	gebco Digital Atlas
GEBCO	General Bathymetric Chart of the Oceans (IOC-IHO)
GEEP	Group of Experts on Effects of Pollutants
GEF	Global Environment Facility (World Bank-UNEP-UNDP)
GEMIM	Group of Experts on Marine Information Management (IODE)
GEMSI	Group of Experts on Methods, Standards and Intercalibration
GEOHAB	Global Ecology of Harmful Algal Blooms
GESAG	GIPME Expert Scientific Advisory Group
GESAMP	Group of Experts on the Scientific Aspects of Marine Environment Protection (IMO-FAO-UNESCO/IOC-WMO-WHO-IAEA-UN-UNEP)
GESREM	Group of Experts on Standards and Reference Materials (GIPME)
GETADE	Group of Experts on Technical Aspects of Data Exchange (IODE)
GIPME	Global Investigation of Pollution in the Marine Environment
GIWA	Global International Waters Assessment (Word Bank)
GLOBEC	Global Ocean Ecosystems Dynamics (SCOR-IOC)
GLODIR	Global Directory of Marine (and Freshwater) Professionals
GLOSS	Global Sea-level Observing System
GODAE	Global Ocean Data Assimilation Experiment (GOOS)
GOOS	Global Ocean Observing System
GOSSP	Global Observing Systems Space Panel (G3OS)
GPA	Global Programme of Action [*for the Protection of the Marine Environment from Land-based Activities*] (UNEP)
GPO	GOOS Project Office (formerly GSO)
GPS	Global Positioning System
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System (WWW)
GTSPP	Global Temperature-Salinity Pilot Project/Profile Programme
HAB	Harmful Algal Blooms
HOTO	Health of the Oceans (module of GOOS)
HOTS	Hawaii Ocean Time-Series Station
IACCA	Inter-Agency Committee on the Climate Agenda (FAO-ICSU-UNEP-UNESCO/IOC-WHO-WMO)
IAEA	International Atomic Energy Agency [*AIEA*]
IAP	Inter-Agency Programme
IASC	International Arctic Science Committee (Oslo, Norway)
IASI	Intra-Americas Sea Initiative
IBCAO	International Bathymetric Chart of the Arctic Ocean
IBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
ibcea	International Bathymetric Chart of the Central Eastern Atlantic
IBCM	International Bathymetric Chart of the Mediterranean
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	International Bathymetric Chart of the Western Pacific
IBP	IGOSS Product Bulletin
ICAM	Integrated Coastal Area Management
ICCOPS	International Centre for Coastal and Ocean Policy Studies
ICES	International Council for the Exploration of the Sea [CIEM]
ICRI	International Coral Reef Initiative
ICSEM	International Commission for the Scientific Exploration of the Mediterranean Sea [*CIESM*]
ICSPRO	Inter-secretariat Committee on Scientific Programmes Relating to Oceanography [*CISPRO*]
ICSU	International Council for Science [*CIUS*] [previously: International Council of Scientific Unions]
ICZM	Integrated Coastal Zone Management
IDNDR	International Decade for Natural Disaster Reduction

IEO	Instituto Español d'Oceanografia (Madrid, Spain)
IFREMER	French Institute of Research and Exploitation of the Sea
IGBP	International Geosphere-Biosphere Programme (ICSU)
IGOS	Integrated Global Observing Strategy (GCOS-GOOS-GTOS+CEOS) [*SOMI*] [*EOMI*]
IGOSS	Integrated Global Ocean Services System [*SMISO*]
IGU	International Geographical Union
IHO	International Hydrographic Organization
IISc.	Indian Institute of Science
IMO	International Maritime Organization [*OMI*]
IOC/OCS	IOC Ocean Services
IOC/OOS	IOC Operational Observing Systems
IOC/OSC	IOC Ocean Sciences
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 Co-operative Investigation in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IOCSOC	IOC Regional Committee for the Southern Ocean
IODE	International Oceanographic Data and Information Exchange (IOC)
IOP	Intensive Observing Period
IOSLON	Indian Ocean Sea Level Observing Network
IRD	Institut français de recherche scientifique pour le développement en coopération (ex ORSTOM)
ITIC	International Tsunami Information Centre
ITSU	International Co-ordination 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 (ICSU)
IYO	International Year of the Ocean (1998)
J-COMM	Joint IOC-WMO Technical Commission for Oceanography and Marine Meteorology
J-DIMP	Joint G3OS Data and Information Management Panel
JGOFS	Joint Global Ocean Flux Study (IGBP)
JODC	Japan Oceanographic Data Centre
JTA	Joint Tariff Agreement (Argos)
KMFRI	Kenya Marine and Fisheries Research Institute
KMI	Korean Marine Institute (Republic of Korea)
KOICA	Korean International Co-operation Agency
KORDI	Korea Ocean Research and Development Institute
lba	Land Based Activities
LME	Large Marine Ecosystems
LMR	Living Marine Resources (module of GOOS)
LOICZ	Land-Ocean Interaction in the Coastal Zone (IGBP)
MAP	Mediterranean Action Plan (UNEP)
MARPOLMON	Marine Pollution Monitoring System
MEA	Working Group on Marine Environmental Assessments (GESAMP)
MedGOOS	Mediterranean regional GOOS
MEDI	Marine Environmental Data Information Referral Service
MEDPOL	Co-ordinated Mediterranean Pollution Monitoring and Research Programme (UNEP)
MEL	Marine Environment Laboratory (IAEA)
MEMAC	Marine Emergency Mutual Aid Centre, Bahrain
MESL	Marine Environment Studies laboratory (IAEA-MEL)
MICOA	Ministry for Co-ordination of Environmental Affairs of Mozambique
MIM	Marine Information Management (IODE)

MPU	Marine Pollution Research and Monitoring Unit (IOC)
NATO	North Atlantic Treaty Organization [*OTAN*]
NCEP	National Center for Environmental Prediction (NOAA)
NEAR-GOOS	North-East Asian Regional GOOS
NGDC	National Geophysical Data Center (NOAA)
NGO	Non-Governmental Organization (ONG)
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre (IODE)
NOS	National Ocean Service (USA)
NOWPAP	Northwest Pacific Action Plan (UNEP)
OAS	Organization of American States
ODINAFRICA	Oceanographic Data and Information Network for Africa
ODINEA	Oceanographic Data and Information Network for Eastern Africa
OOPC	Ocean Observations Panel for Climate
OOSDP	Ocean Observing System Development Panel (replaced by OOPC)
OPC	Ocean Processes and Climate (IOC) (old)
OSLR	Ocean Science in Relation to Living Resources (IOC)
OSNLR	Ocean Science in Relation to Non-Living Resources (IOC)
OSPARCOM	Oslo and Paris Conventions Commission
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management (Maputo, Mozambique, 18-25 July 1998)
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
PSMSL	Permanent Service for Mean Sea-level (UK)
PTT	Platform Transmitter Terminal (Argos)
RECOSCIX	Regional Co-operation in Scientific Information Exchange
RECOSCIX-WIO	RECOSCIX for the Western Indian Ocean
RECOSIX-CEA	RECOSCIX for the Central Eastern Atlantic
RMS	Root Mean Square
RNODC	Responsible Oceanographic Data Centre (IODE)
ROPME	Regional Organization for the Protection of the Marine Environment
SAREC	Swedish Agency for Research Co-operation with Developing Countries
SBSTA	Subsidiary Body for Scientific and Technological Advice (UN/FCCC)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SCUFN	Sub-Committee on Undersea Feature Names (GEBCO)
SEAPOL	Southeast Asian Programme on the Law of the Sea
SHOM	Service hydrographique et océanographique de la Marine (France)
SICOM	Sustainable Integrated Coastal Development
SIDA-SAREC	Swedish Development Agency
SIDS	Small Island Developing States
SISMER	Marine Scientific Information Systems (IFREMER)
SOOP	Ship-of-Opportunity Programme
SOOPIP	SOOP Implementation Panel (IGOSS)
SOPAC	South Pacific Applied Geoscience Commission
STAR	Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
START	Global Change System for Analysis, Research and Training (IGBP, IHDP, WCRP)
SVP	Surface Velocity Programme (of TOGA and WOCE) (replaced by GDP) drifter
SVP-B	SVP "barometer" drifter
TAO	Tropical Atmosphere Ocean Array
TEMA	Training, Education and Mutual Assistance (IOC)
TIME	Tsunami Inundation Modelling Exchange
TOGA	Tropical Ocean and Global Atmosphere (WCRP)
TOS	The Oceanographic Society
TREMORS	Tsunami Risk Evaluation through Seismic Moment from a Real-time System

TTR	Training-through-Research
UKMO	United Kingdom Meteorological Office
UNCED	United Nations Conference on Environment and Development (Brazil, 1992)
UNCLOS	United Nations Convention on the Law of the Sea (Montego Bay, 1982)
UNEP	United Nations Environment Programme
UNIDO	United Nations Industrial Development Organization
UOP	Upper Ocean Panel (CLIVAR)
URL	Uniform Resource Locator (Internet)
USAID	United States Agency for International Development
VOS	Voluntary Observing Ship (WMO)
WCRP	World Climate Research Programme [*PMRC*]
WDC	World Data Centre
WESTPAC	IOC Sub-commission for the Western Pacific
WINDOW	Western Indian Ocean Waters (IOC newsletter for WIOMSA and RECOSCIX-WIO)
WIOMSA	Western Indian Ocean Marine Science Association
WIPO	World Intellectual Property Organization (UN) [*OMPI*]
WMO	World Meteorological Organization (UN) [*OMM*]
WOA	World Ocean Atlas
WOCE	World Ocean Circulation Experiment (WCRP)
WOD	World Ocean Database
WOTAN	Wind Observation Through Ambient Noise
WWW	World Wide Web (Internet)
XBT	Expendable Bathythermograph
ZNIs	Zones of National Interest