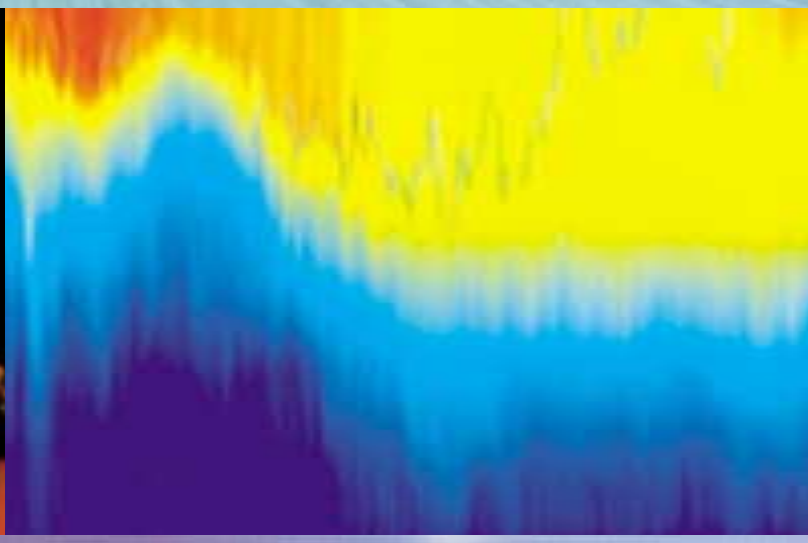
40th anniversary

Intergovernmental Oceanographic Commission

Annual report 2000



UNESCO

Intergovernmental Oceanographic Commission
Annual Reports Series

7

40th anniversary

Annual Report 2000
40th Anniversary

UNESCO

Edited by Gary Wright
Layout and design by Eric Loddé

Acknowledgements
Appreciation is expressed to all those who assisted in the preparation of this document, for their good will and responsiveness in providing articles, advice and ideas. Special thanks are due to the invited authors.

For the volume's illustrative materials, we recognize the excellent co-operation of the US Joint Global Ocean Flux Study (JGOFS) Office in Woods Hole Oceanographic Institution (WHOI), USA; Permanent Service for Mean Sea-Level (PSMSL) and British Oceanographic Data Centre (BODC) in the UK; European Space Agency (ESA), International CLIVAR Project Office (Southampton Oceanography Centre, UK), USA's National Oceanic and Atmospheric Administration (NOAA) and National Aeronautics and Space Administration (NASA), and Australia's Bureau of Meteorology and Centre for Marine Studies (CMS, University of Queensland). Credits, where known and as appeared appropriate, were included with each illustration. The Editor wishes to acknowledge personally the talent, tenacity and team spirit of both the designer and the IOC Documentalist Patrice Boned during our weeks of concentrated effort.

For bibliographic purposes, this document should be cited as follows*:
Annual Report 2000 – 40th Anniversary
IOC Annual Reports Series No. 7, UNESCO 2001
(Original: English)

Printed in 2001
by the United Nations Educational, Scientific and Cultural Organization
7, place de Fontenoy, 75352 Paris 07 SP, France

SC-2001/WS/39

* Note: Prior to this printing, a provisional version of this report was issued in limited numbers for special distribution.

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A milestone volume...

Message from the Chairman

"We must spare no effort to free all of humanity, and above all our children and grandchildren, from the threat of living on a planet irredeemably spoilt by human activities, and whose resources would no longer be sufficient for their needs"

Millennium Declaration
8 September 2000

Addressing a changing context

This year the IOC celebrates its fortieth anniversary under the motto 'One Planet – One Ocean'. It was adopted to highlight the fact that the integrity of the unique system that supports life on Earth depends on the ocean. Protecting the integrity of the ocean and its ecosystems is essential for the maintenance and security of life on Earth for generations to come.

Over the past forty years, IOC has experienced significant evolution. It has gone from being an organization devoted mostly to the coordination of scientific programmes to becoming one that has expanded its role in order to serve the multiple needs of its Member States – towards developing their own capacities to use science for the development and management of the uses of the oceans.

The Thirtieth Session of the UNESCO General Conference approved the new Statutes of the Commission, retaining the original text approved by the Twentieth Session of the IOC Assembly. This approval is the culmination of a six-year process during which IOC Member States worked to adapt the Statutes to the new international context created by the United Nations Conference on Environment and Development (UNCED) in 1992 and the associated new global conventions, as well as by the entry into force of the United Nations Convention on the Law of the Sea (UNCLOS) in 1994.

In the new Statutes, the mission of the IOC is defined as: 'to promote international cooperation and to co-ordinate programmes in research, services and capacity building, in order to learn more about the nature and resources of the Ocean and Coastal areas and [I emphasize] to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment, and the decision-making process of its Member States'.

This evolution is a matter not only of emphasis. New emerging issues – such as environment, climate and global change – have forced societies to resort to science for solutions. This means that IOC has not only to deal with science issues *per se*, something that it has done successfully in the past, but also to address the resources and management issues themselves, something that we have still to learn.

IOC has succeeded in these years to maintain a well-centred focus on ocean science within the UN system. This is indeed a major asset. There is no question that there are difficulties in establishing the precise boundaries defined by the missions of the different UN agencies. However, nobody will dispute that IOC is the Ocean Science focal point for the UN system.

This recognition was once more ratified in the last United Nations Informal Consultative Process on Oceans and the Law of the Sea, held in New York, 29 May to 2 June 2000. On that occasion the IOC was unanimously recognized as the leading agency of the UN System with regards to ocean science and services, especially in global ocean observations through its leadership in GOOS.

This is a very important achievement, upon which IOC must be ready to build. It was the consensus of the participants in New York that next year the Informal Consultative Process would deal with ocean science. We have expressed our interest and willingness to take on the leading role in the preparation for this forthcoming meeting, together with other UN agencies, NGOs and other interested parties.

In New York, there were many who stressed the need for information on ocean sciences for a host of users. Facing up to this challenge, we also offered to lead in the development of a 'clearing-house mechanism' for ocean science. This idea was very well received at the meeting. The 'Ocean Portal', a new website being developed under IODE, has already 1,500 entries that give access to ocean data and information. But a 'clearinghouse' is more than just that. To do things right, we should develop this facility in association with our partners within and outside the UN System. This would afford an enormous opportunity to strengthen our links with these partners.

Now that we have expanded our responsibilities, we need to further engage our governments in support of our work through our Regional Sub-Commissions and Regional Committees. We have been extremely successful in leading the development of operational oceanography, something that is well reflected in the progress of GOOS. We have been very successful in developing partnerships with our sister organizations in the UN System, most notably with WMO in the development of the Climate Agenda, with UNEP in coastal management and with UNEP and IAEA in marine pollution. We have a unique relationship with SCOR of ICSU that facilitates the linkage with the scientific community. However, to succeed in the many challenges that we face today, we need further development in our co-operation with other organizations, as well as increased support from our Member States.

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

From the Executive Secretary

40 years of sciences and services: Building the bases of Ocean stewardship

The creation of effective co-ordination for ocean affairs within the UN System is an issue with a long history. The basis for the debate is simple: the UN does not have a single dedicated specialized agency for the oceans.

The IOC has played a permanent and active role in building close institutional links among the different partners in the System. In the early years of the Commission, there were efforts that finally gave birth, in 1969, to the Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography (ICSPRO). Under the Chair of the Director-General of UNESCO, this high-level protocol brought together the heads of the UN agencies and programmes on a regular basis.

ICSPRO functioned as an effective vehicle for the input of the agencies and programmes into the long process that led to the adoption, in 1982, of the UN Convention on the Law of the Sea. The atmosphere of co-operation created under ICSPRO made it possible that, at a certain point, more than half of the IOC staff were officers from UNEP, IMO, WMO and FAO, seconded by their agencies and stationed in UNESCO, Paris. Clear mandates and sufficient resources made of IOC an effective 'joint specialized mechanism' working for the whole UN System.

Many joint projects were developed under ICSPRO. Among them, it is worthwhile to mention the Global Investigation of Pollution in the Marine Environment (GIPME) and the co-ordination of GESAMP[1] – the Joint Group of Experts on the Scientific Aspects of Marine Pollution. Following the United Nations Conference on the Human Environment in Stockholm (1972), the Fifteenth Session of ICSPRO asked GESAMP for a methodology 'to generate a continuous authoritative review and assessment of the health of the oceans.' In 1982, *The Review of the Health of the Oceans* was published as Volume 15 of the Reports and Studies of GESAMP.

After UNCED (Rio de Janeiro, 1992) and following a recommendation of the Commission on Sustainable Development, the Subcommittee for Oceans and Coastal Areas (SOCA) was created. Co-operation under SOCA has developed in a different international environment, increasingly favouring bi-lateral co-operation, and facing a significant reduction of the resources available to the multilateral system. The IOC has volunteered the resources and personnel to secure the Secretariat of SOCA and is now serving as its Chair as well. Following a recommendation of the Seventh Session of the Commission on Sustainable

Development in 1999, the General Assembly of the United Nations created the Informal Consultative Process on Oceans and the Law of the Sea. This is an important decision that may have strong implications for the IOC and the other agencies of the UN System dealing with the ocean.

The fact that this Resolution was adopted implies that the current level of co-ordination is judged as insufficient by Member States and that more needs to be done. It also means that Member States, at the level of the General Assembly, want to be directly involved in judging the progress achieved.

The Informal Consultative Process (ICP) has three years to prove its utility before the General Assembly re-visits its original decision. There is an emerging consensus that what is needed is a more focused and integrated effort to assess, on a regular basis, the state of the Ocean and to monitor the progress on ocean affairs. This new effort needs to be seen as more than the simple addition of the regular reporting of each agency and programme of the UN, and it might require significant additional work and resources. New emerging issues and the new sets of international priorities will require specific policy analyses and answers.

The first meeting of the ICP, in New York, concentrated in the analysis of fisheries and the progress in the implementation of the Global Plan of Action for the Protection of the Marine Environment from Land-based Sources of Pollution. In 2001 the ICP will deal with ocean scientific research and the increase in piracy. IOC has been invited to take a leading role in addressing ocean science and capacity building.

By preparing a substantive report to the next session of the Informal Consultative Process, IOC will contribute to demonstrating the usefulness of ICP and to confirming the Commission's position as the focal point of the UN System for Ocean Sciences and Services, paving the way for the universal support and endorsement of a regular mechanism to conduct a science-based, but policy-oriented, Global Assessment of the Ocean.

Patricio A Bernal,
Assistant Director-General, UNESCO

[1] At the time, the sponsoring Agencies of GESAMP were IMCO (now IMO), FAO, UNESCO-IOC/WMO,WHO, IAEA, UN and UNEP. Now GESAMP's name is Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection.

Fortieth anniversary foreword

Looking back...

Assault on the Largest Unknown: Daniel Behrman's account of the human dimension of the IIOE, the co-ordination of which became IOC's first major task. (UNESCO, 1981-86, in Arabic, English, French, Russian and Spanish; out of print.)

From 21 to 26 March 1960 a committee, composed of 38 experts representing 25 UNESCO Member States and joined by observers from 11 other international organizations, met in Paris. They were preparing the First Intergovernmental Conference on Oceanographic Research, to be convened in Copenhagen later that same year and called for by Resolution 2.42 of the Tenth UNESCO General Conference in 1958.

The discussions centered on the need to improve the knowledge about the oceans and just how, under the auspices of UNESCO, States could organize themselves 'to participate in oceanographic programmes which require concerted action by them'.

Let us look at the historical context of the times.

This meeting was held in the wake of the International Geophysical Year (IGY, July 1957-December 1958), which had very successfully increased international scientific co-operation to survey systematically the physical properties of the earth. IGY included successful expeditions to both poles, observations of the higher layers of the atmosphere and ionosphere and deep drillings of the Earth's crust. IGY also created the System of World Data Centres under ICSU. The scientific notion of perforating the Earth's crust up to the Mohorovicic discontinuity, to reach the Earth's mantle – the so-called 'Mohole project' – was a daring idea of the times. IGY was also the first substantive break of the ice in international relationships created by the 'cold war'.

Among ocean scientists at the time, there was the general feeling that they had 'missed the boat' during the IGY. The opportunity had escaped them to significantly increase the amount of data available on the different ocean basins. This was considered as a special case that needed correction. As a result, the scientific community created a 'Special Committee for Ocean Research' (SCOR) under ICSU, to look at this matter and to find ways to correct this unbalance.

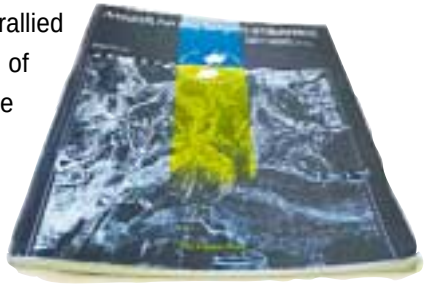
SCOR deliberated on how to better attack the problem of the scarcity of ocean observations. The Committee concluded that the task was huge and that it required a sustained effort on the part of many nations. Full of enthusiasm, they focused on the then least-known ocean basin, the Indian Ocean, and started preparations to conduct an International Expedition to that ocean. Soon the organizing group realized that they needed a new institutional instrument to facilitate the mobilization of resources and to secure

the commitment from the different States for the Expedition. It was clear in their minds that if the Indian Ocean experiment proved successful, this should become a permanent mechanism to promote the gathering and sharing of ocean data.

The delegates sitting around the table in Paris included several well-known cornerstone personalities in the domain of ocean study. Professor Henri Lacombe from France was elected Chairman. Roger Revelle, at the time director of Scripps Institution of Oceanography, headed the USA delegation. Evgeni Federov was present for the Soviet Union and George E. R. Deacon represented the UK. Also present were H. E. Steemann Nielsen (Denmark), Günther Böhnecke (Germany), Umberto d'Ancona (Italy) and Commandant Jacques-Yves Cousteau (Monaco) – to name just a few of the participants.

The need and the will were clear. Speaking to the audience, Roger Revelle elaborated on the difference between research and surveying and went on to give some examples: Scientific problems that require nearly simultaneous observations over a wide area or over the entire ocean also demand international co-operation in taking the observations, and close co-ordination to ensure comparability of results. An example is the present attempt to determine the total carbon dioxide content in the atmosphere and the change in this content with time as a result of the input from fossil fuel combustion and the loss to the ocean and biosphere. One of the questions we are asking is: Where is the carbon dioxide absorbed by the ocean?

There was agreement that an intense and hopefully continuous surveying effort of the oceans was needed. They proposed to conduct three types of surveys: (i) bathymetric, magnetic, gravimetric surveys of the deep-sea floor; (ii) measurements of the physico-chemical properties of sea water, including currents; and (iii) the biological conditions and the rates of organic production. To make his point crystal clear, Roger Revelle rallied his colleagues by saying: '…our maps of the ocean basins today have about the same accuracy and detail as maps of the land areas of the earth made in 1720…'.



International Indian Ocean Expedition (IIOE): 1959-65

The meeting was a success as it led to the Copenhagen conference, convened at the Danish Parliament Building (Christiansburg Castle, 11-16 July), later that year. With the benefit of hindsight, without any doubt we can say that the main out-

come of the conference was the recommendation to UNESCO to establish the Intergovernmental Oceanographic Commission.

IOC celebrates this year its fortieth anniversary under the theme 'One Planet – One Ocean'. We chose this motto to underscore the intimate link between the Ocean and life. The Earth is the only planet that we know to have life. The Earth harbours life, as we know it, because it is able to maintain water in liquid state on its surface. Most of this water, 99.4% to be precise, is contained in the Ocean.

This is a strong argument on the importance of the Ocean to humankind. The integrity of the system that supports life on earth strictly depends on the Ocean. The example given by Roger Revelle forty years ago to study the CO_2 cycle in the Ocean is at the centre of our current concerns regarding the stability of climate. Now we do not just require a scientific answer but a system for measuring and monitoring the concentration, inputs and outputs of CO_2 over the whole planet.

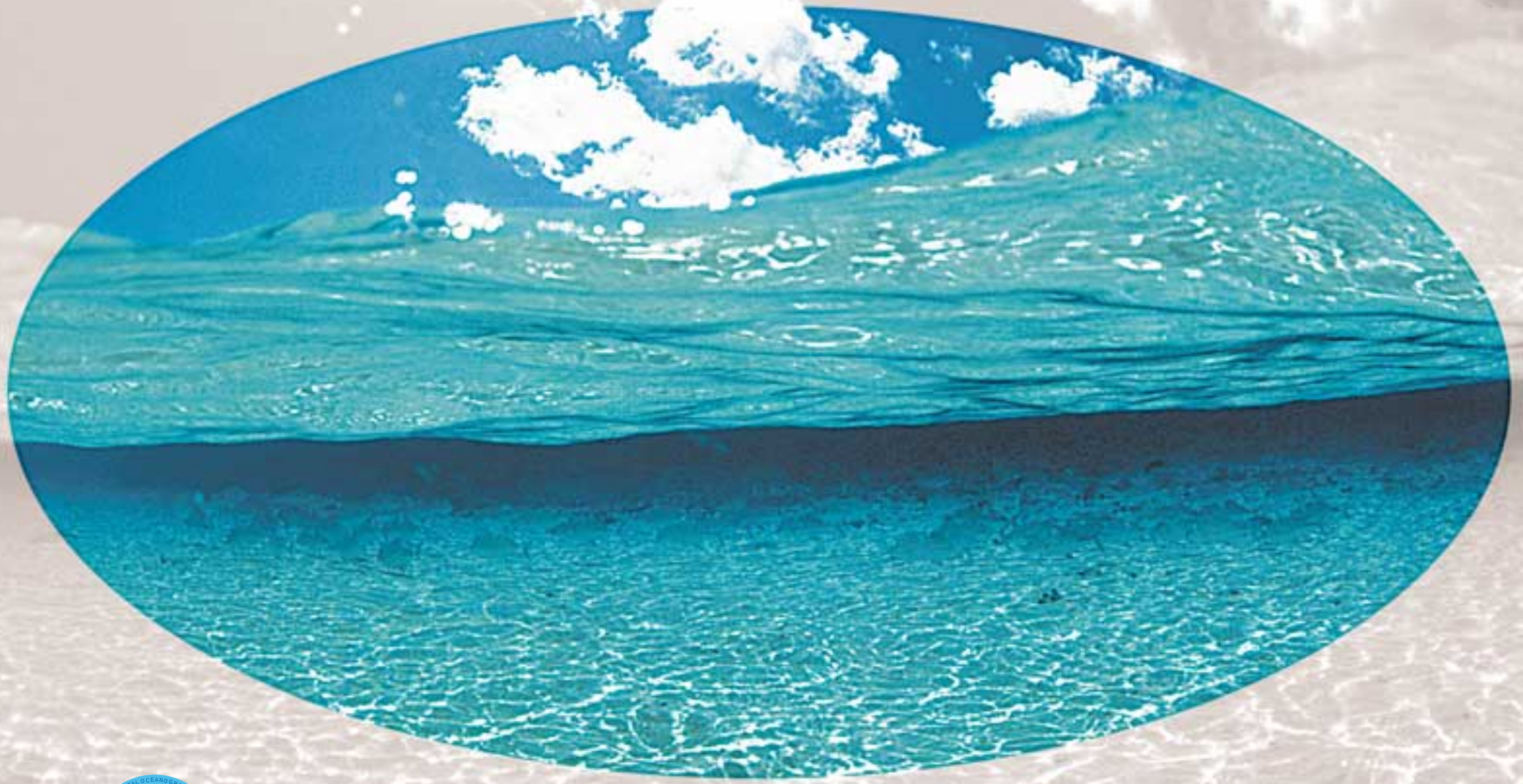
During these 40 years IOC has sponsored an uninterrupted series of international scientific efforts to enhance the knowledge and database of the oceans. It also has established IODE, a successful archival and data exchange system, has sustained GEBCO as a continuous effort to chart the bottom of the ocean with increased precision, and is now engaged in supporting the development of operational oceanography through GOOS the Global Ocean Observing System.

Some of the challenges then are still challenges today, but our forerunners in 1960 would not have imagined the scope, amount, and quality of the data and information available on the oceans today. IOC and UNESCO can be proud of their contribution to this important achievement for humankind.

Dr Patricio A. Bernal

Copies of this poster are available from the IOC Secretariat (p.boned@unesco.org)

ONE PLANET...ONE OCEAN



INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

40 YEARS

Poster designed by Ardrea Miljö (Sweden); photo: © Greatshots

Ocean sciences

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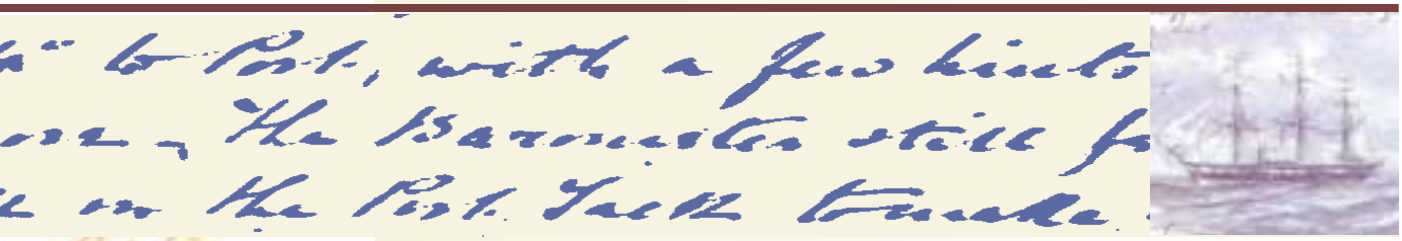


Partners in action

By Dr John Gould, *Director of the International Project Office for CLIVAR and WOCE*, and

Arthur Alexiou*, *Senior Assistant Secretary, IOC*

**See IOC Staff Section, p.176*

history

The ocean's effect on Earth's climate has long been recognized, but the past four decades have seen an increasing awareness of its importance to mankind and the scientific complexity of the topic at time scales ranging from seasons to millennia. During this period, the study of climate, once a small, largely neglected corner of atmospheric science, became a prominent branch of science in its own right. In the 1960s and 70s oceanography was far behind meteorology with respect to the availability of climate-related data, in the ability to gather such data and to employ numerical models in processing the data. It soon became clear that, to make any significant advances in the study of climate, a major international multi-year effort was needed, and, since climate recognizes no national boundaries, it would require international collaboration.

Of the three main international bodies concerned with ocean sciences, two are non-governmental: the International Association of the Physical Sciences of the Ocean (IAPSO) and the Scientific Committee on Oceanic Research (SCOR); the third, IOC, is intergovernmental. Their efforts in organizing international studies of the ocean's role in climate began in the late 1970s.

The Global Atmospheric Research Programme (GARP) was originally constructed in the 1960s to yield a database suitable for the initialization and verification of weather forecast models. Taking its lead from the Committee on Oceanography in GARP, SCOR decided, in November 1978, to establish an inter-disciplinary Committee on Climatic Changes and the Oceans (CCCO) with Roger Revelle as chairman and invited the IOC to be a co-sponsor. Meanwhile, WMO and the International Council of Scientific Unions (ICSU) were reaching a similar conclusion, i.e., that an international effort was needed to determine to what extent climate could be predicted and the extent of man's influence on climate. This led to the World Climate Research Programme (WCRP), co-sponsored by WMO, ICSU and later by IOC and dealing with time scales from several weeks to decades. It had a Joint Scientific Committee (JSC) to oversee the programme. These events had the effect

Roger Revelle

of shifting emphasis from weather to climate and metamorphosed GARP into the WCRP. For oceanographers the effect of this change was dramatic; henceforth they played a central role in developing and executing programmes aimed at understanding climate change and climate variability.

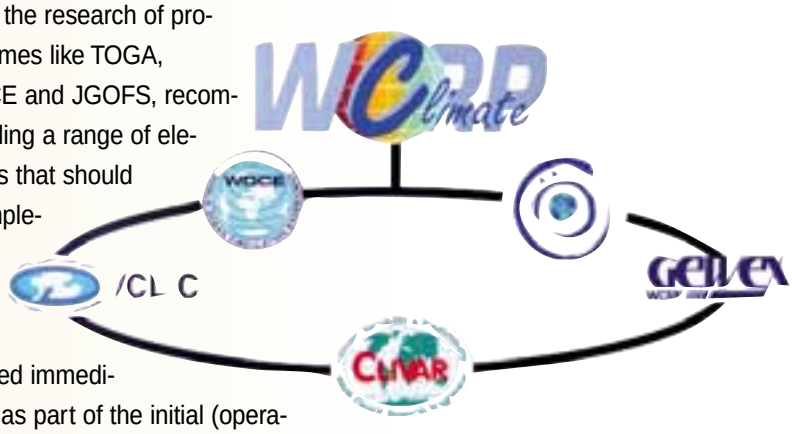
By the end of 1979 there was widespread interest in the large-scale circulation of the

ocean and oceanographers were ready to develop the oceanic aspects of the WCRP. At a meeting in November 1979, Carl Wunsch made a convincing scientific case for a global ocean circulation experiment. The meeting proposed moving forward with the development of observational and numerical modelling techniques, while simultaneously considering the feasibility and design of global experiments. The 100-day 1978 SEASAT mission had demonstrated a precision altimeter measurement of sea surface topography that would, if further improved, provide all-weather monitoring of ocean circulation. The year-on-year trend of rapidly increasing computer power justified the expectation that the advanced computer capabilities needed for eddy-resolving ocean models would soon be available. Conditions and timing for a bold and far-sighted global ocean experiment were propitious.

Responding to concerns about the ocean's possible role in extending weather and climate forecasting, the WCRP and IOC asked their scientific advisory bodies to convene a meeting of experts on the role of the ocean in the global heat budget. This led, in May 1982 in Tokyo, to the JSC/CCCO Study Conference on Large Scale Oceanographic Experiments in the WCRP. That Conference set the scene for the coming decades by establishing oversight mechanisms through CCCO and JSC for the World Ocean Circulation Experiment (WOCE) and for the Tropical Ocean Global Atmosphere (TOGA) study. The Conference also recommended a Pilot Ocean Monitoring Study (POMS), using a variety of methods for the collection of oceanic data. The significance of POMS for the study and prediction of climate variability can now be clearly recognized in the subsequent programmes that benefited from new and improved methods for measuring the ocean.

WOCE and TOGA were the early beneficiaries but POMS also led to the CCCO Ocean Observing System Development Programme (OOSDP), organized by Francis Bretherton, that addressed the wide range of oceanographic and atmospheric measurement systems that needed either strengthening or development within the framework of IOC and WMO in support of the WCRP. In September 1990, the popular OOSDP acronym was inherited by a follow-on activity: the Ocean Observation System Development Panel. It was established jointly by the JSC and the CCCO with Worth Nowlin as Chair to formulate a conceptual design for a long-term, systematic observing system for climate.

With the subsequent establishment of Joint Scientific and Technical Committees for GOOS and GCOS in 1993, these programmes became de facto sponsors of the OOSDP along with the WCRP. Thus the OOSDP became regarded as the scientific steering group for the (common) climate module of GOOS and the ocean component of GCOS. Under the stewardship of the IOC, that Panel completed its work and produced a final report at the end of 1994. The report built upon the research of programmes like TOGA, WOCE and JGOFS, recommending a range of elements that should be implemented immediately as part of the initial (operational) observing system, and a further suite of measurements that should be phased in as enhancements to the system depending upon emerging scientific results.



Roger Revelle,
a pioneer in oceanography and global ocean science co-operation, was convinced that the adequate study of the ocean exceeded the capabilities of one country. He became one of IOC's founders.


© UNESCO


© UNESCO


© TOGA Project Office

Directly above and to the right: courtesy of International CLIVAR Project Office, SOC, UK


Photo: W. Baum

The Ocean Observations Panel for Climate (OOPC) was established in 1996, with Neville Smith as Chair, by GCOS, GOOS and WCRP to follow up the report of the OOSDP. The IOC continued to provide the secretariat for this follow-on panel, which placed emphasis on implementing an end-to-end system that satisfied both operational and climate research requirements for long-term systematic observations. It became clear early on to the OOPC that the envisioned observing system would not become a reality without strong, long-term commitments of governments. The Panel concluded that a convincing global demonstration project, which could produce operational products of demonstrably high value, would be required to persuade governments that it was in their own self interests to commit to the long-term investments necessary. Hence was born GODAE – the Global Ocean Data Assimilation Experiment. GODAE is to be implemented as a practical demonstration during 2003-2005 of near-real-time global ocean data assimilation that provides regular, complete descriptions of the temperature, salinity and velocity structures of the ocean in support of operational oceanography, seasonal-to-decadal climate forecasts and analyses, and oceanographic research. Though GODAE was spun off as a separate project on its own, the OOPC continues to monitor its progress and to generate technical studies and scientific workshops focused on related observational issues, data management and end products.

The latest WCRP major initiative, the Climate Variability and Predictability Study (CLIVAR), is building on the observing systems that became prominent during WOCE and TOGA and relying on their continuing improvement through the efforts of the OOPC and GOOS.

The IOC and WMO were co-sponsors of the Intergovernmental WOCE Panel (1988-1997) and the Intergovernmental TOGA Board (1987-1993). These panels served as forums for joint planning, priority setting and commitments of resources. Their reports were instrumental in obtaining the essential long-term backing of Member States as participants in these precedent-setting, multi-year international ocean programmes. By this means, and more generally through its co-sponsorship of the WCRP, IOC has played a significant role in fostering and enabling activities that have helped shed light on the ocean's role in climate.

history

WCRP: WOCE and CLIVAR achievements in 2000 1.1

This year marked the mid-point between the completion of the WOCE* observational period and the project's formal end in 2002. It has been marked by an intensive effort aimed at completing the submission of the outstanding data sets and the distribution of the second version of the CD-ROMs to scientists and to libraries. The CD-ROMs represent a substantial effort by the WOCE Data Assembly and Special Analysis Centres. Their production was generously supported by the US National Oceanic and Atmospheric Administration (NOAA). The challenges that remained at the end of the year were the submission of data from the repeat occupations of hydrographic sections, some remaining tracer data sets and data from subsurface floats. It is clear that for some data streams the final WOCE data archive would contain all of the observations made and that, for all streams, the submission rate would ultimately exceed 85%. This is indeed a remarkable achievement for such a large, complex international project.

The scientific analysis of these data made rapid progress with the addition of almost 200 refereed publications during the year to the tally maintained by the WOCE International Project Office in its WOCE bibliography (accessible via www.woce.org). These papers focused primarily on the analysis of individual regional and basin-scale data sets but included the following global results:

- new estimates of global property transports,
- new insights into the role of topography and tides in ocean mixing, and
- substantial progress on global ocean data assimilation

The sixth workshop forming part of the WOCE Analysis Interpretation Modelling and Synthesis (AIMS) phase was held on the topic of ocean variability (jointly organized with CLIVAR in Fukuoka, Japan).

Major progress was made towards the compilation of WOCE data and results. Plans for a series of atlases based on the WOCE hydrographic programme data took a major step forward with the agreement reached with BP-Amoco to provide funding for the production and printing of the Atlases. The final editorial tasks were completed for the book 'Ocean Circulation and Climate - Observing and Modelling the Global Ocean', the origins of which lay in the plenary talks given at the 1998 WOCE conference in Halifax, Canada, that was co-sponsored by IOC. Publication is scheduled for 2001.

The WOCE Scientific Steering Group (SSG), at its annual meeting, started the planning process for bringing WOCE to an end. This will entail completing the AIMS phase with a workshop on the global and basin-scale estimation

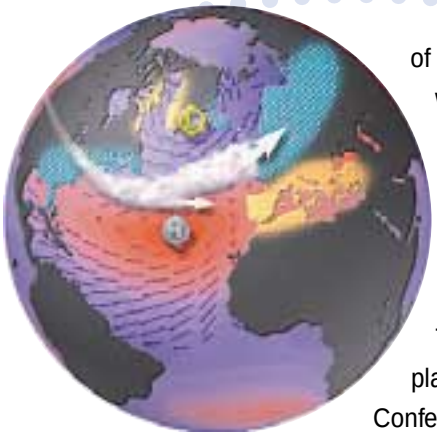
* The World Ocean Circulation Experiment (WOCE), a component of the World Climate Research Programme (WCRP), is the most ambitious oceanographic experiment undertaken to-date. It was designed to improve the ocean models necessary for predicting decadal climate variability and change. In addition to global observations furnished by satellites, conventional in situ physical and chemical observations have been made by nearly thirty nations in four of the world's oceans. At the same time global numerical ocean models are being developed to assimilate these measurements. The field phase of the project lasted from 1990-1998 and is now being followed by analysis, interpretation, modelling and synthesis (AIMS) activities. This, the AIMS phase of WOCE, will continue to the year 2002 and the tasks to be undertaken are described in the WOCE AIMS Strategy document. The success of WOCE AIMS will have considerable impact on follow-on programmes: CLIVAR, a global study of ocean climate variability and predictability, and GODAE, the Global Ocean Data Assimilation Experiment.

Below: Moorea, French Polynesia

Photo: © Yann Arthus-Bertrand/Earth from above/UNESCO

UNESCO/D. Roger

Research vessel, Nosy Bé, (Madagascar) research center



of ocean heat and fresh water transports. It is being organized jointly with JGOFS to include consideration of ocean carbon storage and carbon transports as well. The SSG also started planning for a final WOCE Conference late in 2002.

The North Atlantic Oscillation

The two phases of the NAO: Positive phase (top), leading to mild and wet winters over Northern Europe and dry conditions in the Mediterranean. Opposite conditions during the negative phase (right)

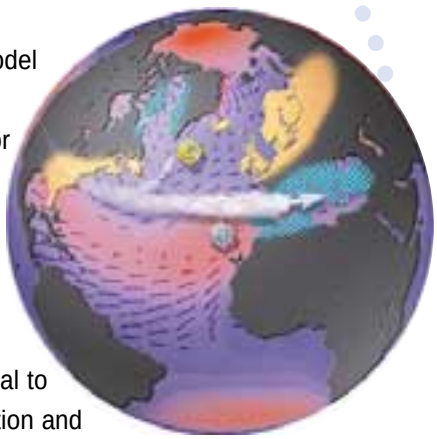
From: CLIVAR brochure, courtesy of International CLIVAR Project Office, SOC, UK

Globes: © LDEO, Palisades, NY

The WCRP's biggest and newest project on Climate Variability and Predictability (CLIVAR) made major strides in its transitions from planning (based on the project's 1998 Initial Implementation Plan) to implementation. The Pacific Tropical Atmosphere Ocean (TAO) array officially became the TAO/TRITON array since the Japanese assumed responsibility for maintaining sites in the western Pacific with their TRITON moorings. The Atlantic now has PIRATA (Pilot Research Array in the Tropical Atlantic) in place supported by the USA, France and Brazil. The development of an Indian equatorial moored array was discussed at the SOCIO (Sustained Observations for Climate in the Indian Ocean) meeting co-sponsored by IOC Perth Regional Programme Office in Western Australia. Thus an important component of the long-term tropical upper-ocean measurement capability needed by CLIVAR is starting to become a reality.

The tropical arrays are just one element of the global sustained observations of the oceans (and of the atmosphere) needed by CLIVAR both for improving our understanding of climate phenomena and for the initialization and validation of predictive climate models. Thus CLIVAR interacts closely with GOOS and GCOS and has a strong commitment to the implementation of the global Argo profiling float array.

CLIVAR's regional and phenomenological foci (on monsoons in Asia-Australia and the Americas, on African climate variability and on the ocean sectors) made excellent progress. Its Atlantic panel met in Ourense, Spain, in conjunction with the Chapman Conference on the North Atlantic Oscillation. A Southern Ocean panel was formed and a Pacific panel planned. These ocean sector panels are charged with the implementation of CLIVAR science on all timescales (from seasons to decades and longer) and with equal emphasis on the atmosphere and the ocean.



As with WOCE, model improvement is a major motivation for CLIVAR. For the sake of convenience there are two thrusts, through Working Groups on Seasonal to Interannual Prediction and

on Coupled Modelling. This latter group has responsibility for much of the modelling effort that underpins the Intergovernmental Panel on Climate Change (IPCC) that will publish its Third Assessment Report (TAR) in 2001.

With the approaching end of WOCE and the rapid moves towards implementation in CLIVAR, the study role of the oceans in climate (including ocean biogeochemistry and the oceans role in the carbon cycle) is assuming increasing importance.

Ocean Observations Panel for Climate (OOPC) 1.2

The principal focus at the start of 2000 was a review of the outcomes from the major OceanObs Conference held in Saint Raphael, France, in October 1999. A monograph entitled 'Ocean Observations for the 21st Century', based on the OceanObs papers, was begun and by the end of 2000 was approximately 75% completed. Target date for publication was estimated for the 3rd quarter 2001. Follow-up proceeded on a number of priority areas during the year. These were addressed in OOPC-V held in Bergen (Norway) in June 2000 and results are described below.

Temperature observations

Further progress has been made by the SST group in defining *in situ* requirements and in analyzing differences between various SST climate products produced from blends of *in situ* and satellite observations. A product server was created to facilitate intercomparisons. Issues concerning bulk and skin temperatures were raised that were later taken up by the GODAE SST group.

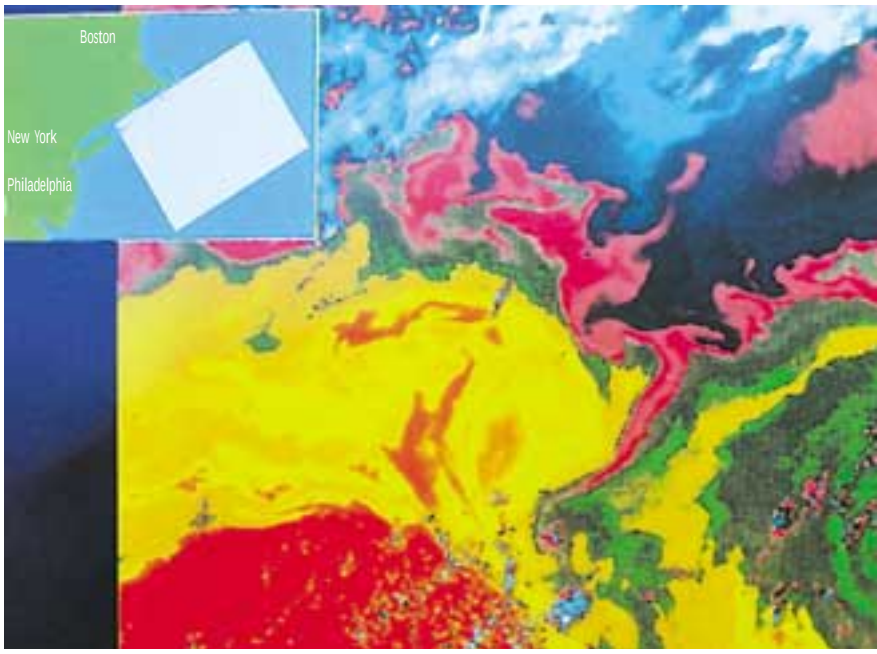
Surface reference sites

The Surface Flux Analysis Project (SURFA, joint with the Working Group on Numerical Experimentation) outlined a strategy for involving meteorological agencies and ocean observers in routine and regular validation of model surface flux estimates. OOPC convened a small workshop (December 2000) to develop recommendations on the preferred surface reference sites. An initial set of sites was agreed. Methods for exchanging information in real-time were also discussed. The enthusiasm from both sides augurs well for the project.

Tropical moored buoy arrays

On the basis of briefings on some of the problems with the mooring arrays, most notably the problem associated with vandalism and increasing financial and logistical pressures facing TAO and TRITON as well as PIRATA, OOPC agreed to lead an

Gulf Stream and Labrador Current (***Cape Cod, Massachussetts, USA***)



This ATSR (along-track scanning radiometer) infrared image shows variations in brightness temperature in the Atlantic Ocean off the northeast US coast (see insert). Colours correspond to a range of temperatures spanning an interval of about 7° from the top to the bottom of the image. Warm water from the Gulf Stream flowing eastwards along the bottom of the image (dark orange) meets cold water from the Labrador current flowing south along the US east coast, resulting in a giant warm-core eddy structure (green swirl). Source: ESA

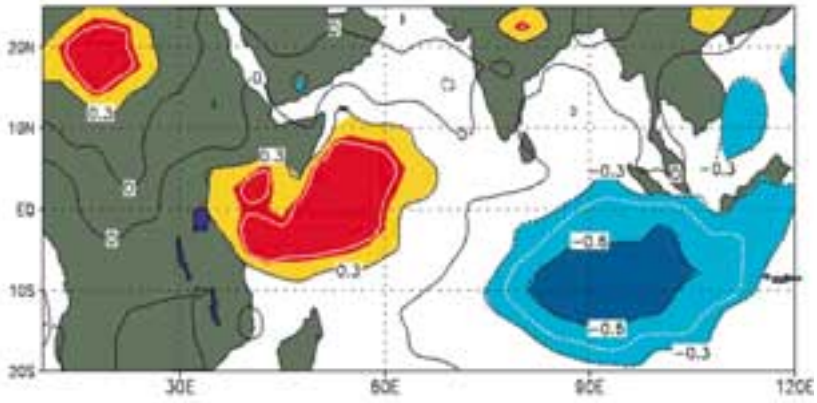
International Review of tropical moorings. It was agreed the review should cover (a) the status of the arrays, (b) the contribution of the data to both operational and research interests, and (c) guidance on the future of the arrays. The likely date and location of the Review were set for 10-12 September 2001, in Seattle. All relevant groups would be offered an opportunity to submit comment to the review.

Time series stations

The OOPC reaffirmed its position that a major effort is warranted and feasible, and that co-ordinated action should be taken without further delay. A science team was established under the joint sponsorship of GOOS / GCOS (OOPC) and the CLIVAR Ocean Observations Panel (OOP), with support from POGO. A Workshop was scheduled for late May 2001. Terms of Reference for the Science Team were adopted and it was agreed that links would be established to the GOOS Coastal Ocean Observations Panel (COOP), DEOS and JGOFS.

Indian Ocean Dipole

Courtesy of Toshio Yamagata, Univ. of Tokyo



When sea surface temperature (SST) is warm off western Australia, it rains heavily in Australia; when SST is warm off Kenya it rains heavily in east Africa. The see-saw is referred to as the dipole. To forecast the behviour of the dipole accurately, and hence rainfall, routine monitoring is needed both of the surface and the subsurface

GODAE and Argo

A report on GODAE is given under a separate item. However, OOPC noted that GODAE provided considerable opportunity for developing guidance on aspects of the observing system and that perhaps OOPC should be more pro-active in the area of observing system experiments. Several areas were discussed (e.g., sensitivity of various climate products to elements of the subsurface observing system) and it was agreed that a more detailed set of recommended studies should be presented to OOPC VI.

Ship-of-Opportunity Programme

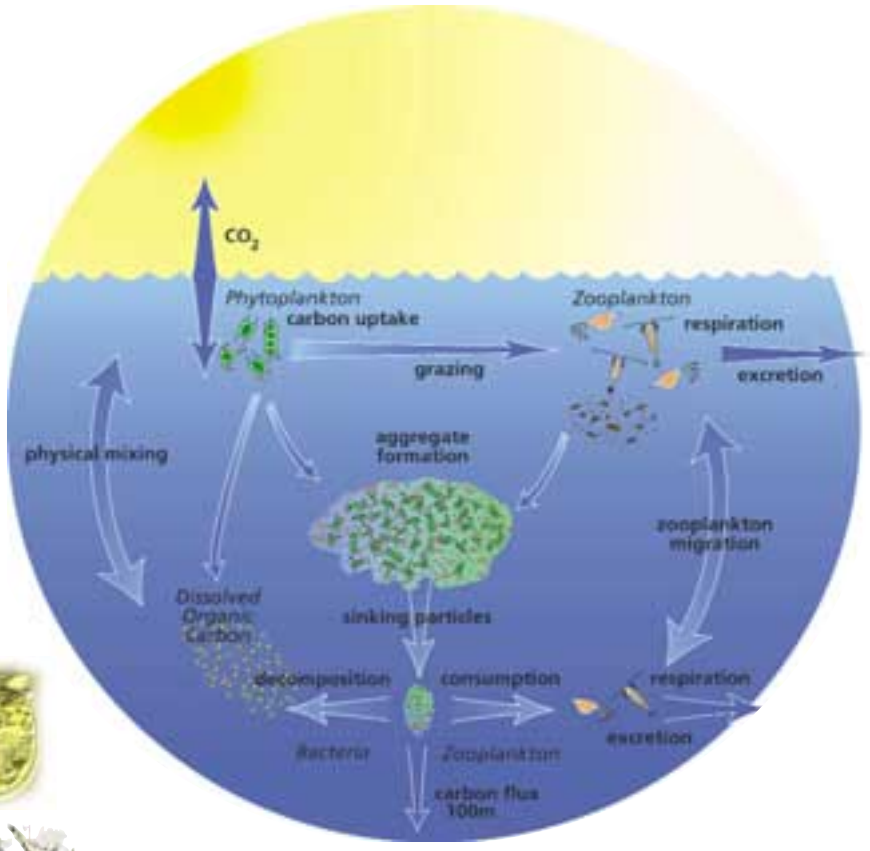
Due to significant increases in the price of XBTs (~ 60%), implementation of the revised plan for high-density and frequently repeated lines has been difficult. The SOOP Implementation Panel accelerated its efforts to persuade the international community to support the revised plan. OOPC reaffirmed their support for SOOP and noted that the revised strategy provided for unique, complementary information for the global observing system.

Indian Ocean workshop

A workshop was held in Perth on Sustained Observations for Climate in the Indian Ocean by CSIRO, with significant support from the IOC Perth Regional Programme Office in Western Australia to follow up on recommendations from OceanObs. The Workshop embraced both research and applications and attempted to bring together individuals and agencies with the potential to jointly implement a sustained ocean observing system for the Indian Ocean. The Workshop was well attended and successfully addressed all of its prime objectives. The rationale for such a system was developed in detail and an observational strategy agreed. The OOPC will examine the conclusions of the Workshop at its next meeting and develop a strategy for implementation.

Ocean observations for the carbon cycle

OOPC V concluded that it should maintain close contact with the many carbon cycle initiatives planned for 2000/2001 in order to decide on a realistic set of requirements for ocean carbon observations. Several individuals have been active in keeping discussions of ocean carbon measurements to the fore, resulting in the development of a background paper being prepared by IOC with other groups. OOPC will review this paper at its next meeting.



The biological pump

© K. Buesseler, J. Cook, P. Oberlander and K. Joyce, WHOI

Deep ocean observations

OOPC concluded that significant pressure had not built up yet from potential users of deep ocean observations for generating a plan for repeated hydrographic sections. The need for such information was recognized and accepted at OceanObs 99 but the OOPC was uncomfortable about taking a leading position. The development of the carbon background paper perhaps would provide a better route. For both time-series stations and hydrography, it was becoming increasingly clear the carbon cycle is providing the major rationale for action, as suggested by OceanObs 99.

Ice-covered ocean

OOPC V provided an excellent opportunity to review and refine the observational strategy for the ice-covered ocean. Major points were:

- There is increasing evidence of Arctic ice volume changes.
- The SSM/I is essential for sea ice extent, and overlap for intercalibration is essential.
- Ice thickness is now feasible to measure from space (CRYOSAT and NASA IceSAT) and should be supported by a range of *in situ* measurements (sonar data from submarines. upward-looking sonar sensors in the Arctic).
- The strategy for the Antarctic must be different for ice thickness.

Boundary currents

OOPC recommended that CLIVAR take the lead through its Ocean Observations Panel to define the most promising and useful tech-

Photo: © M. Dennett; Courtesy of US JGOFS Office, WHOI

RVIB *Nathaniel B. Palmer* near McMurdo Station, Antarctica

niques for boundary currents, based on the discussions from OceanObs.

Wind waves

The recommendations from OceanObs were reviewed. The need to predict and monitor conditions for extreme waves is an issue since measurements from space are not reliable for extremes. In general, it is in the area of *in situ* observations that OOPC believes it can make some contribution; most other aspects are well covered elsewhere. A small pilot-project to put bow-mounted sensors on VOS ships over the high-density XBT tracks was one suggestion. The Chair agreed to liaise with SCOR and other groups on the possibility of establishing a scientific working group to consider this and other *in situ* approaches.

Data servers and data management

The OOPC examined the GOOS Data and Information Management Plan and options for addressing some of the many pressing issues. The OOPC initiated discussions on a few issues:

- a mechanism for maintaining the integrity of data and data sets,
- an improved method for auditing value-adding (and value-depreciating) actions,
- methods for recording such actions and for recognizing excellence, and
- a more robust system to archive key data.

OOPC VI will receive a paper on these issues and, perhaps, initiate a small project in collaboration with JCOMM to develop a solution.

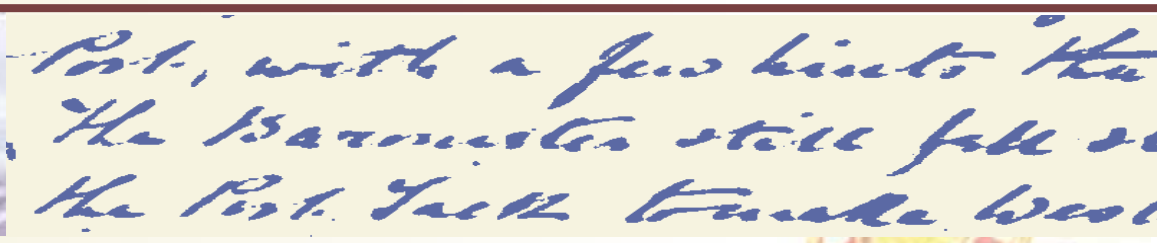
Liaison and collaboration

Consistent with its terms of reference, the OOPC continued to liaise and collaborate with other panels and groups in areas where its own expertise is limited. These include the GCOS/WCRP AOPC, the CLIVAR Ocean Observations Panel, the IOC/SCOR CO_2 Panel, the SCOR/WCRP WG on Air-Sea Fluxes, JCOMM and its various programme areas, POGO and WGNE. OOPC is pursuing several initiatives with co-sponsorship with one or more of these groups. The GOOS Coastal Ocean Observations Panel (COOP) is clearly one of the more important groups and the OOPC agreed to provide representation at COOP meetings. IOC Perth Regional Programme Office has been very active over its first year and has provided OOPC with a strong presence in the Indian Ocean region. This presence is proving essential for progress in the region.

UNFCCC observations reporting process

Many nations have started the process of gathering information on their contributions to the climate observing system. The Chair of OOPC participated in a workshop that provided guidelines for this reporting. GCOS has recommended that a formal assessment process be initiated to analyze the responses. While this assessment would presumably be restricted to climate and climate change observations, the National Reporting is also likely to include much information relevant to other aspects of the global observing system and OOPC will consider how best to take advantage of this information.

The major action items established for 2001/2002 include (a) the Tropical Moorings Review, (b) development of the SURFA project, (c) the first meeting of the Time-Series Science group, (d) action on data management issues, (e) follow-up actions for the Indian Ocean, (f) review of the carbon background paper and (g) completion of the OceanObs monograph.



Ocean CO_2 and climate

By Dr Maria Hood* and Arthur Alexiou**

See IOC Staff Section
** p. 173*
*** p.176*

Over the last two centuries, fossil fuel emissions, biomass burning, and land use changes have profoundly impacted the global carbon cycle, and present atmospheric CO_2 levels are higher than experienced on the planet for at least the last 400,000 if not the last several million years. The ocean is the largest mobile reservoir of carbon on decadal to millennial time-scales, and ocean circulation and the long-term sequestration of anthropogenic carbon in the ocean significantly influence the regulation of climate. In 1979, recognizing the importance of the ocean's role in global climate change, IOC and SCOR formed the first Committee on Climate Change and the Ocean (CCCO), with Roger Revelle as its Chairman. In his 1979 address to the 11th IOC Assembly, he described the climate issue to be the most important challenge facing the IOC. His concluding remarks set the stage for over two decades of climate science at IOC:

> *'In concluding, let me say that there are two important aspects of the world climate problem. One is statistics, that is the average conditions and variance. And the second is the possibility of actually forecasting climate. We cannot forecast it now; we may never be able to forecast it, but if we could, the results would be so valuable that the gamble is worth taking. And I conclude by emphasizing what I have said in the beginning, that the World Climate Programme and the possible role of the IOC in that programme represents the greatest challenge and the greatest responsibility that this body in my experience has ever had.'*

In 1984, the CCCO established a CO_2 Advisory Panel under the chairmanship of Revelle. This panel recommended to CCCO an observation programme and sampling strategy to determine the global oceanic CO_2 inventory with a relative accuracy of 10-20 Gigatons, nearly one order of magnitude better than the GEOSECS data. The Panel believed that it would be possible to estimate the amount of anthropogenic CO_2 taken up by the oceans, one of the parameters that must be defined in order to predict the future evolution of atmospheric CO_2. Since that time, the completion of the WOCE-JGOFS CO_2 survey has brought us close to achieving that goal.

When the SCOR Committee for JGOFS was established in 1987 it was recognized that understanding the carbon cycle would be central to JGOFS and that

global oceanic CO_2 measurements would be critical to that understanding. As the objectives of both groups were nearly congruent with respect to CO_2, it was agreed that JGOFS and CCCO should jointly assume responsibility for executing a global ocean CO_2 observation programme in association with the World Ocean Circulation Experiment (WOCE). Accordingly, in September 1988 the CCCO panel was disbanded and the Joint JGOFS-CCCO Advisory Panel on Ocean CO_2 was created with Peter Brewer as Chair to provide the primary focus for international planning and commitment for implementing such a programme. A decision to phase out CCCO in December 1992 was followed by an agreement to continue this Panel under joint sponsorship of JGOFS and IOC. The Panel continued its efforts under this arrangement with Liliane Merlivat and Andrew Watson as chairs until it was dissolved in 2000.

Over the years, in addition to providing a ready source of expertise to IOC, the Panel contributed in many ways to the advancement of ocean CO_2 research, to greatly improved accuracy of field observations, to expanding the ocean pCO_2 data set, and to enlarging the community of ocean CO_2 scientists. It sponsored the first controlled international laboratory exercise for the intercalibration of the various types of equipment being used for pCO_2 observations at sea. The results revealed unsuspected operating limitations that had to be accounted for to achieve required accuracies. Thereafter, Principal Investigators were encouraged to conduct field intercalibration experiments on ships at sea, whenever schedules allowed, to assure the continuing integrity of the accumulated data set. Panel efforts were central to making available certified reference materials for all countries participating in JGOFS. These were critical to assuring CO_2 data from any cruise would be compatible and comparable

THE ROGER REVELLE MEMORIAL LECTURE, 2000
21 June 2000

Responding to Climate Change: Scientific Questions Regarding the Possible Disposal of CO_2 in the Deep Ocean

Lecture summary:

Within the next two decades society will make critical choices on how to respond to climate change, and on how to stem the growth of greenhouse gases in the atmosphere. Ocean disposal of CO_2 is one possible course of action. I believe that it is fair to say that at this time we have no unified body of knowledge of this topic. Yet this is a very achievable goal for the international ocean science community. Within the last few years this has become an active experimental science, with novel techniques and new insights. We have the opportunity to increase fundamental understanding, and to make powerful and original contributions to deep sea chemistry, physics and biology. I do not pre-judge whether this course of action will ultimately be seen as wise. But I do believe that it is important that those decisions be based upon sound scientific evidence, evidence that only the international ocean scientific community can provide.

By **Dr Peter G. Brewer**

Dr Brewer, an ocean chemist, is Senior Scientist at the Monterey Bay Aquarium Research Institute (MBARI). Internationally he has served as a member of SCOR, and as Vice-Chair of JGOFS.

in accuracy. Perhaps the Panel's most enduring legacy was achieved through the organizing of a continuing series of international Ocean CO_2 Symposia. The evidence is growing that these symposia have turned out to be a major factor in attracting increasing numbers of new young scientists to the field.

With the completion of the field phases of WOCE and JGOFS, and the evolution of CLIVAR and its priorities, agreement was reached to restructure the Panel as a Joint SCOR-IOC Advisory Panel on Ocean CO_2 with revised terms of reference reflecting the changing circumstances and new priorities. This new Panel under the chairmanship of Douglas Wallace met for the first time in September 2000. New programme areas outlined by the Panel include providing scientific input and coordination for ocean carbon measurements in observing programmes, providing advice and advocating the development of standards and reference materials for ocean carbon measurements, and maintaining a watching brief on ocean carbon sequestration activities. In its first year of activity, the Panel has been actively involved in providing scientific expertise to observation programme planning for GOOS and the IGOS Integrated Global Carbon Observation Theme, and is providing a mechanism for coordination and integration of carbon measurements for the hydrographic programme of CLIVAR.

SCOR-IOC Advisory Panel

The SCOR-IOC Advisory Panel on Ocean CO_2 was established to replace the IOC-JGOFS Ocean CO_2 Panel, with new terms of reference that reflect the ocean carbon issues that are important today and the state of the science for addressing them. The Panel held its first meeting at IOC in September 2000, followed by participation in a number of workshops in collaboration with other programmes with the goal of establishing international community consensus on ocean carbon research, observation requirements and priorities. These programmes include JGOFS, CLIVAR, WCRP, SOLAS, the proposed GOOS Pilot Project on Time Series Stations, and the IGBP-IHDP-WCRP initiative to develop the Carbon Joint Project, an interdisciplinary approach to carbon cycle research.

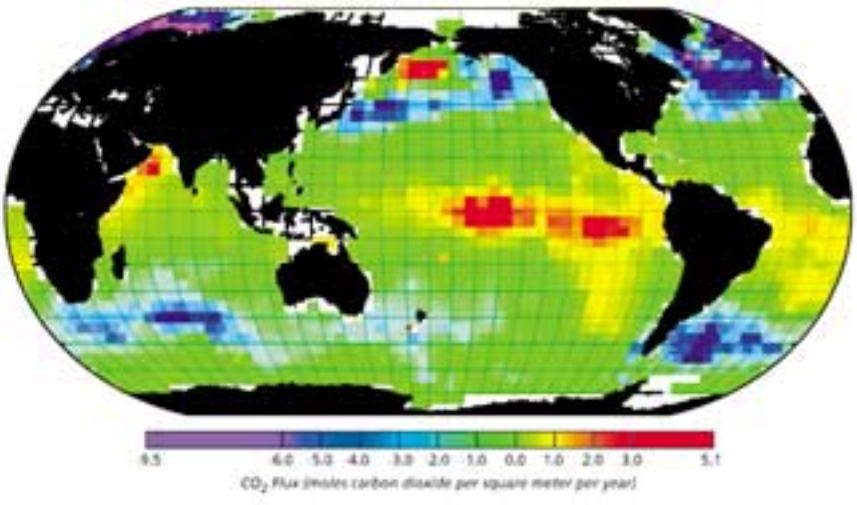
Some Panel highlights from this first year and plans for future activities include:

Establishing observational requirements for ocean CO_2

Several Panel members participated in the development of 'A Global Ocean Carbon Observation System – A Background Report. A Contribution to the Integrated

CO_2 flux map

Courtesy of US JGOFS Office, WHOI



© T. Takahashi

Global Observing Strategy (IGOS)'. This document includes scientific rationale for ocean carbon observations and an inventory of ongoing and planned ocean carbon observational programmes. This will be published as a GOOS technical document and will serve as the ocean component of the IGOS Partners Integrated Global Carbon Observation Theme.

Coordination and planning of international ocean carbon research programmes

The Panel, as requested by CLIVAR and IGBP, will aid in co-ordination of ocean carbon measurements in the repeat hydrography programme of CLIVAR.

Providing advice and advocacy for certified reference materials

The Panel serves as an international liaison to the US National Research Council Ocean Studies Board programme on Standards and Reference Materials for Marine Science. The Panel is also working to advocate the support and use of certified reference materials within the GOOS programme.

Watching brief on ocean carbon sequestration

Several Panel members have been active this year in a number of national and international programmes on ocean carbon sequestration. The Panel has gathered information for the development of a web site on these issues.

Above and left: UNESCO/D. Roger

Ocean Science in Relation to Living Resources 1.4

An overview

By Dr Ned Cyr*
and
Dr Umit Unluata**

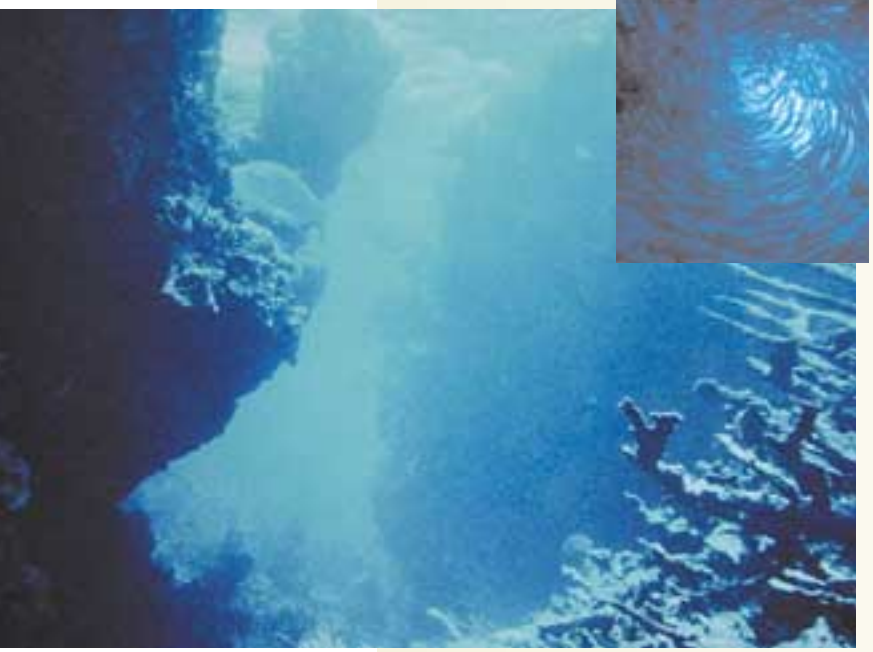
See Staff Section
* p. 172/177
** p. 172

The 11th Assembly (1979) of IOC approved a resolution to develop a plan of applied oceanographic research relating to living marine resources. In developing the plan consultation were held between FAO and IOC and later with the Advisory Committee on Marine Resources Research (ACMRR) and the Scientific Committee on Ocean Research (ICSU). The FAO-IOC consultations led to the recommendation of a programme of research on physical-biological linkages as they affect the variability of fish stocks in boundary currents, coral reefs, tropical demersal shelves and open ocean regions. To implement research proposals an ACMRR and SCOR Working Group proposed a series of process oriented field experiment, IREX (International Recruitment Experiment), designed to examine relationships between environmental variability and living resources. The 12th Assembly (1982) endorsed the programme thereby establishing the OSLR as an organized component of IOC.

Field programmes were established by IOC throughout the 1980s. They were overseen by a Guiding Group of Experts (GGE) that met in 1984, 1987 and 1990. The programmes included the International Recruitment Project (IREP) and its components (Sardine and Achovy Recruitment Project, SARP; Tropical Demersal Coastal Fishery Recruitment Project, TRODERP; and Penaeid Prawn Recruitment Project, PREP). The recruitment processes programmes ended in 1992. Despite a number of successes, the fisheries recruitment studies fell into decline in the early 1990s. The reasons given for this decline have been attributed to: the complexity of the fisheries recruitment problem and the demanding nature of the research that made it difficult to get active participation by developing countries; the difficulty of obtaining full involvement from fisheries scientists in developed countries who already have their own research programmes, and the narrow focus on fisheries recruitment that prevented focus on other issues. FAO withdrew from cosponsorship of OSLR in 1995 due to resource constraints and the need to concentrate on their own programmes.

In the late 1980s and early 1990s, some new issues emerged that were appropriate for incorporation into the OSLR Programme. The IOC created the Harmful Algal Blooms (HAB) Programme and arranged to co-sponsor with ICES the ICES/IOC Study Group on the Dynamics Harmful Algal Blooms and with SCOR a Working Group on the Physiological Ecology of HABs. These activities led subsequently to the establishment of the interdisciplinary IOC-SCOR Global Ecology and Oceanography of Harmful Algal Blooms

Insert: Photo by Tibor Dombovari (Hungary), bronze medal winner, slides category, Antibes 2000 festival. See pp. 157-158



Above: Courtesy of World Underwater Federation (CMAS)

(GEOHAB) programme, which works toward developing international capabilities for assessment, prediction and mitigation of HABs. There is an Intergovernmental Panel on HAB (IPHAB) attached to the Programme that functions as the overall coordinating body for most international and regional HAB initiatives. It sets priorities, revises and updates the HAB Programme Plan, and is responsible for interaction with other relevant organizations and programmes.

The HAB Programme includes permanent regional working groups in South America (COI-FANSA), the Caribbean (COI-ANCA), and the Western pacific WESTPAC/ HAB. The Global Coral Reef Monitoring Network (GCRMN) was established jointly with UNEP, IUCN, ICLARM and WB and focuses on (i) improving the conservation, management and sustainable use of coral reefs and related coastal ecosystems by providing data and information on the trends in biophysical status and social, cultural and economic values of these ecosystems, and, (ii) providing individuals, organizations and governments with the capacity to assess the resources of coral reefs and related ecosystems and to collaborate within a global network to document and disseminate data and information on their status and trends. In addition, the IOC co-sponsors the Global Ocean Ecosystem Dynamics Programme (GLOBEC) and contributes to the study of processes in large marine ecosystems through support to the Large Marine Ecosystem (LME) Initiative. OSLR has been involved in the development of the Living Marine Resources Module of GOOS.
These current activities within the OSLR envelope are related to HAB/GEOHAB, GLOBEC, GCRMN, and LME, and are concerned in one form or another with the effects of anthropogenic forces and climate variability on marine ecosystems.

The 31st Session of the IOC Executive Council instructed the Executive Secretary of the IOC to convene a meeting of experts to review the Ocean Sciences in Relation to Living Resources (OSLR) Programme. This review was undertaken in the latter half of 2000. The review examined the range of IOC activities within the OSLR Programme and a wide variety of international scientific programmes of other agencies, some linked to IOC activities and some not. The principal conclusion of this review is that future OSLR activities should be based on an ecosystems approach.

The two decades of OSLR's existence have witnessed significant advances in ocean science. In particular, recent advances in marine science make it possible to study, monitor, assess, model and in some cases manage the ocean's resources using an ecosystem approach. Studies such as JGOFS have improved understanding of the factors controlling spatial and temporal variability of ocean

primary production. GLOBEC has identified many of the critical processes controlling the variability in zooplankton abundance and distribution and their relationship to fish recruitment. Programmes such as GLOBEC SPACC and Bering Sea FOCI are establishing clear linkages between physical ocean variability and fish abundance and distribution for some populations, to the point where environmental indices (e.g. wind stress, upwelling) are routinely observed for incorporating into fish stock assessments. Taken together, these advances permit improved understanding and prediction of the ocean environment and the way that it influences fishery production.

Significant scientific challenges remain before an ecosystem approach to living marine resource management can be fully realized. The SCOR Workshop on the Future of Global Ocean Biogeochemistry (Plymouth UK, 23-26 September 2000) listed among its chief information needs for fisheries: (i) how changes in higher trophic levels feedback to affect primary and secondary production; (ii) how physical and chemical variability at different scales affect community structure in the ocean; and (iii) how physical, chemical and trophic processes associated with meso-scale features respond to environmental variability or anthropogenic influences and how these affect fisheries.

The IOC's role in an ecosystem approach must be similar to that established for the OSLR programme at its inception by the 11th IOC Assembly in 1979 with one important difference. The IOC must now be active in interdisciplinary ocean science not just related to living marine resources, but to ecosystems and the resources that they contain, in response to the new knowledge on ecosystem effects of fisheries. This greatly expands the range of potential scientific endeavours for the IOC, and creates for the IOC a unique role among the UN specialized agencies attempting to define and implement an ecosystem approach to marine resource management, in keeping with the call for responsible fisheries.

Killer whales

From the 'Marine Mammals of the World' CD-ROM; produced by ETI and FAO; published by Springer-Verlag

HAB/GEOHAB Programmes of the Ocean Science Section already constitute successful activities that are interdisciplinary and take into account the need for the knowledge of the related ocean ecosystem dynamics. Consideration of other scientific issues are needed, though, in order to be effective, the IOC cannot focus on all relevant scientific issues at once. Instead, several key scientific issues central to marine ecosystems and their resources have been identified for study, including: the role of environmental variability in the abundance and distribution of fishes; the use of environmental indices in the management of pelagic fish populations; the development and utility of indicators for coral bleaching; and the monitoring of coral reef ecosystems. Ocean Science Section has already initiated study groups to address carefully defined issues within each of these areas, and use data to test hypotheses. The results will be approaches that can be practically applied to improve marine resource assessment and management.

Published in 1997 by UNESCO with IOC support

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

Photo: Laurent Ballesta (France), gold medal winner, slides category, Antibes Festival 2000, pp. 157-158

Global Coral Reef Monitoring Network (GCRMN)

The GCRMN continues to provide monitoring information relevant to the conservation and sustainable use of reef resources around the world. Three recent activities of the GCRMN are highlighted.

In October, GCRMN published *Status of the Coral Reefs of the World: 2000*, a follow-up report to the *Status of the Coral Reefs of the World: 1998* report, which documented massive coral bleaching, particularly in the Indian Ocean and Southeast and East Asia, with major shifts in populations structure on many reefs. The 2000 report documents a continued decline in the health of coral reefs, with a loss of 11% of the world's reefs, and a further 16% not fully functional. The most sig-

Photo: Ove Hoeg-Guldberg, CMS

Heron Island Research Station, southern Great Barrier Reef (Australia), a centre for coral bleaching research

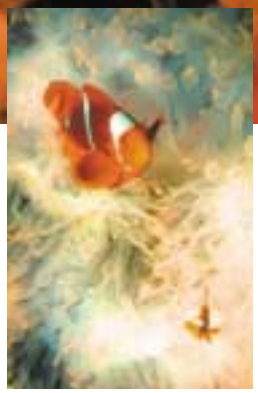
nificant impact continues to be from coral bleaching associated with elevated sea surface temperature, which has been particularly acute in the Indian Ocean and Western Pacific. However, the 2000 status report also documents some encouraging news. Recruitment of new corals has occurred to some reefs in the Indian Ocean and East Asia, suggesting that sufficient parent corals survived to provide some larvae. It may be years before it is known if the reefs will fully recover, or if the community structure will be changed.

Degradation of coral reefs also affects those human communities that depend on them for their livelihoods through such activities as coral harvesting, fishing and tourism. Understanding human communities and their social and economic conditions and motivations associated with reef use is becoming a major focus within the coral reef monitoring community. In 2000 the GCRMN, in association with the US National Oceanic and Atmospheric Administration (NOAA), IUCN (World Conservation Union), and the Australian Institute of Marine Science published the *Socio-economic Manual for Coral Reef Management*. The manual is intended to help reef managers understand the steps in a socio-economic assessment and provide practical guidelines on how to conduct baseline socio-economic assessments of coral reef stakeholders. The manual will be used to gather socio-economic information in parallel with the biophysical information already collected by GCRMN. Training using the manual has been conducted in South Asia and East Africa, and is planned for Southeast Asia and the Caribbean.

A review of the five-year GCRMN programme will be undertaken in March 2001, with the goal of strengthening the effectiveness and sustainability of the network. The evaluation will be conducted by a team led by Dr Richard Kenchington of Australia.

Bleached coral polyps that have lost their symbiotic algae which, under healthy conditions, would absorb light and turn it into energy for the host coral

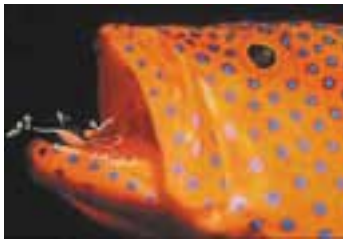
Photo: Ove Hoeg-Guldberg, CMS (Australia)



Insert: Reinhart Dirschel (Germany), silver medal 2000 winner, slides category, Antibes Festival 2000 (pp. 157-158)

The DFID-funded GCRMN South Asia node, under regional coordination by Ms. Emma Whittingham, continues to make progress monitoring the biophysical conditions of reefs and the social and economic condition of reef-dependent communities in India, Sri Lanka and the Maldives. Training has been conducted in socio-economic monitoring techniques and biophysical data analysis and interpretation for staff at national institutions, and pilot demonstration sites have been established in Sri Lanka and the Maldives, with further sites being established in India. A regional database with biophysical and socio-economic data for coastal area management has been developed with input from all three participating countries, and is now being tested prior to implementation.

Tibor Dombovari (Hungary), bronze medal winner, slides category, Antibes Festival 2000



New IOC study group on coral bleaching

In response to the increasing incidents of coral bleaching, a new study group – the ad hoc Study Group on Coral Bleaching and Related Indicators of Coral Reef Health – has been initiated to investigate the underlying physiological causes and the ecological effects of coral bleaching. The objectives are to: (i) develop possible molecular, cellular, physiological or community indicators of coral bleaching that are reliable in their ability to detect stress signals due to changes in variables such as SSTs, PAR, UV radiation, pCO_2 and hydrodynamics; (ii) examine potential mechanisms of corals for adaptation/acclimatization to global environmental change; and (iii) investigate long-term responses of coral reefs to large-scale changes in environmental variables. One of the aims is to use the increased understanding of coral bleaching in the development of predictive models and recommendations for focused management to mitigate the negative effects of bleaching.

The Maldives (Male atoll to the right). Its inhabitants live in uncertainty as they face marine pollution, diminishing fisheries, demographic and touristic development and possible sea-level rise. The surrounding coral reefs, previously a rich food source and a natural physical protection against waves, are under threat. IOC and its partners work to monitor and help protect the coral reefs of Maldives, Sri Lanka and India through the GCRMN South Asia project

Photo: © Yann Arthus-Bertrand/Earth from above/UNESCO

IOC/GLOBEC co-operation

Three new activities were initiated with GLOBEC in 2000, in response to the OSLR Programme Review and the Review of the IOC Ocean Science Section. Consistent with the recommendation of the reviews, these activities are highly interdisciplinary in nature and advance an ecosystem approach for the study and management of living marine resources.

The IOC/GLOBEC/SCOR ad hoc Study Group on Use of Environmental Indicators in the Management of Marine Fish Populations is concerned with how the environment influences the productivity of commercially important fish stocks such as clupeids, and how environmental indices can be used to better manage them. The study group is a subgroup of GLOBEC's Small Pelagic Fishes and Climate Change Programme. This group will review the use of environmental indices for such stocks, develop a framework to understand the role of the environment in fishery fluctuations, investigate how to incorporate the indices in models and management procedures, and propose indices that should be monitored locally and globally. The group will target its studies to West Africa, South America, the Iberian Peninsula and the Oyashio/Kuroshio Currents.

Considering the importance of small pelagic fishes to the economies or many coastal developing states, in June 2000 the IOC offered to host the Small Pelagic Fishes and Climate Change Programme's Synthesis and Training Office. The IOC is in the process of identifying an appropriate secondee to head this office.

The joint SCOR/IOC WG 119 on Quantitative Indicators of Marine Ecosystem Change Induced by Fisheries is an attempt to develop

practical techniques for the implementation of an ecosystem approach to fisheries management. This is a specific response to the OSLR Programme Review, which recommended an ecosystem framework for the IOC's activities with regard to living marine resources. The group will review the state of knowledge with regard to development of indicators and develop new indicators to study marine ecosystems.

Large Marine Ecosystems (LMEs)

During the year 2000, the collaborative efforts of the IOC, IUCN, and NOAA, in coordination with the Global Environment Facility and its international agency partners (UNDP, UNEP, World Bank, UNIDO and FAO), made significant advances in assisting coastal nations toward ecosystem-based assessment and management of these marine natural resources. Through a series of symposia, conferences and workshops, a total of 58 coastal countries in Africa, Asia, Latin America and Eastern Europe reached national and international agreements to proceed with the planning and implementation of Large Marine Ecosystem projects.

Among other notable advances during the year 2000, were:

(i) the development and application of a methodology by the University of British Columbia Fisheries Center to assign the annual FAO reports on fishery landings to specific LMEs and

(ii) the completion of a manuscript describing a consensus approach for Regional, Oceanic, and Global integration of marine fisheries data. The approach allows for the Longhurst global biomes and coastal provinces to be merged with the LMEs, replacing the coastal provinces as large marine ecosystems.

© UNESCO/D. Roger

RV of the National Centre for Oceanographic Research, Nosy Bé, Madagascar

The IOC-IUCN-NOAA Large Marine Ecosystem Consultative Committee Meeting was held 13-14 June 2000 at UNESCO-IOC headquarters. Over 15 marine scientists from ten countries participated in the meeting that made recommendations for future LME activities. This has been a highly successful programme, with over $45m in Global Environment Facility funds now committed for GEF Monitoring and Assessment projects, and an additional $75m pending. Over 50 IOC Member States are now involved in LME monitoring and assessment projects.

The Consultative Committee made several specific recommendations with regard to the IOC's further role in LMEs, including: (i) the IOC Secretariat should help foster collaboration between GEF-supported LME projects and fundamental large-scale marine research underway or planned; (ii) coordination

between LMEs and LMR GOOS be further strengthened; and (iii) the ACC Subcommittee on Oceans and Coastal Areas should take note of the growing number of LME projects among UN Member States, and assist in coordinating the involvement of the UN agencies involved, in LME projects and in promoting the LME approach within the UN system.

Below:
Plankton research equipment. The CPR can be deployed in a towed vehicle from research vessels or ships of opportunity

Images courtesy of Chelsea Instruments (UK), suppliers to SAHFOS activities (http://www.chelsea.co.uk/index.html)

Sir Alister Hardy Foundation for Ocean Science (SAHFOS)

The IOC continued its productive collaborative relationship with SAHFOS in 2000. SAHFOS received $18,000 in support from IOC.
Dr Patricio Bernal was elected to the SAHFOS Management Council, and Dr Ned Cyr and Dr George Grice continued to serve as a SAHFOS Sponsoring Governors.

Census of Marine Life

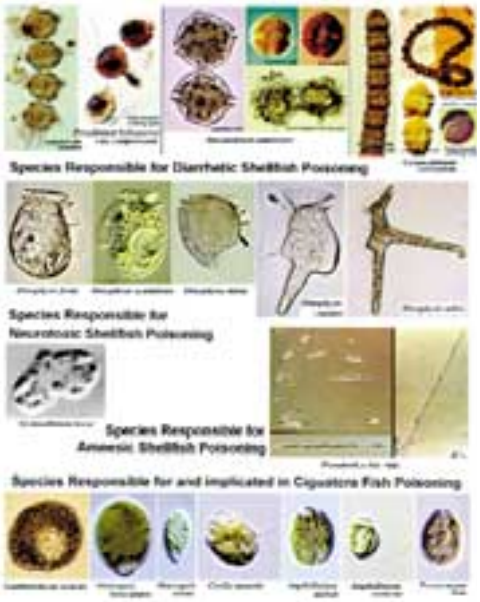
The Census of Marine Life is a developing programme, sponsored by the Alfred P. Sloan Foundation, which aims to investigate the range of life in the oceans. Since 1997, a series of workshops have been held to explore the feasibility of conducting a global census of marine life. The Oceanography Society recently published a special issue of the journal *Oceanography* dedicated to the Census of Marine Life, which reported on these workshops. Among the workshops reported in *Oceanography*, themes included: use of advanced technology for identifying and assessing populations of marine life; new information systems to handle the vast amounts of taxonomic data arising from such an exercise; and methods for prioritizing areas of the ocean to be surveyed. A secretariat for the Census of Marine Life has now been established at the Consortium for Oceanographic Research and Education (CORE), and an international steering committee has been established. CORE and the steering committee will work with the oceanographic community to prepare a report outlining plans for a possible 8-10 year duration of the Census of Marine Life.

The recent progress made toward implementation of the Census was provided to the Thirty-third Session of the Executive Council on June 2000, including the formation of an International Scientific Steering Committee, and the announcement of awards to support development of the Ocean Biogeographical Information System (OBIS). OBIS will underpin the entire Census by providing an enhanced framework for the management of the complex biological and ecological information that will result from it. The Census has the potential to expand significantly our knowledge of the biodiversity in the world's oceans. The programme will contribute to the Living Marine Resources Module of GOOS, providing synoptic information on status of the marine ecosystems, which GOOS can use as a baseline to assess future changes. The Executive Council expressed its support for the Census and recommended the involvement of national focal points in Member States as well as linkage to other IOC programmes, taking into account budgetary constraints and the existing priorities of the Commission.

Harmful Algal Bloom Programme

The objective of the IOC Harmful Algal Bloom Programme is to provide services and capacity building to Member States within Harmful Algal Bloom (HAB) research and mitigation.

During 2000, the activities were focused at follow-up and implementation of the Resolutions of the Fifth Session of the IOC Intergovernmental Panel on Harmful Algal Blooms (IPHAB). This included development of the science plan for the new international IOC-SCOR research programme on the global ecol-



ogy and oceanography of HABs, GEOHAB. The GEOHAB mission is to foster international co-operative research on HABs in ecosystem types sharing common features, comparing the key species involved and the oceanographic processes that influence their population dynamics.

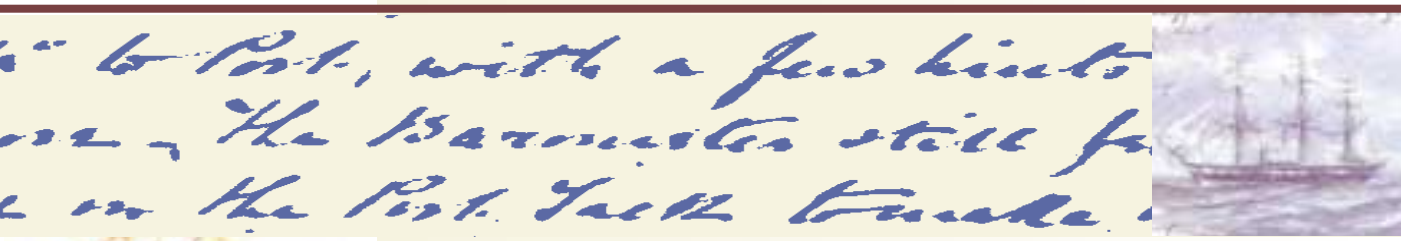
The Science Plan was drafted at meetings of the GEOHAB Scientific Steering Committee in Copenhagen, Denmark, and La Paz, Mexico. GEOHAB is the first international research programme of its kind and will be a significant activity area for the Commission and SCOR for the next 10 to 15 years. The GEOHAB SSC is also charged with the fundraising for, and establishment of, an international project office (IPO) for GEOHAB. France has offered to host the IPO within IFREMER, and complementary funds are sought to be able to establish the IPO.

The ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms, met in Barcelona, Spain, in March. A permanent term of reference is updating of the meta database on Harmful Algal Events, HAE-DAT, which is on-line at the IOC server. The Working Group also examined possible ways of analyzing historical data and fossil records, reviewed scenarios of toxic events developments, considered the role of ICES in the new international programme GEOHAB, examined information on the possible implication of benthic species in toxic events and reporting on induced problems on monitoring procedures, and reviewed a draft IOC-APEC document 'Guidelines on Emergency Measures for Harmful Algal Events'.

Capacity building continues to be a main component of the HAB Programme. The backbone in the implementation of the capacity-building effort is the IOC Science and Communication Centres on Harmful Algae in Copenhagen, Denmark, and Vigo, Spain. The centres allow the IOC to offer training opportunities in close cooperation with institutions internationally recognized for their expertise. The courses at the two centres train 30-40 people annually. There were over 100 applicants for each course. In 2000 the IOC also held an advanced course in toxin detection, in cooperation with the Cork Institute of Technology, Ireland. Within WESTPAC, a HAB species identification course was held in Bangkok in March, and within IOCARIBE the HAB working group (ANCA), held a training course in Mexico. The two IOC HAB Centres are also a mechanism for North-South institutional twinning and cooperative research, and projects are ongoing with countries in South East Asia, Africa and Latin America.

The HAB Programme sponsored the 9th International Conference on HAB, 7-11 February 2000, Hobart, Australia, and will publish the proceedings. This series of Conferences is the main interdisciplinary conference within the HAB field and the IOC is now a longstanding partner.

This page: Training materials and activities of the IOC HAB Programme



The role of IOC in HAB capacity building

By Professor
Øjvind Moestrup
Director of the Botanical Institute University of Copenhagen

Over the last almost ten years, the IOC has systematically offered training courses, workshops and individual training opportunities in identification of potentially harmful algae, quantitative and qualitative algal toxin analysis, and HAB monitoring and management. The IOC has been unique in this respect, and has also implemented HAB training on behalf of other agencies and organizations.

The interest in these capacity-building activities among IOC Member States has been strong and growing. This interest reflects how national HAB monitoring and research has developed in response to an increased need to protect living resources and to comply with regulations for seafood safety in home and export markets.

From the outset it was clear that one basic element in national capacity to monitor and develop HAB mitigation plans is to be able to identify the causative organisms. The very first initiative for IOC HAB training was taken in 1984 in South-East Asia by a then newly established WESTPAC HAB working group. The result was a regional training course organized by Profs. Okaichi (Japan) and Sudara at the Chulalongkorn University, Thailand, in 1985. Shortly afterwards an initiative to organize international IOC capacity building on HABs was taken by the former Danish Delegate to the IOC, Mr Christian Vagn-Hansen in response to the increasing number of HAB reports worldwide, and the broad geographical request for assistance from IOC Member States. It took him several years to convince me that the Botanical Institute at the University of Copenhagen was a natural place to start with international courses in HAB species identification, and that we should try to find the necessary funding. Nevertheless, we were finally convinced, and with the strengthening of the IOC Secretariat with Danish Associate Experts we succeeded in securing the necessary funding. With the support of the Nordic Research Council and with the cooperation of Dr Yasuwo Fukuyo, University of Tokyo, a regional Nordic course was held in Sweden in 1992, and served as a pilot course. In 1993 we obtained funding from DANIDA, and the first international IOC Training course on HABs was held in Copenhagen in 1993.

The HAB training needs of Member States had been identified and documented at an IOC workshop held in cooperation with the Bremen Maritime Training Centre, Germany, in 1992. These results served as an important basis for the formulation of an IOC HAB Training Programme with prioritization of topics. With the formulation of the HAB Programme and its endorsement by the newly established IOC Intergovernmental Panel on HABs, the IOC was ready to expand the number of HAB topics in which courses were offered.

Through close cooperation with internationally recognized research institutions it has over the last ten years been possible to implement

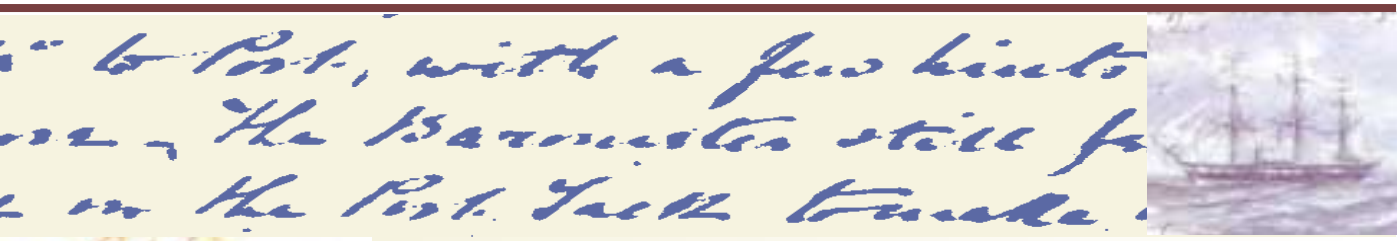
circa 30 HAB training courses. The strong commitment by institutions such as the Universities of Tokyo (Japan), Copenhagen (Denmark), Jena (Germany), Trieste (Italy), the Spanish Institute of Oceanography (Spain), Cork Institute of Technology (Ireland), national funding agencies, and numerous local hosts and assisting lecturers, provides a very nice example of how national institutions have taken responsibility in implementing an IOC programme. The core of the training programme is supported by Denmark and Spain through the IOC Science and Communication Centres in Copenhagen and Vigo, and by Japan through WESTPAC.

The close and continuous partnership between national institutions and the IOC has proven to be beneficial not only to the trainees but has also established networks and friendships that reach beyond the immediate goals of the training programme.

Looking back at the past years, it is reasonable to reconsider what role and what level of impact the capacity-building efforts of the IOC can be expected to have. Certainly, a main challenge in organizing short-term training courses is to select the right 10-15 participants among the typically over 100 applicants. Even with an optimal selection, there will be many trainees that change job shortly after etc. This makes it difficult to directly assess the impact on the institutional capacity building in the respective countries. A questionnaire survey among former trainees (1993-99) showed that around 60% were still working with HABs. The IOC HAB Centre in Copenhagen has since 1998 worked also on another level of HAB capacity building through a cooperative project with Vietnam. The project involves institutional capacity building in relation to research, monitoring, and graduate training. This type of capacity building has proven to be very successful and beneficial to the recipient country. The HAB Centre in Vigo has redesigned its courses to directly provide assistance to countries that wish to comply with EU requirements for HAB monitoring and seafood safety. These types of activities aim at reaching further than providing basic scientific training in species identification, although this skill is still a major and critical component as new species and new toxins are discovered and taxonomy changes. There are obviously many countries that would benefit from such a targeted and individually tailored capacity building to enhance their research, management and educational capacity. Nevertheless, this would require operation and funding at a quite different scale than at present. The critical question is whether the role of the IOC is primarily to provide capacity building in the basic skills within species identification and toxin analysis, including tools such as manuals, guides, inter-calibrations etc, or it should aim at larger scale institutional capacity building through operational projects in individual countries as in the case of Vietnam.

We must evaluate our experience in HAB capacity building and, based on this and the present needs in Member States, formulate an appropriate and feasible strategy for HAB capacity building for the next 10 years. No matter which direction it takes, it will be crucial to success that the IOC expands the network of institutions willing to contribute manpower and resources to the implementation. Based on my experience with the IOC over the past 10 years, I consider long-term partnerships with the IOC as a very good model for capacity building, and I can only recommend that other colleagues and IOC programmes do the same.

1.5 Ocean science in relation to non-living resources



Ocean science and non-living resources, 1960-2000

By Dr Peter J. Cook
Chairman, Committee on Ocean Science in relation to Non-Living Resources (OSNLR) and Executive Director, Australian Petroleum Cooperative Research Centre, Canberra

The progress in marine science over the past 40 years has been extraordinary, almost breathtaking. Nowhere has this been more marked than in our understanding of marine geosciences and non-living resources and in the application of that knowledge to the exploitation of resources.

It is perhaps worth recalling our state of knowledge of the ocean floor and its resources in 1960. At that time there was speculation about the possibility of continental drift and of the sea floor spreading but most such ideas were dismissed as idle speculation. The development and acceptance of the theory of Continental Drift, which was to so profoundly affect our understanding of oceans and their evolution, was still some years off. Our knowledge of the ocean floor was still quite rudimentary but the development of seismic and magnetic techniques had started to reveal some of the diversity of the ocean basins and their sediments. Submarines and dedicated new oceanographic vessels had started to collect new types of data and a few primitive computers were starting to be employed to analyze that data. Most of the impetus for this work arose not from scientific curiosity but from the rivalries of the Cold War, which in the 1960s, were at their height. In 1960 the exploitation of offshore non-living resources had hardly started. There was some small-scale offshore dredging for tin and gold and a small amount of sand and gravel was being dredged from shallow depths in the North Sea. People were starting to speculate about the potential value of manganese nodules. There were a few offshore oil and gas wells in the near shore zone in places such as offshore Louisiana and in the Persian Gulf but neither the technology nor indeed the economic impetus were there to encourage the explorers to extend their search in more than a few metres of water.

Also, in 1960 cooperation in the marine geosciences was limited and our knowledge of the ocean floor was rudimentary. Because of the constraints of the Cold War large areas of the ocean floor were 'off limits' and much valuable scientific information was regarded as secret. For example, a large amount of bathymetric information so vital to our understanding of resource distribution was classified as secret. The founding of the Intergovernmental Oceanographic Commission (IOC) in 1960 was to play an important part in helping to change this climate of secrecy and non-cooperation.

The General Bathymetric Chart of the Ocean (GEBCO) was initiated in 1903 but it was only under the auspices of the IOC and the IHO,

after 1960, that GEBCO was able to collect up-to-date worldwide datasets and attract eminent marine geologists and geophysicists to contour the maps and produce new charts. The outstanding set of 5th edition GEBCO charts produced between 1975 and 1982 and subsequently the digital charts, are a wonderful example of the benefits of international collaboration in the marine sciences that would not have been possible without the IOC. Similarly the setting up, by the IOC, of the International Oceanographic Data Exchange (IODE) has provided scientists with ready access to geological and geophysical information of direct relevance to marine mineral resources. The role played by the IOC in fostering marine research collaboration between nations and facilitating free access to the world's oceans for research has been especially notable resulting in not only enhanced knowledge but also transfer of knowledge and expertise between nations.

In part, through the effort of the IOC the legal and scientific framework for the delineation of the Continental Shelf has evolved to the stage where we now have the United Nations Convention on the Law of the Sea (UNCLOS), one of the most important international treaties ever established, providing a firm, sensible and equitable basis for marine resource development and conservation of the marine environment. The IOC's role in providing advice to the United Nations has helped to establish a strong scientific base for the Convention. In a fitting tribute in 2000 through Oxford University Press, the IOC and the IHO produced the definitive volume *Continental Shelf Limits: The scientific and legal interface*, (See page 141).

The burgeoning in knowledge of the oceans and their non-living resources over the past 40 years has been astounding and the IOC has been a key element in those developments but, of course, many of the developments have been driven not by scientific curiosity but by the search for new mineral resources. However, this commercial impetus in no way diminishes the scientific importance of results obtained from exploration programmes, surveys and drilling activity. What we have also witnessed over the past 40 years has been the increasing use of airborne and satellite systems for the obtaining of ocean data including information very relevant to non-living resources, such as satellite-based gravity, magnetics and altimetry.

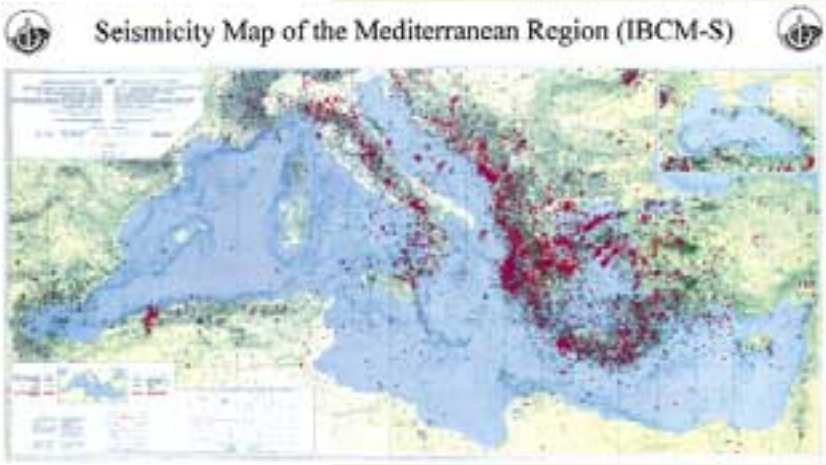
So, what has been the impact of all this on our knowledge of offshore mineral and energy resources and their exploitation? Undoubtedly the offshore resource that has undergone the greatest change in terms of exploitation is oil and gas. Whereas 40 years ago, exploration and exploitation were primarily undertaken in the near-shore zone in very shallow waters, they now routinely extend hundreds of kilometres offshore and in water depths of 1,000 metres or more.

The same advanced drilling technologies developed by the oil companies have been used in scientific ocean drilling. Undoubtedly the largest and most important marine geoscience research programme in the past 40 years has been the Ocean Drilling Programme (ODP) and its precursor, the Deep Sea Drilling Programme (DSDP). Drilling in water depths to 6500 m and to depths below the seabed of 2500 m by DSDP-ODP has given extraordinary insights into the evolution of the oceans of the past 150 million years or more and has enabled us to understand how non-living

GEBCO set, 5th edition.
See article starting on page 65

resources have accumulated on and below the sea floor.

However, it is not only commercial drilling techniques that have provided new scientific insights. The enormous improvements in seismic techniques over the past 40 years (again, developed by and for the oil industry) have provided an extraordinarily detailed picture of patterns of marine sedimentation. Whilst this information has been of crucial importance to petroleum exploration, it has also made it possible to develop a picture of sea-level change that in turn provides us with a picture of past climate change extending over many millions of years. It is important to be able to see these long-term climatic trends and to be able to separate out natural from anthropogenic change. The marine record helps us to do this. However, the patterns of sea level change have also led to a new understanding of what is now called sequence stratigraphy relating sea level change to the large-scale geometry of sediments. This, in turn, has become a key exploration tool for the oil industry. Modern seismic techniques have also enabled us to discover methane hydrate, or clathrate, which are now known to underlie large parts of the ocean floor and may constitute a major energy resource for the future.



For map information, contact:
d.travin@unesco.org

Exploration for, and exploitation of, some offshore mineral resources has also increased over the past 40 years. Expansion of offshore sand and gravel extraction, particularly off Western Europe, increased markedly for a number of years before recognition of the adverse impact that offshore mining was having on fish spawning areas. Production of offshore diamond resources on the southwest African continental margin climbed dramatically during this period. However, many other offshore mineral resources have yet to realize their potential.

In the 1960s, manganese nodules (now more commonly known as polymetallic nodules) were seen as a very important resource of the future. Large areas of the ocean floor were prospected for manganese nodules and the likelihood of exploiting these nodules was one of the early drivers for UNCLOS. However, the reality has been that cheap onshore mineral resources continue to be found and there is little prospect of marine manganese/polymetallic nodules being mined commercially in the near future. The same goes for offshore phosphate deposits. Placer minerals (rutile, zircon, ilmenite, gold, tin, etc.) continue to be extracted from the beach zone, and estuaries, but there is essentially no continental shelf mining activity. In no small measure the lack of mining activity, particularly in the near-shore zone, is a consequence of recognition of the importance of this zone to humankind, not as a place from which to extract resources but as a place in which to live and play and grow our food. The IOC has played a major role in studying issues such as coastal erosion and marine

pollution over the past 40 years, particularly in developing countries. The training and education offered through IOC programmes, such as OSNLR (Ocean Science in relation to Non-Living Resources), has been at least as important as the research and surveying programmes. Training and education have enabled developing countries to build up a cadre of people that enable these countries to carry out their own assessments of their offshore resources and who also are able to participate on an equal footing with other scientists on international cruises or on international research programmes.

In conclusion, over the past 40 years the IOC has played a very important role indeed in our understanding of geology of the oceans and marine mineral resources. It has also been a key player in strengthening the scientific and legal interface that has been so vital in the establishment of a viable regime for UNCLOS, the most important international treaty of the past 40 years.

Marine science for integrated coastal area management (ICAM) 1.6

Since its establishment in 1998, the IOC programme on Marine Science for Integrated Coastal Area Management (IOC/ICAM) has continued to develop its activities and established successful cooperation with international and regional partners. The programme objectives are to promote the use of science at all steps of the ICAM process, and link the natural scientific data to provide indicators based on the integration of different scientific disciplines. In pursuing these goals, IOC/ICAM aims to provide the necessary integration and dialogue between the various actors dealing with ICAM through partnership with other organization, research agencies, NGOs and government agencies, representing other strengths such as social science input, fisheries management, awareness building, land-sea interaction, watersheds and hydrology.

In 2000, the following activities can be highlighted:

LOICZ Basins project

Following the LOICZ Workshop on Global Island States and the Caribbean (held during the LOICZ Open Science Meeting in Bahía Blanca, Argentina, 15-18 November 1999), IOC/ICAM and the Land-Ocean Interaction in the Coastal Zone Project of IGBP are complementing their work in the field of interdisciplinary science addressing and linking the physical, biogeochemical and human dimensions of coastal processes and changes. IOC is supporting the LOICZ BASINS approach in South America, the Caribbean and Africa (SAMBAS, AFRIBAS). This approach focuses mainly on the development of regional project proposals for demonstration sites, using the holistic approach of watershed management and the application of critical load indicators for the needs of coastal managers.

The LOICZ Basins project identifies classes or defined types of coastal sea and river systems and describes the interaction and change through qualitative or semi-quantitative indices of drivers and pressures applied to a catchment scale. These in reverse can be linked to

classes or types of state changes observed in the coastal zone. The latter refers to biogeochemical but also biological state parameters and may also encompass changes in human use such as sediment increase affecting the aquacultural sector, for example.

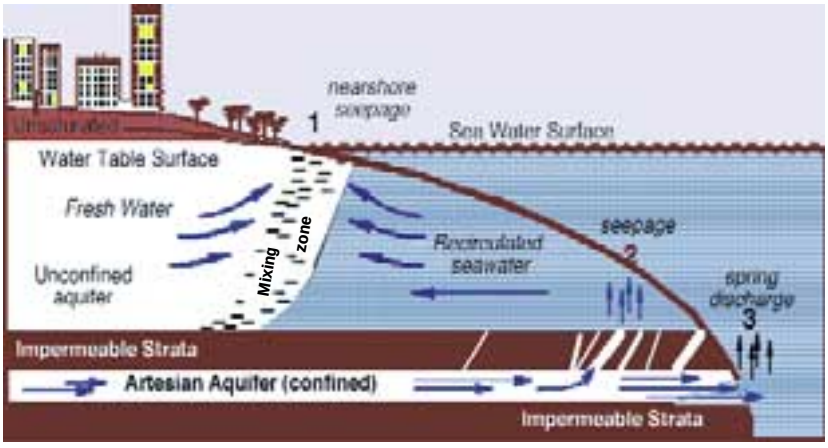
With regard to the exploitation and application of science, the issue-driven and human dimensions-oriented character of BASINS investigations on catchment or island scales and related coastal zones, have an implication for coastal zone management. BASINS results, particularly through looking into response (i.e. policy and management response to coastal change), may also fertilize the discussion on more local management needs dealing with catchment-coast interaction issues or classes of these. Especially when the time elapsing between at least two investigations at the same location is recognized, response investigations provide insight into how society acknowledges the Pressure - State-change and Impact relation and how this reflects in either success or failure of sustainable coastal use and management.

Submarine Groundwater Discharges (SGD) project

Increasingly, groundwater is being recognized as a potentially significant – but still poorly quantified – source of nutrients and other dissolved elements to coastal ecosystems. It is now recognized that groundwater discharge may be an important pathway for diffuse pollution to enter the coastal zone where coastal aquifers have become contaminated by septic systems or other pollution sources. Submarine groundwater discharges is a process that occurs across the land-sea interface, and spans different scientific disciplines as well as environments. Seawater intrusion has traditionally been a subject for hydrologists, while oceanographers are more interested in SGD. However, it is clear that seawater intrusion into terrestrial aquifer systems and SGD are closely linked processes that directly affect each other.

In order to further understand these processes, IOC/ICAM is co-sponsoring a project on the assessment and management implications of SGD into the coastal zone. This is a five-year programme aiming to: (i) develop, test, and standardize methodologies for assessment of submarine groundwater discharge (SGD) into the coastal zone; and (ii) evaluate the management implications of SGD and provide appropriate training for coastal zone managers via ICAM. A central part of this is to define and test the most appropriate assessment techniques through carefully designed intercomparison experiments.

Five sites that span a broad range of conditions will be selected for the intercomparison. One experiment will be run per year for a five-year period. Systematic intercomparison exercises will be conducted which will involve as many methodologies as possible. The first intercomparison was performed at Cockburn Sound in November 2000, located in the southwest margin of continental Australia,



Diagrammatic view of the relationships between coastal aquifers, seawater, and groundwater discharge. Three types of submarine groundwater discharge are illustrated: (i) near-shore seepage, (ii) offshore seepage and (iii) submarine springs.

Burnett, W.C., M. Taniguchi, and J. Oberdorfer, 2000. Measurement and significance of the direct discharge of groundwater into the coastal zone. *Journal of Sea Research*, (submitted)

near metropolitan Perth and Fremantle. Cockburn Sound is a marine embayment protected from the open Indian Ocean by reefs, a chain of islands including the dominant Garden Island, and a man-made causeway. The programme is also sponsored by the Scientific Committee on Oceanic Research (SCOR) and the Land-Ocean Interactions in the Coastal Zone (LOICZ) Project of IGBP, as well as the International Hydrological Programme (IHP) of UNESCO.

Regional ICAM Activities

ICAM consultation in the IOCINDIO region

IOC/ICAM organized a Regional Workshop on Integrated Coastal Area Management, including Marine Pollution, in Tehran, Islamic Republic of Iran (19-21 February 2000) back to back with the IOCINDIO-III Regional Committee meeting. The Workshop was attended by experts (*see adjacent photo*) from Bangladesh, Canada, India, Islamic Republic of Iran, Kuwait, Qatar, Sri Lanka, and Thailand as well as representatives from IOC, IOMAC, and ROPME. The Workshop recommended that, as a first step, a broad regional strategic ICAM action plan should be formulated and invited IOC, through the IOCINDIO Committee and the IOC/ICAM programme, to take steps for its formulation by organizing regional experts consultations. The Workshop also recommended the necessity of designing specific demonstration projects (for example on coastal megacities, and the vulnerability of the Persian Gulf to oil pollution) with a view to develop methodology in the ICAM process, taking advantage of emerging new science and technology (including ICAM tools and techniques). Following the IOCINDIO Workshop, IOC and ROPME signed a Memorandum of Understanding calling for strong co-operation in the implementation of an ICAM regional work plan.

ICAM conference for Russia and CIS countries

In the context of the cooperation with the International Geographic Union and the Oceans 21 programme, IOC/ICAM cosponsored the International Conference on ICAM and its Integration with Marine Sciences (Saint Petersburg, Russia, 25-30 September 2000). The purposes of the Conference were to consider the experiences from Europe in applying the ICAM approaches and integrating marine science research into the coastal decision-making as well as how to best transfer these experiences into management practices of Central and Eastern Europe and CIS countries.

ICAM workshop in Tehran

One hundred thirty participants, representing twenty countries, took part in the Conference. They emphasized the special importance of acquaintance of administrative, managerial, economic and scientific circles of the Central and Eastern Europe and CIS countries with the global practice of development and implementation of the ICAM approaches and pro-

grammes as well as with the role of the marine sciences in this process. The lack of experience of activities in the market economy conditions and the deficiency in the practical use of scientific research results, including in marine sciences, are characteristic for the countries with economies in transition. A possibility to use international achievements in these fields is considered to be an important immediate challenge.

The Conference provided an opportunity:
(i) for the scientists and experts from different countries to exchange their experience in the preparation and implementation of projects in the ICAM field at national and international levels, as well as for the scientists and experts from countries with transition economies to become acquainted with new developments in Western countries;
(ii) to consider the state of the adaptation and implementation of the ICAM methodology in Russia, both at federal level and in various regions; and (iii) to develop the recommendations aimed at the support of certain international and national activities in the ICAM field. The proceedings of the conference will be published in 2001.

Dakar (Senegal). Coastal megacities are a concern of IOC-ICAM

Photo: UNESCO

Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa project

Together with the Advisory Committee on Protection of the Sea (ACOPS), IOC has launched a Global Environment Facility (GEF) Medium-Sized Project (MSP) on Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa. The project, the goal of which is to assist sub-Saharan countries in achieving sustainable management of their coastal and marine environment and resources, was developed in response to resolutions of the Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM, Maputo, 1998) and of the Cape Town Conference* (1998). The Global Environment Facility will provide the core funding, with co-financing from ACOPS, IOC of UNESCO, UNEP, UNEP/GPA, United Kingdom, United States of America, and the participating countries from Africa (Côte d'Ivoire, Ghana, Kenya, Mozambique, Nigeria, Seychelles, and South Africa). The participation of additional countries is being sought.

The specific objectives of the project are to:
(i) identify areas, sites or living resources of regional and global significance that are suffering measurable degradation (i.e. are hot spots);
(ii) determine the sources/causes of this degradation and the associated scales of impact (national, regional and global) to provide a basis for calculating incrementality at regional and extra-regional scales;
(iii) identify areas, sites and resources of regional significance that, although not currently degraded, are threatened with future degradation either because of the

* Capetown Conference on Co-operation for the Development and Protection of Marine and Coastal Environment in sub-Saharan Africa

sensitivity of the receptor or the magnitude of the activity posing the threat; and

(iv) determine, through causal chain analysis, the fundamental socio-economic causes of the damage or threat posed, and design a programme of interventions addressing problems of regional priority that may be presented to the Partnership Conference*.

The methodology used to carry out this analytical task was developed by the Global International Water Assessment (GIWA), but was adapted and simplified for use in Africa. The national assessments resulting from phase I of the project will be used to develop a Programme of Intervention, based on regional and national priorities, to be presented to potential donors at the Partnership Conference*, tentatively scheduled for September 2002. The implementation of the project started with the organization of the first Workshop on the Protection and Development of the Marine and Coastal Environment in Sub-Saharan Africa (5-7 December 2000, Paris). IOC and ACOPS are coordinating the implementation of the project.

Training and Education in ICAM

ICAM training for the Mediterranean

IOC organized, in partnership with the University of Nice-Sophia Antipolis, an advanced course on Mediterranean Integrated Coastal Area Management, held in Nice (France), 4-15 September 2000. This bilingual French/English course was supported by the European Commission (DG-XII), UNESCO and the Provence-Alpes/Côte d'Azur Region, and also received the patronage of IGU (Oceans 21 Programme). It was oriented toward: (i) the 51 participants from 20 countries, mostly of 3rd cycle university level and mainly from Europe and (ii) those participants from countries of the Mediterranean Basin, consisting of graduates from universities and engineering schools, and (iii) professionals from the public and private sectors already or potentially involved in coastal management. Twenty-seven lecturers, mostly from the Mediterranean countries, acted as instructors (See photo p.130).

The main objectives of the course were to:

(i) provide participants with comprehensive basic data on natural processes, environment/development interactions and their possible evolution in the Mediterranean Basin;

(ii) sensitize participants to the impact of human activities on the marine environment and to the societal challenge of sustainable development;

(iii) incite the course participants to contribute in the future in activities helpful for sustainable coastal zone management;

(iv) complement course lectures with practical examples of coastal environmental management observed directly on the field;

(v) consider the Mediterranean Basin as a geographic entity in which environment/development interactions have to be integrated in a whole system submitted to the anthropic pressure from all riparian countries; and

(vi) establish links between participants and lecturers of different countries, involved in a Euro-Mediterranean MICAM 2000 network of ability in the field of coastal environment protection to be developed in the future.

* Partnership Conference for the Development and Protection of Marine and Coastal Environment in sub-Saharan Africa

Other training activities organized in collaboration with IOC/ICAM include:

- Summer Course on 'Processes in the Coastal Zone: Links to Management Issues', 3–14 July, CNR Conference Centre, Bologna, Italy
- Training Programme in Modelling and Monitoring of Coastal Marine Processes (MAMCOMP-2000), New Delhi, 6–17 November, 2000, organized by the Indian Institute of Technology, Delhi, India
- 2000 Summer Institute in Coastal Management, 29 May–23 June, 2000, Coastal Resources Center, University of Rhode Island, USA

Information Dissemination on ICAM

In 2000, IOC/ICAM continued its support to the development of the Global Web Service for Integrated Coastal Management, jointly with NOAA, University of Delaware, the UNEP GPA Coordination Office and the World Bank. The GWS can be found at: http://icm.noaa.gov/
The IOC/ICAM Web site can be found at the following URL: http://ioc.unesco.org/icam/default.htm

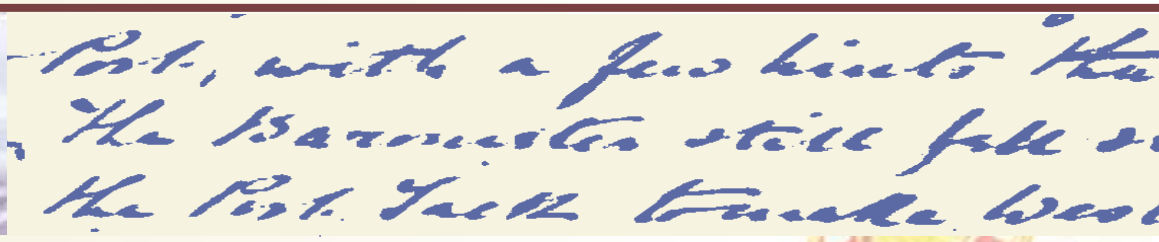
New Publications in 2000

IOC Manuals and Guides, 38

One of the goals of the IOC/ICAM programme is to develop manuals, procedures and guidelines, which would provide guidance to coastal scientists and managers, and enable them to build scientific research, investigation and operation techniques into the ICAM process. In 1998, in co-operation with the Indian Ocean Commission (PRE-COI/UE), IOC published a *Sensitivity Atlas of the Shallow Water of Mahé* (Seychelles). We received several requests and enquiries regarding the methodology used for the production of such an Atlas. As a result in 1999, IOC together with PRE-COI and IFREMER (France), initiated the production of a concise methodological guide for the mapping of shallow coastal areas. The Guide is illustrated by case studies from the Indian Ocean, and describes the methodology available for the zoning of coastal areas, which is cost-effective and transferable to other coastal regions.

IOC Manuals and Guides, 40

Shoreline change is a widespread environmental problem in the West Indian Ocean Region that affects all the region's coastal countries (Somali, Kenya, Tanzania, Mozambique and South Africa), and the Island States (Madagascar, Comoros, Mauritius, Reunion-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 a pool of scientists from the region with support from IOC and SIDA (Sweden), 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 Guidelines have been circulated within and outside the region. The final guidelines were published in 2000. Special attention was given to the need to produce a document that is useful to both coastal practitioners and scientists.



An overview of GIPME

By Dr J. Michael Bewers
Chairman, Global Investigation of Pollution in the Marine Environment (GIPME)

The Global Investigation of Pollution and the Marine Environment (GIPME) is an international cooperative programme of scientific investigations focused on marine contamination and pollution. It was established in 1976 in response to the recommendations of the United Nations Conference on the Human Environment, Stockholm 1972. The programme has been co-sponsored by the Intergovernmental Oceanographic Commission (IOC), the United Nations Environment Programme (UNEP) and the International Maritime Organization (IMO). The International Atomic Energy Agency (IAEA) has also been a partner in several aspects of the programme through participation by the IAEA's Marine Environment Laboratory (MEL) in Monaco.

The Comprehensive Plan for GIPME was published in 1976 by IOC (IOC Technical Series n° 14). It proposed a systematic approach to determining the extent of marine pollution and the formulation of control measures through a set of discrete, sequential and iterative procedures. Implicit in the Plan was the use of mass-balances for evaluating the extent of contemporary marine contamination and the combination of contamination and biological effects data for determining the extent of marine pollution (i.e. adverse effects consistent with the long-standing GESAMP definition of the term 'pollution'). A compatible approach was advocated for potential marine contaminants in which characterization of their hazards is combined with predictions of the effects of exposure to infer threats of pollution. The term 'contamination' applies to the presence of contaminants in the marine environment but without presumption regarding the significance of associated effects.

In 1984, a contemporary re-evaluation of the Comprehensive Plan for GIPME was undertaken. This resulted in a revised strategic and operational framework for the subsequent implementation of the programme (IOC Technical Series n° 25, 1984). By that time the programme had assumed a relatively well-developed structure with core activities centered on the topics of contaminant measurement technology and standardization, marine contamination by chemicals and associated biological effects. This was reflected by the titles of the two GIPME Groups of Experts – one on Methods, Standards and Intercalibration (GEMSI) and the other on the Biological Effects of Pollutants (GEEP). Soon thereafter this substructure was further revised with GEMSI devolving analytical standardization issues to a newly established Expert Group on Standards and Reference Materials (GESREM).
GIPME had considerable success assisting

in the development, proving and standardization of sampling and analytical techniques at an international level, partly in cooperation with the International Council for the Exploration of the Sea (ICES) and the IAEA Monaco Laboratory. GIPME interacted with the UNEP Regional Seas Programme in the development of methods, the preparation of methods manuals, the conduct of analytical intercalibrations and the design and execution of marine pollution monitoring projects. During the period 1986-2000, GIPME completed a contaminant baseline survey of the Atlantic Ocean. The results of this latter survey have been published in the scientific literature. [See special issues of *Marine Chemistry* (Vol. 49, 1995; Vol. 61, 1998) and *Deep Sea Research* II (Vol. 46, No. 5, 1999)]. Through GIPME, significant contributions were made to GESAMP activities, most recently two GESAMP assessment reports *A Sea of Troubles: Issues in Focus* (GESAMP Reports and Studies, nº 70, scheduled for publication in 2001) and *Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environments* (GESAMP Reports and Studies, nº 71, scheduled for 2001). The former of these reports is a summary of the state of the marine environment for a general or public audience while the latter specifically assesses the needs of the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities (GPA-LBA), adopted in 1995. GIPME has also been involved in the development of the Health of the Oceans (HOTO) Module of the Global Ocean Observing System (GOOS). Recent GIPME activities include the development of indicators of the health of benthic communities, the preparation of 'Guidance on Assessment of Sediment Quality Guidelines' (19 pp., IMO, 2000) and the application of Rapid Assessment techniques for Marine Pollution (RAMP).

In 1997, the 19th IOC Assembly adopted Resolution XIX-4 that fundamentally changed the manner of GIPME implementation, disbanding GEMSI, GEEP and GESREM and clarifying the relationship between GIPME and HOTO. This decision necessitated a detailed re-evaluation of ocean science activities within GIPME, particularly its objectives and modus operandi. The previous GIPME Strategic Plan (IOC Technical Series nº 25,1984) had primarily addressed the issue of 'pollution' from the perspective of the introduction of substances into the marine environment. A major change in scientific perspectives on marine environmental protection has been a growing recognition that the greatest threats to the ocean environment do not always stem from the anthropogenic mobilization and release of chemicals. Other human activities, such as physical alterations to coastal and hydrological environments are, at least locally, as – or more – important. Furthermore, the ubiquity of human influences frequently makes them the causes of marine degradation of widespread, even global, significance. Thus, the concept of marine pollution needed to be revised to encompass all aspects of the adverse effects of human activities on the marine environment, its resources and amenities.

New perspectives in marine environmental protection demand similar integration in science as in management. The challenge for marine environmental research is to formulate direct links between root causes and effects and to identify informative indicators of

history

environmental state. For example, the issue of effects of increased nutrient influxes on ocean ecology encompasses the study of fluxes through ocean boundaries, ocean physics, and chemical-biological interactions in relation to nutrient uptake and regeneration, carbon cycling, and associated oxygen demand. The subject relates to eutrophication, harmful algal blooms, hypoxia, species composition and community structure as well as changes in ocean chemistry. Tackling such topics necessitates interdisciplinary science approaches aimed at understanding the coupling of physical, chemical and biological processes and ecosystem dynamics. It is therefore thought desirable that IOC activities regarding protection of the marine environment should increasingly be organized along interdisciplinary lines.

GIPME AND RELATED ACTIVITIES IN 2000

Restructuring GIPME

A progress report on the restructuring of the GIPME Programme was provided in 2000 to the Thirty-third Session of the IOC Executive Council. The Council was informed that the restructuring process constitutes an attempt to align the scientific activities of GIPME more closely with contemporary international policy interests and emerging interdisciplinary scientific priorities. It was proposed that the overall focus of the Programme should be on anthropogenic activities (aside from those involving climate change, habitat destruction and fisheries) causing, or likely to cause adverse effects in the marine environment, its resources and amenities, and associated threats to human health (i.e., those arising from exposures to the marine environment or the use of resources obtained therefrom) and that the scientific components of core activities of the Programme be identified within two core activity envelopes: Transport, cycling, fate and effects of contaminants; and Indicators of marine environmental condition and effects. Such a focus can respond to contemporary demands in a number of areas and programmes, to which GIPME could legitimately provide advice and information, required protocols and approaches for diagnoses and prediction of state, trends and vulnerability of marine systems and/or areas which are of concern to governments regarding damage and threats to the marine environment to be addressed by IOC. The Executive Council commended the adoption

of a broadened and interdisciplinary approach in addressing scientific issues of marine pollution and requested the final proposal be made to the Twenty-first Assembly with a view of its endorsement and adoption at that time.

Directly above: Drawing by Manta R. Jain (India), 15 years old, for the International Year of the Ocean

IOC ad hoc Benthic Indicator Group (BIG)

The BIG was established in 1999 with the following objectives: (i) to develop recommendations for a suite of globally applicable indicators of benthic ecosystem health; (ii) to demonstrate the effectiveness of the technique(s) in test data sets; and (iii) to promote the use of these indicators by a broad user community. The Group emphasizes in its work plans the importance of the third goal and plans to utilize an internet-based approach as an efficient mechanism to disseminate its recommendations and products. BIG's efforts are based on existing data sets. A working principle of the Group is that indicators can encompass both: (i) efforts to identify a threshold in a specific variable indicative of degraded versus non-degraded conditions, or (ii) data-analysis techniques useful in detecting patterns of stress. Furthermore, although an individual indicator may be useful, multiple indicators may be needed to accurately predict adverse effects in the benthos. By 'benthic health' the macrobenthos is implied; however, because of their trophic importance and demonstrated sensitivity as indicators of stress, meiofauna may be included in future analyses (e.g. perhaps on a limited case-study basis, where good data sets are available).

The Group held its second meeting, 10-12 May 2000 in Paris. By utilizing data available from the Southeastern United States, the northern Black Sea, the eastern Mediterranean Sea, and the Seto Inland Sea in Japan, substantial progress has been made in the testing of an initial approach of using Total Organic Carbon (TOC) as an indicator of benthic ecosystem health (IOC Technical Series, 57). Preliminary comparisons of benthic and other abiotic environmental variables (e.g. eutrophication, heavy metal contaminant levels, Eh) across different ranges in TOC concentration suggest that it may be possible to identify TOC thresholds that could serve as indicators of high versus low risks of benthic impacts and related sources of stress. Exact values of thresholds vary among regions and choice of variable. However, there are some basic similarities in their patterns that appear to support a general classification scheme. The meeting welcomed the additional data that will be made available to the Group from the Northeast Atlantic Ocean, the North Sea

(near oil rigs), coastal waters of the United Kingdom (associated with sewage, sludge, and waste disposal), Massachusetts Bay and the Boston Harbor.

It was agreed by the Group to consider at its next meeting in 2001: revisions to the list of benthic indicators, analysis of the combined data to recommend global TOC benchmarks, how to disseminate the group's information, and preparation of a journal article.

GIPME and the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)

IOC continued in 2000 to contribute, through GIPME, to the activities of GESAMP, particularly to the activities of the GESAMP Working Group on Marine Environmental Assessments (MEA). Two reports prepared by the MEA Working Group were adopted by GESAMP at its XXXth Session, held in May 2000 in Monaco. One of these reports is entitled *A Sea of Troubles; Issues in Focus* and deals with the state of the marine environment, addressing current major issues and emerging problems. The second report is entitled *Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment*. It addresses, in particular, the assessment needs of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA). These reports have been peer-reviewed by more than 70 experts worldwide. They are expected to be published sometime in 2001 and planned to be disseminated widely to the Governments, international organizations and the marine environmental management community (See also Section 6.1, p. 136).

GIPME and JGOFS/LOICZ/IOC Continental Margins Task Team

The Joint Global Ocean Flux Study (JGOFS) has successfully finished its ten-year observation phase and is now beginning a programme of synthesizing the collected data. One of these synthesis activities is to assess the contribution of continental margins and seas to CO_2 sequestration and the horizontal flux of carbon, nitrogen and phosphorus across the ocean/continental margin boundary. Many recent regional studies on continental margin biogeochemistry suggest that cross-shelf transport probably influences the carbon cycle of the ocean as a whole, and that the margins constitute an important, but often neglected, link in the global carbon cycle. For this synthesis activity, JGOFS has formed the Continental Margins Task Team. The activities of the Team include identification of major gaps and uncertainties in the current understanding of continental margin carbon, nitrogen, and phosphorus fluxes, assessment of anthropogenic influence on these fluxes and recommend priority needs for observational and modelling efforts. As of November 2000, IOC (through GIPME) began supporting this initiative jointly with LOICZ.

Drawing by Atok Kosbitnath Sabn, India, 14. Winner of the poster contest organized for the International Year of the Ocean

Reviews of IOC Ocean science programmes: towards restructuring 1.8

Pursuant to a request from the 20th Session of the IOC Assembly in 1999, the IOC Executive Secretary commissioned a group of experts to review its Ocean Sciences Programme. The request from the Assembly specified that the group of experts should review the framework of the existing ocean sciences programmes of the IOC in light of new developments and requirements in ocean science and identify new approaches for the IOC to meet the evolving aspects of interdisciplinary ocean science, with a view to bringing benefits to Member States. The review group met in May 2000 and, in a report submitted in October 2001, concluded that there was a need to restructure the Ocean Science Section to provide more appropriate alignment of activities. The review group recognized three natural groupings of activities in the realm of the Ocean Science Section that fall within the Global Ocean System, Coastal Environment System, and Integrated Management System. It proposed the retirement of the names OSLR (Ocean Sciences in Relation to Living Resources) and OSLNR (Ocean Sciences in Relation to Non-Living Resources) and a restructuring of all activities within the Ocean Science Section into these three new components.

The 31st Session of the IOC Executive Council instructed the Executive Secretary of the IOC to convene a meeting of experts to review the Ocean Sciences in Relation to Living Resources (OSLR) Programme. This review was undertaken in the latter half of 2000 and a first draft of the review was submitted to the IOC Secretariat in December 2000 (to be followed by a final draft in February 2001). This review examined the range of IOC activities within the OSLR programme and a wide variety of international scientific programmes of other agencies, some linked to IOC activities and some not. The principal conclusion of this review is that future OSLR activities should be based on an ecosystems approach.

In the context of these reviews, a further initiative relating to the nature and organization of ocean science activities of the IOC is relevant. During the 19th Session of the IOC Assembly in 1997, a decision was made to revise the manner in which the Programme of Global Investigations of Pollution In the Marine Environment (GIPME) was conducted. A result of this decision was a requirement to restructure the GIPME programme to achieve improved alignment with current international and national marine pollution issues. A first draft of a restructuring plan was prepared and subsequently presented in summary form to the 31st Session of the IOC Executive Council in June 2000. The principal recommendation of the plan was that the scientific components of core GIPME activities be identified within two core activity envelopes: 'Transport, cycling, fate and effects of contaminants', and 'Indicators of marine environmental condition and effects'. During the ensuing discussion some suggestions were made for revisions of the scientific activities proposed to form the main focus of GIPME activities in the future. It had been intended that a revised proposal for GIPME restructuring would be prepared and submitted to the 21st IOC Assembly. However, in the light of the conclusions of the reviews referred to previously, it was considered preferable by the IOC Secretariat to develop a proposal for top-down restructuring of the entire Ocean Science Section and submit it for endorsement to the 21st Session of the IOC Assembly.

1.9

CONFERENCES AND MEETINGS IN 2000

GESAMP Working Group on Marine Environmental Assessment	The Hague, The Netherlands	31 Jan.-4 Feb. 2000
9th International Conference on Harmful Algae, HAB 2000	Hobart, Australia	7-11 February 2000
Meeting of the Joint Scientific Committee of the World Climate Research Programme (WCRP-JSC)	Tokyo, Japan	13-17 March 2000
ICES-IOC Working Group on the Dynamics of Harmful Algal Blooms, CSIC	Barcelona, Spain	21-24 March 2000
Joint Global Ocean Flux Study – CO_2 Panel and Symposium (JGOFS CO_2)	Bergen, Norway	April 2000
GESAMP XXX	Monaco	22-26 May 2000
ICRI CPC	Noumea, New Caledonia	27-28 May
3rd International Conference on Molluscan Shellfish Safety (IOC co-sponsored)	Southampton, UK	19-24 June 2000
Meeting of the Scientific Steering Group of the Climate Variability and Predictability Programme (CLIVAR-SSG)	Honolulu, USA	1 – 5 May 2000
Meeting of the Group of Experts on the demonstration project for great river basins and coastal areas	Novgorod, Russia	May 2000
IOC Ocean Science Programme Review	Paris, France	30-31 May
IOC-SCOR Scientific Steering Committee for GEOHAB	Copenhagen, Denmark	1-4 June 2000
IOC OSLR Programme Review	Paris, France	17-18 July
First Session of SCOR-IOC Advisory Panel on Ocean CO_2	Paris, France	4-6 September 2000
EC-US Workshop on Ocean CO_2	Paris, France	6-8 September
Leadership Seminar on Mediterranean Basin-Wide Co-development and Security; International Ocean Institute Headquarters	Malta	21-24 September
SCOR The Future Ocean Biogeochemistry Workshop	Plymouth, UK	22-26 September
Fifth Session of the Health of the Oceans Panel	Paris, France	25-29 September
Marine Science for Integrated Coastal Area Management Conference	Saint Petersburg, Russia	25-30 September
Scientific Committee on Oceanic Research (SCOR) General Meeting	Washington DC, USA	10-13 October
WOCE/CLIVAR Variability and Representativeness Workshop	Fukuoka, Japan	17-20 October
WOCE Scientific Steering Group, 27th Session	Fukuoka, Japan	21-22 October
International Coral Reef Initiative Coordination and Planning Committee	Nusa Dua, Bali, Indonesia	27-29 October
IOC-SCOR Scientific Steering Committee for GEOHAB	La Paz , Mexico	13-17 November
IOC/ACOPS-GEF Workshop on the Protection and Development of the Marine and Coastal Environment in Sub-Saharan Africa	Paris, France	5-8 December
Meeting on the Development of an Aquatic Animal Diversity Information System	Rome, Italy	11-13 December

TRAINING COURSES

IOC-DANIDA Training Course on the Taxonomy and Biology of Harmful Microalgae	Copenhagen, Denmark	14-26 August
Advanced Training Course on Mediterranean Integrated Coastal Area Management	Nice, France	5-15 September
Training Workshop on Harmful Algae	Ha Long Bay, Vietnam	25-29 September
GCRMN South Asia Node Socio-economic Monitoring Training Workshop	Sri Lanka	12-21 November

PUBLICATIONS

IOC/IMO/UNEP (2000). *Guidance on Assessment of Sediment Quality*, IMO Pub. No. 439/00.

IOC Technical Series No. 57 (2000). "Ad Hoc Benthic Indicator Group; Results of the Initial Planning Meeting".

Wilkinson, C.R. (2000). *Status of Coral Reefs of the World: 2000.* Global Coral Reef Monitoring Network and Australian Institute of Marine Science, Townsville, Australia, 363pp.

IOC Manual and Guides No. 40, *Guidelines for the Study of Shoreline Change in the Western Indian Ocean Region.*

IOC Manual and Guides No. 38 *Guide Méthodologique pour l'Elaboration de Cartes de Vulnaribilité des Zones Côtières de l'Océan Indien.*

IOC newsletter : *Harmful Algae News.*

IOC 2000

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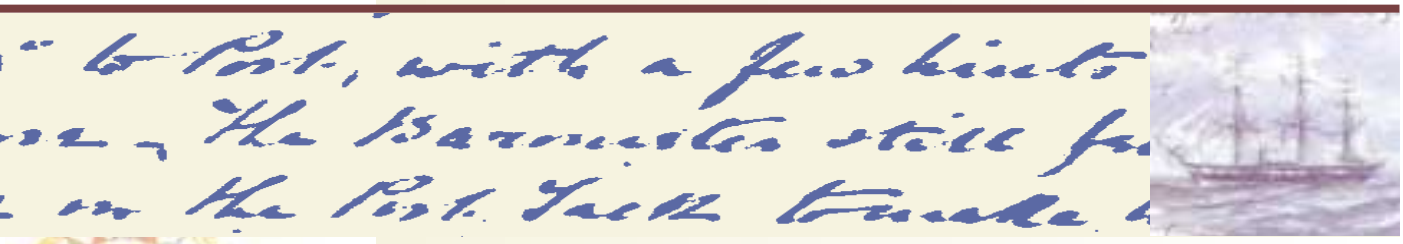

OCEAN DATA MANAGEMENT: IOC'S INVOLVEMENT

By Ben Searle, *Chairman, International Oceanographic Data and Information Exchange (IODE) Programme*

In October 1961, the IOC discussed the need for the 'immediate exchange of marine data' that was collected as part of international programmes and also arising from Declared National Programmes. As a result of Resolution 9 of this meeting, the IODE programme was born and the vision of easily accessible marine data was created.* The IODE programme began with a simple vision: aiming to improve our knowledge and understanding of the oceans and its processes through the effective management and exchange of ocean data. This vision was implemented through a programme to facilitate the aggregation of data collected by many people for a multitude of purposes – to create extensive global data sets that would have many uses, although primarily aimed in the early days at improving the scientific knowledge of the ocean as the final frontier.

The initial direction and objective of the data programme was to encourage Member States to create their own national oceanographic data centres to support the coordination of marine data management at the national level and to provide the conduit for the submission of national data into the international system comprised of the World Data Centres, established during the International Geophysical Year (1957-59). The success of IODE in this area is considerable with some 70 Member States now having established national data centres. The IODE community has followed closely the vision of our predecessors and has developed strong and integrated links with the World Data Centre system. In fact, the International Council for Science (ICSU) holds up the IOC's data programme as an example to other disciplines on how to arrange global data management and exchange programmes together with the World Data Centres.

In the early years of the IOC the focus for data exchange was primarily on the physical properties of the ocean such as sea level, bathymetry, surface meteorological variables and temperature and salinity at depth. In many ways today this has not changed, although there is considerable pressure to cover all areas of science as requirements have now changed towards multi-disciplinary activities. The causal relationships between many physical and biological land, atmosphere and ocean processes are now at least recognized, if not yet fully understood. Our overall understanding has increased substantially from the 1960s, but the original underlying vision is still very relevant to today's data managers and the broad marine community.

Today's ocean data managers are supporting a broader range of users from the military to the commercial sector and the general public (who are more interested in the oceans as a 'fragile' environment), to the continuing support of the scientific community. Issues such as climate change, sea level rise, the declining natural resources of the oceans, the UN Convention on the Law of the Sea and the significant value of ocean resources have

changed the 'playing field' in relation to data exchange. The need for data exchange has gone way beyond the initial scientific requirement that characterized the data exchange programme of the IOC in the 1960s.

An area where unfortunately only minimal progress has been made is in relation to standards. While there has been some general progress, the lack of commonly used standards is limiting our ability to easily locate and access and therefore limiting our ability to develop a full understanding of ocean processes. This is despite the huge advances in information technology that have been made since 1961. While the computing industry has provided us with a suite of sophisticated tools and applications such as the Internet, the marine data community has not taken full advantage of these technologies to deliver data to the user in a consistent manner. The marine data exchange community is still using a huge range of data formats, which complicates the exchange process and increases the effort in both locating and processing data. Improving this situation is one of our primary goals for the future.

The IODE community has made considerable progress in building global databases. However, in many ways we have not made as great a progress as our predecessors would have hoped for. The IODE community is still being challenged by more and more users with greater needs and until we can provide a well-conceived and practical data exchange framework we will not meet the vision first proposed by IOC in 1961.

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* Editor's note: Originally IODE's full name was the IOC Working Committee on International Oceanographic Data Exchange. The Twelfth Session of IODE (Moscow, December 1986) recommended to the following IOC Assembly that the Working Committee's name be changed to its present one, Working Committee on International Oceanographic Data and Information Exchange, and that its mandate be enlarged accordingly. Thus was recognized the increasingly important role of marine information management in IOC's programmes.

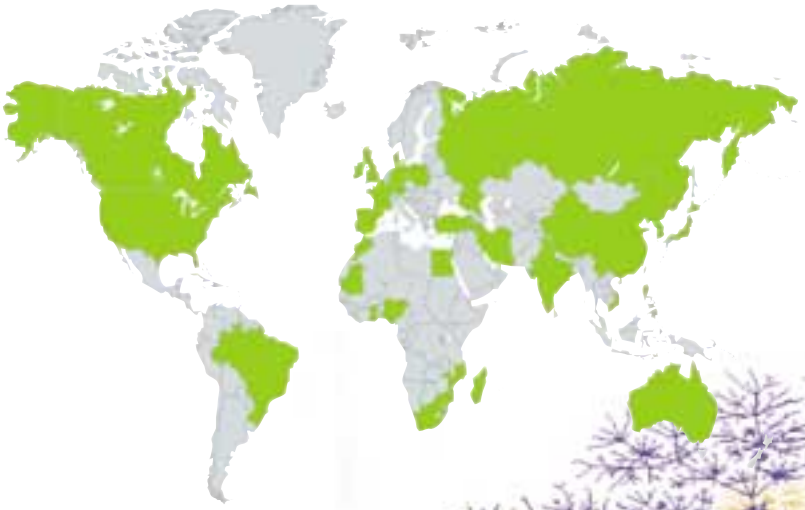
2.1 International Oceanographic Data and Information Exchange (IODE)

The IODE System was established in 1961 to enhance marine research, exploitation and development by facilitating the exchange of oceanographic data and information between participating Member States and by meeting the needs of users for data and information products.

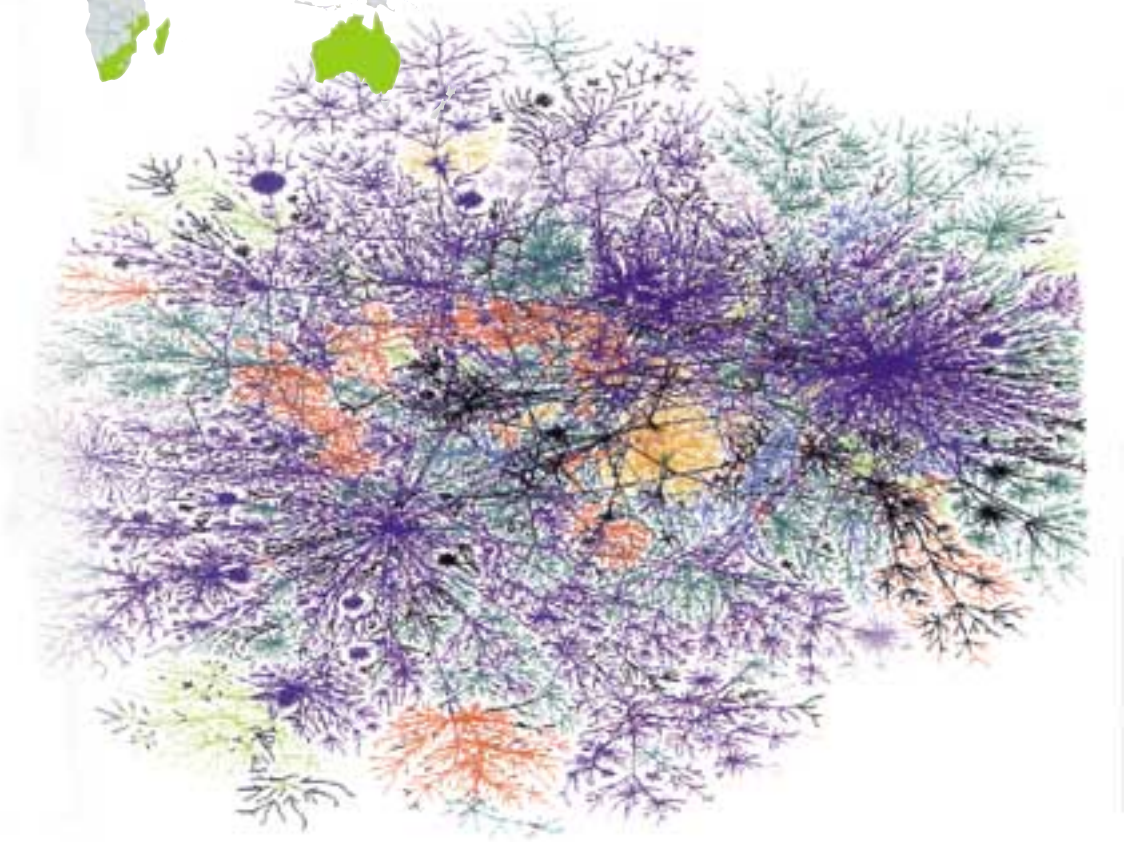
The IODE system forms a worldwide service-oriented network consisting of DNAs (Designated National Agencies), NODCs (National Oceanographic Data Centres), RNODCs (Responsible National Oceanographic Data Centres) and WDCs (World Data Centres – Oceanography).

During the year 2000, six IOC Member States (Belgium + Flanders, Georgia, Madagascar, Mauritius, Mauritania and The Netherlands) joined the IODE system of Data Centres, making a total of 61. Thanks to the ODINAFRICA project (see further), growth has been substantial, especially in Africa with three new centres.

World map of countries with NODCs



Computer links from a 'skitter' analysis of the Internet connections between USA and western Europe



Taken from:
Ocean Circulation and Climate, edited by G. Siedler, J. Church and J. Gould. Published in 2001 by Academic Press.

IODE's operational and management structure

Management structure

- The IODE Committee
- The IODE Chairs
- The IODE Officers
- The IODE National Co-ordinators
- The IODE Regional Co-ordinators
- IODE at the IOC Secretariat

Technical expertise

- IODE Group of Experts on Technical Aspects of Data Exchange
- IODE Group of Experts on Marine Information Management
- IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices (GE-BCDMEP)
- IODE Steering Group for the MEDI Project (SG-MEDI)
- IODE Steering Group for the IODE Resource Kit (SG-ResKit)
- IODE Steering Group on establishment, maintenance, and strengthening of co-operation between IODE and research and monitoring programmes (SG-CORM)
- IODE/JCOMM Steering Group on End-to-End Data Management Systems (SG-E2EDM)
- IODE Steering Group for the Underway Sea Surface Salinity Data Archiving Pilot Project (SG-USSSDAP)

The data centres

- The World Data Centres
- The Responsible National Oceanographic Data Centres
- The National Oceanographic Data Centres
- The Designated National Agencies

During the year 2000, the IODE System continued to provide access to millions of measurements and observations and this increasingly over the Internet's World Wide Web. Many of the IODE Data Centres are now providing their services and products over the WWW.

Projects and programmes

Expertise: IODE Group of Experts on Technical Aspects of Data Exchange (GETADE)

The objective of this Group is, *inter alia* to identify technical solutions for the management, exchange and easier integration of oceanographic data and information with data from other disciplines. During its Eighth Session (Greenbelt, Maryland, United States, 13-17 March 2000), the GETADE identified critical activities that need to be undertaken by IODE.

The MEDI Pilot Project

The Marine Environmental Data Information (MEDI) Referral Service Pilot Project continued the development of an off-line input software tool, in close consultation with NASA's Global Change Master Directory (GCMD), towards a global ocean metadata system and development of the MEDI software for off-line metadata entry; leading to a global ocean metadata directory.

MEDAR/MEDATLAS-II Project

The overall objective of the MEDAR/MEDATLAS II project is to make available a comprehensive data product of temperature, salinity and bio-chemical data in the

Mediterranean and Black Seas, through wide co-operation among the Mediterranean countries. IODE provided support for the MEDAR/MEDATLAS Annual Workshop and 4th MEDAR/MEDATLAS Steering Committee, held in Cyprus between 12 and 15 December 2000.

IODE Resource Kit

With the growth in the number of oceanographic data centres it is essential that all data centres utilize the same methodology, standards, formats and technologies. The development of the IODE Resource Kit, a comprehensive reference tool for ocean data and information management, continued with the release of its Version 3 in the year 2000. Whereas the IODE Programme organizes a number of training courses and workshops every year, these cannot be effective without follow-up and/or continued self-study. The Resource Kit provides a continuously updated reference tool for this purpose.

Global Directory of Marine and Freshwater Professionals (GLODIR)

Growth of the database continued in the year 2000, reaching nearly 12,000 individual expert descriptions from over 100 countries. The database has gained substantial visibility and other organizations and projects are now recommending GLODIR as their expert directory. The system received approximately 1500-2000 queries/month.

EURASLIC and IAMSLIC support

The European Association of Aquatic Sciences Libraries and Information Centres (EURASLIC) is a network linking European aquatic sciences libraries and information centres, a forum for the exchange of information and ideas relevant to aquatic sciences in Europe and a regional group of the International Association of Aquatic and Marine Sciences Libraries and Information Centres (http://siolib-155.ucsd.edu/iamslic/). For the EURASLIC 2000 Conference (Aberdeen, UK, 2-5 May 2000), the IOC provided support for participants from Eastern Europe.

The International Association of Aquatic and Marine Science Libraries and Information Centres (IAMSLIC) is an association of individuals and organizations interested in aquatic and marine information science. The association provides a forum for exchange and exploration of ideas and issues of mutual concern. Within the framework of the IAMSLIC-IOC co-operation, support was provided for the participation of an information expert from Kenya to attend the IAMSLIC 2000 Conference (Victoria, Canada, 30 September – 5 October 2000).

Aquatic Sciences and Fisheries Abstracts (ASFA)

Aquatic Sciences and Fisheries Abstracts (ASFA) is an abstracting and indexing service covering the world's literature on the science, technology, management, and conservation of marine, brackish water, and freshwater resources and environments, including their socio-economic and legal aspects. ASFA is produced through the co-operative efforts of four UN partners (FAO, UNEP, IOC and UNDOALOS), six international partners (ADRIMED, ICCAT, ICLARM, ICES, IUCN, PIMRIS), 31 national partners and the ASFA Publishing Partner CSA.

In the year 2000 the IOC participated in the annual ASFA Advisory Board meeting and

contributed content for the ASFA database. IOC also provided support for the participation of Kenya (as regional input centre for the IOCINCWIO region) in the Advisory Board meeting.

Meeting of the ad hoc Working Group on Oceanographic Data Exchange Policy

The meeting of the ad hoc Working Group on Oceanographic Data Exchange Policy (UNESCO Headquarters, Paris, France, 15-17 May 2000) was convened to review existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products. The Group, Chaired by Dr David Pugh (United Kingdom) discussed these issues with a view to 'proposing to the next session of the Assembly a restatement of the general IOC principles and policy with regard to oceanographic data exchange, and a statement of recommended practices and the required institutional arrangements for the operational exchange of oceanographic data'. The Group concluded that issues of data commercialization are very complex and that they have far-reaching implications and consequences for the programmes of the IOC, and thus need to be discussed among Member States. Although the Group was unable to reach consensus on a new IOC data exchange policy, it brought together a substantial amount of information to aid the decision-making process of the IOC governing bodies. As well, the Group outlined a general statement of principles and practices for data exchange, with commercialization issues clearly marked for further discussion.

The findings of the Group (Document INF-1144 rev.) were presented to the 33rd Session of the Executive Council for comments and recommendations for further action. At that Session (June 2000) the Executive Council decided to establish an 'Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy'. The purpose of the Group is to continue detailed discussions and assessments of existing agreements and practices, both within and outside IOC, with regard to the exchange of oceanographic and related environmental data and products, with a view to proposing to the IOC Assembly: (i) a statement of the general IOC principles and policy with regard to oceanographic data exchange; (ii) a statement of recommended practices and associated institutional arrangements for the exchange of oceanographic data; and (iii) a draft resolution for consideration by the Assembly. The Executive Council also elected Dr Angus McEwan as Chairman of the Group.

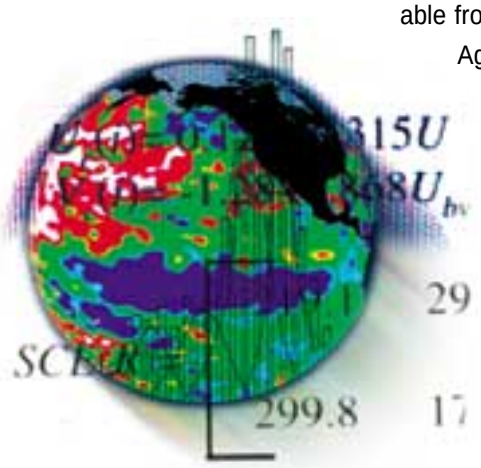
IOC Ocean Portal logo

IODE on the web

The IODE programme continued the development of its web-based information services with a renewed IODE website http://iode.org (or http://ioc.unesco.org/iode), as well as the Ocean Portal (http://oceanportal.org or http://ioc.unesco.org/oceanportal), launched in September 2000 as a high-level directory of Ocean Data and Information related websites. Its objective is to help scientists and other ocean experts in locating such data and information.

UN Ocean Atlas

The UN Atlas of the Oceans (http://www.oceansatlas.org) will be a CD-ROM and web-based interactive information tool focusing on policy-oriented issues and the sustainable use of the ocean resources. The project is being implemented by a core group of UN Agencies (FAO, UNESCO-IOC, IMO, UNEP, UNDP, IAEA, and WMO) under the co-ordination of FAO, and in collaboration with prominent academic organizations and research institutions. The Atlas is being built from existing documents available from programmes of the UN Agencies and participating organizations, and is to be regularly updated. IOC continued to provide input to the Atlas on areas of its expertise, such as Large Marine Ecosystems; Harmful Algal Blooms; Storm Surges and Tsunamis; Coastal Area Management; Coral Reefs; Monitoring and Observing Systems; Sea Level change; and Living Marine Resources.



16th Session of the IODE Committee

The major event for the IODE Programme in the year 2000 was the Sixteenth Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XVI), held in Lisbon, Portugal between 31 October and 8 November 2000. The Session was attended by nearly 100 participants from 37 countries and a number of partner organizations. This 16th Session made many decisions that will have a substantial impact of the future of the IODE programme. The Committee recommended a stronger role for IODE Regional Co-ordinators as a mechanism to improve the visibility of the IODE programme in the regions.

In view of the success of the 'Pilot Project on the Revision of MEDI', the Committee recommended: (i) making the MEDI a permanent IODE programme; (ii) establishing a Steering Group for MEDI; and (iii) including the MEDI software tool in IODE training activities and capacity-building products/projects. The Committee recognized the importance for IODE, through its data centres, of actively participating in the planning of marine scientific and monitoring programmes. The Committee thus recommended setting up a Steering Group on Establishment, Maintenance and Strengthening of Co-operation between IODE and Research and Monitoring Programmes.

The Committee welcomed the establishment of JCOMM and decided that a constructive relationship should be established between JCOMM and IODE.

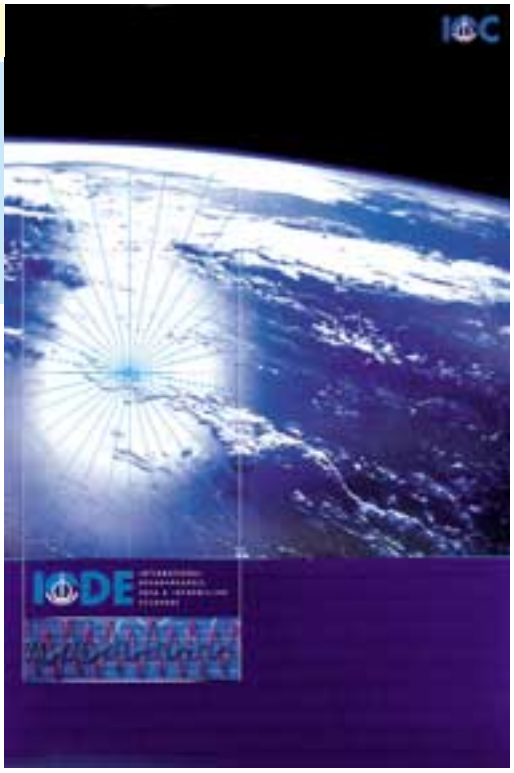
The Committee recommended increased attention in the IODE system for remotely sensed data, biological and chemical data, pollution data and coastal data. The Committee recommended the establishment of a Group of Experts on biological and chemical data management and exchange practices.

Following the success of the GODAR project the Committee approved the development of the World Ocean Database Project.

Recognizing the importance of new technology to provide services to users, IODE-XVI

Public Awareness

An IODE information folder was designed for increased awareness of the IODE programme. Several inserts on ODINAFRICA, MEDI, GLODIR, the e-Library etc were produced and distributed.



Artwork from ODINAFRICA website

endorsed the further development of the IODE website, the IODE Data and Information Portal and the related services and products.

The Committee recommend for IOC to participate in the development of a marine Extensible Markup Language (XML) as a means to facilitate the exchange of, and access to, data (especially over the Internet) and to promote the use of XML at the national level.

The Committee recommended the establishment of a Steering Group for the IODE Resource Kit. Noting the success of regional data and/or information networks such as RECOSCIX, ODINAFRICA and MEDAR/ MEDATLAS, the Committee recommended the development of additional regional networks.

IODE Regional Programmes

In December 2000, the IODE Programme completed the ODINEA (Ocean Data and Information Network for Eastern Africa), a three-year ocean data and information management capacity-building project, funded by the Government of Flanders. The project was completed with the 3rd and final ODINEA workshop, which was held in Lisbon, Portugal, 25 to 27 October 2000 (the report is available as IOC Workshop Report No. 172). The Workshop assessed the project at the regional as well as national level and concluded that ODINEA had been very successful and should be continued.

Based on the success of the project, the donor agreed to expand the scope of the project to the entire African continent (20 coastal states). The ODINAFRICA (Ocean Data and Information Network for Africa) will, over a period of four years (2001-2004), assist Member States in the co-operating countries to build national oceanographic data centres, to link equipment, and help provide training and operational support. The data centres will provide services and develop products for a variety of users focusing on science for development.

In order to agree on the detailed implementation plan of the project, the nineteen cooperating countries in Africa met for the First Planning Workshop of the 'Ocean Data and Information Network for Africa – Phase II' (ODINAFRICA-II) project (Dakar, Senegal, 2-4 May 2000). The meeting decided to establish a project management structure composed of two regional co-ordinators, one for the IOCEA region and one for the IOCINCWIO region. The Workshop elected Dr Sekou Cisse (Guinea) as regional coordinator of the ODINAFRICA-II project for the IOCEA region, and Mr Mika Odido (Kenya) as regional co-ordinator of the ODINAFRICA-II project for the IOCINCWIO region. Both are being hired by the IOC as consultants to enable them to carry out their duties.

Between 28 July and 9 August 2000 a meeting was held, attended by the two regional co-ordinators and the Head, Ocean Services of IOC, to discuss the implementation details of the project and to set up an efficient management and communication structure. It was also decided to develop an ODINAFRICA-II website for the use not only of the participating country co-ordinators but also of other audiences (scientific community in Africa and elsewhere, decision makers, general public) as a means to publicize the project and to demonstrate the usefulness of ocean data and information for development and management. The site will furthermore include a section including financial information on the implementation of the project, for access by the national project co-ordinators only, to promote open, transparent and participatory management of the project. A local contractor was hired to develop the website that will be hosted on the UNESCO/IOC web server.

2.2 Ocean mapping

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

Source: *UNESCO Courier*, April 1989

Detail of an old Portuguese maritime map

GEBCO: a century of ocean mapping

By Dr Meirion Jones,
Chairman
GEBCO Subcommittee on Digital Bathymetry

history

The *General Bathymetric Chart of the Oceans*, better known as GEBCO, was initiated at the beginning of the twentieth century by Prince Albert I of Monaco and the First Edition was published in 1905 as a compilation of the 18,000 depth measurements then available for the world's oceans. Sheets of the succeeding three editions began to reveal the presence of large-scale positive relief features, such as parts of the mid-ocean ridge system, but they lacked detail.

Almost up to World War II, all soundings in the deep ocean were discrete wire soundings, and only with the advent of the echo-sounder in the 1940s did sufficient data start becoming available for the compilation of meaningful bathymetric charts. However, even to the present day, the sounding coverage of the world's oceans is very patchy and often concentrated on isolated tracklines with large gaps in between. Very few areas of the deep ocean have been systematically surveyed and a proper scientific understanding of the processes involved in shaping the seafloor is required in order to interpolate the bathymetry between sounding lines.

The Fifth Edition of GEBCO was published by the Canadian Hydrographic Service between 1975 and 1982 with 16 Mercator sheets covering the world from 72°N to 72°S, on a scale of 1:10 million at the equator, and two polar stereographic sheets covering the polar regions to 64°N and 64°S respectively, on a scale of 1:6 million at 75° latitude. Each sheet depicted bathymetric contours at 200 m, 500 m and at 500 m intervals thereafter, with some sheets also including contours at other intermediate depths. Tracklines and outlines of survey boxes were included on the printed sheets to show the coverage of sounding data available when the contours were drawn. A World Sheet was published in 1984.

The GEBCO System

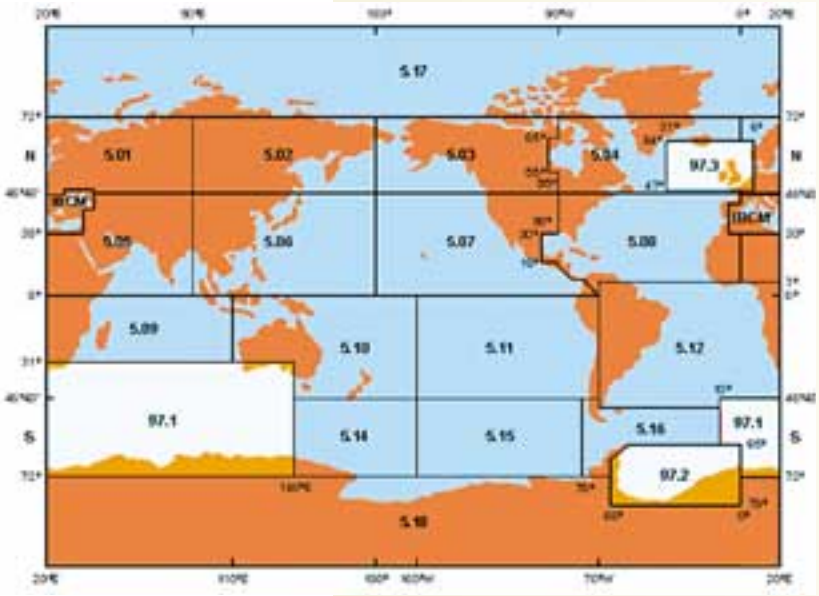
The preparation of the Fifth Edition was a collaborative effort between the International Hydrographic Organization (IHO) and the IOC, with the IHO responsible for co-ordinating the efforts of the Hydrographic Offices in its Member States and the IOC responsible for attracting eminent marine geologists and geophysicists to collaborate in the work of GEBCO. Supervision of the project was provided by a Joint IOC-IHO Guiding Committee for GEBCO, composed of ten members – five nominated by the IHO and five by the IOC.

Photo: IRD

Ocean-bottom seismometer, capable of recording seismic waves down to depths of 10,000 metres

GEBCO overall coverage

GEBCO-97 includes revised bathymetry for the southern Indian Ocean (Sheet 97.1), the Weddell Sea (Sheet 97.2) and the northeast Atlantic off the British Isles (Sheet 97.3). The World Map below shows the geographic coverage of these and other sheets used in the compilation of *GEBCO-97*.



The *GEBCO Digital Atlas* is published by BODC as a CD-ROM together with sophisticated but easy-to-use software interface for PC use. A coloured brochure can be viewed on the BODC website.

Further information can be found on the BODC website: www.bodc.ac.uk or contact: Fax: +44 151 652 3950 or e-mail: mtj@bodc.ac.uk

This arrangement continues through to the present day, with the IHO maintaining the international collection of echo-sounding data and the IOC community providing the scientific expertise for contouring these data.

Until recently, the IHO collection of echo-sounding data was maintained on a world-wide series of 655 hard copy 1:1 million-scale Collected Soundings sheets. From the mid-1950s onwards, these sheets were maintained by a network of Volunteering Hydrographic Offices, each with their own geographic area of responsibility. However, as data volumes increased, it became increasingly more difficult to keep the sheets regularly updated. To overcome this problem, an IHO Data Centre for Digital Bathymetry (DCDB) was set up in June 1990, co-located with the US National Geophysical Data Center in Boulder (Colorado, USA) and taking advantage of their well-developed computerized system for banking underway geophysics data on a global basis. The Collected Soundings sheets have been phased out and the IHO DCDB database currently holds over 40 million echo-soundings covering 14 million nautical miles of track from over 4,300 cruise legs.

GEBCO has international responsibility in the naming of undersea features falling outside territorial waters, and a digital Gazetteer of Undersea Names is maintained on behalf of GEBCO by the International Hydrographic Bureau in Monaco.

Creating the GDA

In order to establish a digital base for the updating of GEBCO, and to provide a more flexible product for users, the GEBCO Guiding Committee decided in 1983 that the printed sheets of the Fifth Edition should be digitized. As with other GEBCO activities, funding was a major problem and the provision of resources for the work was dependent on the foresight and goodwill of national agencies, particularly the UK's Natural Environment Research Council (NERC) and the French Institut Géographique National.

Most of the work was done by the Bureau Gravimétrique International in Toulouse and by the British Oceanographic Data Centre (BODC), although invaluable contributions were also made by the NERC Unit for Thematic Information Systems, Reading; the Head Department of Navigation and Oceanography, St. Petersburg (Russia); the Alfred-Wegener-Institut, Bremerhaven (Germany); and the Japan Oceanographic Data Center, Tokyo.

At each laboratory the digitization was undertaken by raster scanning stable base transparencies of the master plates of the printed charts. The raster output was converted into vector streams that were then checked, edit-

ed and labelled using an interactive graphics terminal.

The resulting vectors were submitted to BODC for quality control and final editing before being assembled into a uniform data set which now forms the basis of the *GEBCO Digital Atlas* (GDA), which was first published by BODC in 1994.

Updating the GDA

The updating of GEBCO through the GDA will be a continual process and the GDA will be published regularly as a product in its own right. Without the scale and projection constraints of the printed chart, it is envisaged that improved bathymetric compilations will be merged into GEBCO at scales ranging from 1:10 million up to 1:500,000 or better, depending on the density of the sounding coverage. New data will be 'stitched in' so as to maintain a seamless global data set.

For the future updating of GEBCO, the coastline will be standardized on the World Vector Shoreline (WVS) of the (formerly) US Defense Mapping Agency (now the US National Imagery and Mapping Agency). It was developed as a digital data file, at a nominal scale of 1:250,000, providing global coverage such that 90% of all identifiable shoreline features are located within 500 m of their true geographic position with respect to the World Geodetic System (WGS-84) Datum. For the Antarctic region, the digital coastline, published by the British Antarctic Survey (BAS) on behalf of the Scientific Committee on Antarctic Research (SCAR), has been used.

The updating of GEBCO through the GDA has already started. While the Fifth Edition was being digitized, the Guiding Committee decided to completely revise the bathymetry of the South Atlantic down to 50°S. The revised contouring was carried out by scientists in the USA, Russia, New Zealand and the UK. Their hand-drawn contours and tracklines were then submitted to BODC for digitizing and for compiling into a single seamless sheet edge matched to the existing Fifth Edition bathymetry, but at a scale of 1:5 million.

A global network of GEBCO Regional Reviewers has been set up to advise on the need for updating GEBCO in the various regions and the post of GEBCO Bathymetric Editor has been created at the NERC Southampton Oceanography Centre to coordinate this work and to feed updated bathymetric compilations to BODC for incorporating into the GDA. The IOC Regional Ocean Mapping Projects will be an important source of new material and the digitized contours and coastlines from the *International Bathymetric Chart of the Mediterranean* (IBCM) have already been included in the GDA.

Conclusion

GEBCO has achieved its current status thanks to decades of co-operation by a number of institutions and agencies in Member States of IOC and IHO. It is salutary to note that, whereas high-resolution topographic maps have already been produced for the moon, Mars and Venus, the mapping of the world's oceans will continue well into the foreseeable future. There is a growing need for improved global bathymetry – particularly amongst modellers studying the role of the oceans in the climate system – and sea floor bathymetry has been recognized as an essential component for the Global Ocean Observing System (GOOS). Recent satellite altimetry missions have, of course, provided

invaluable insights into the nature of the topography in waters uncharted by modern echo-sounders. However, the detailed mapping of the sea floor will continue to depend on a few of scientists across the world who are prepared to apply their skills to the interpretation of random tracklines of data from a multitude of sources and with highly variable data quality and coverage.

It is of paramount importance that future research cruises should aim wherever possible to traverse the gaps in the coverage and to make their soundings available to the IHO Data Centre. In the meantime, it is hoped that this first release of the GDA will be the forerunner of a series of products, each delivering progressively improved bathymetric maps of the world's oceans.

The 'Ocean Mapping' part of this report benefited from the collaboration of Desmond Scott and Tony Laughton

THE OCEAN BOTTOM: A DIGITIZED VIEW...

...from an ongoing project contributing to the *General Bathymetric Chart of the Ocean* (GEBCO)

The above illustration is a simplified extract covering the Indian Ocean, adapted from the *GEBCO Digital Atlas* (GDA). When it was originally published in 1994, the GDA was the first seamless, high-quality digital bathymetric chart of the world's oceans and contained the digitized bathymetric contours, coastlines and trackline control from the printed Fifth Edition of GEBCO. It was updated in 1997 (GEBCO-97), incorporating more recent bathymetric compilations contributed by the Scripps Institution of Oceanography (USA), the Alfred-Wegener-Institut für Polar-und-Meeresforschung (Germany), and the Southampton Oceanography Centre (UK). New bathymetric compilations continue to be incorporated as and when they become available.

OMP activities in 2000

General Bathymetric Chart of the Oceans (GEBCO)

The main GEBCO activities during 2000 were centred on the constitution of a one-minute grid to be introduced with the Third Release of the CD-ROM *GEBCO Digital Atlas* (GDA) in 2001. Additionally, work continued on numerous bathymetric compilations – notably in the Arctic, Atlantic, Indian and Pacific Oceans. More than 500 geographical names of undersea features were approved by the Sub-Committee on Undersea Feature Names (SCUFN). A plan was made for the GEBCO Centenary Conference, to be held in Monaco 14-16 April 2003, 100 years after the first meeting (chaired by Prince Albert 1st) of the first GEBCO Committee, which was held in Wiesbaden (Germany) in 1903. The 18th Session of the Joint IOC-IHO Guiding Committee is planned for April 2001, to be held in Tokyo, Japan.

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

The 8th Session of the IOC Editorial Board for IBCM took place in Kaliningrad (Russia), 1-4 September on board the R/V *Vitiaz*. The *Magnetic Anomalies Map*, the last in the Geological/Geophysical Series, was published by the Head Department of Navigation and Oceanography of Russian Navy (HDNO) and is available for users. The drafts of the explanatory volumes for all maps were completed and are planned for publication in 2001.

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

Sheets 04 and 07 were printed in 1999 in the German Hydrographic Office and made available to users. Sheet 19 was scheduled to be printed near the end of 2000. The colour proof for Sheets 06 and 09 were printed by HDNO and revised by the 5th Session of the IOC Editorial Board for IBCWIO, which was hosted by the Meteorological Service of Mauritius, 24-28 July 2000.

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

Sheets 1.04 and 1.09 were printed. Sheets 1.01, 1.02, 1.03, 1.08, 1.15, 1.16 and 1.17 have been digitized and published on CD-ROM; all of these are now available for users. Sheets 1.107 and 1.108 incorporated new bathymetry data for Cayman Trough and were sent to Cuba for reviewing and acceptance. Sheets 1.13, 1.14, 1.15 and 1.17 were completed. The 8th Session of the IOC Editorial Board for the IBCCA, which will be combined with training in bathymetry, is planned to take place in November 2001 in Boulder, Colorado, USA.

International Bathymetric Chart of the Arctic Ocean (IBCAO)

In the first quarter of 2000, a preliminary version of IBCAO was given wide distribution in digital and printed form, to provide users with an opportunity to examine the results and provide feedback to the Editorial Board. Following this action, a number of significant new data sets were contributed to the database, which made it possible for a more definitive version of IBCAO to be produced by the middle of 2001. In this new product, which is being developed in digital grid only, many errors are being corrected, and control is being improved through the insertion of new observations in several key areas. The existing grid for IBCAO will be released for broad distribution, either

through the IBCAO Website at the National Geophysical Data Center (NGDC, Boulder, Colorado, USA), and/or on CD-ROM as part of the proposed new edition of the *GEBCO Digital Atlas*. Moreover, it has been agreed that new Cartesian grid will be used to develop contour maps according to IOC's GEBCO specifications. Production of those maps, however, has been deferred pending consultation with the IOC and IHO. The 3rd Session of the Editorial Board for the IBCAO is planned for May 2001 at the University of New Hampshire (USA).

International Bathymetric Chart of the Central Eastern Atlantic (IBCEA)

Significant progress was made during 2000 in the implementation of IBCEA. Sheets 1.06 and 1.09 were published in 2000 and are available for users; the colour proof of sheet 1.01 was prepared for printing, the compilation of sheets 1.02, 1.03, 1.004 and 1.05 was completed; and sheets 1.11 and 1.12 were digitized. Digitized curves were communicated to the British Oceanographic Data Centre (BODC) for inclusion into the *GEBCO Digital Atlas* (GDA). A website (www.shom.fr/) in English and French was developed through co-operation between NGDC (USA) and SHOM (France) and was open for users at the end of 2000.

International Bathymetric Chart for the Western Pacific (IBCWP)

The 3rd Session of the Editorial Panel for IBCWP was hosted by State Oceanic Administration of China, 25-30 September 2000 in Tianjin, China. In sub-region 1, Russia completed 12 sheets at a scale of 1:500,000. In sub-region 2, Japan completed 4 sheets at a scale of 1:100,000; and China completed 3 sheets. In sub-region 3, China completed 4 sheets and 1 sheet was completed by Vietnam. In sub-region 4, Australia completed 2 sheets. The bathymetric data in sub-regions 2 and 3 were being collected and processed. China's bathymetric database was being designed and established. Soundings were conducted in China's inshore and offshore waters. The Republic of Korea actively collected the new bathymetric data for its coastal area; also Malaysia was working on data acquisition, and data quality controls were established. All countries submitted their data catalogues to their chief editors, who transmitted them to the GEBCO Bathymetric Editor.

2.3 Ocean-related natural disasters

Natural disasters are becoming increasingly significant in terms of the number of events and the magnitude of their impacts. On a yearly average, natural disasters are estimated to claim 25,000 lives and cause damage valued in excess of US$3,000 million per year.From the International Decade for Natural Disaster Reduction, we learned that disasters have become societal problems and the cost of disasters is becoming unbearable in human and material terms. IOC is among the international agencies leading countries towards the management of risks from ocean-related hazards, notably in order to reduce the impacts of El Niño, tsunamis and storm surges.

A key element of IOC's programmes related to the mitigation of these hazards is the promotion of early warnings with the focus on

Aftermath of a 1983 tsunami in central Japan.
Photo: © A.S. Shinposya Press, taken from a JMA brochure
(*Tsunami Observation and Forecasting Methods in Japan*)

Drawing by Kastushika Hokusa (Edo Period)

the practical application of science and technology.

Tsunamis

In 1960 and 1964, devastating tsunamis generated by earthquakes in Chile and Alaska prompted Member States to take steps to establish the Pacific-wide International Tsunami Warning System (TWS). In 1965, IOC took the lead in coordinating the efforts of its Member States in operating the System and in tsunami mitigation. Today TWS is among the very few operational hazard-warning systems that have gained wide reputation and respect.

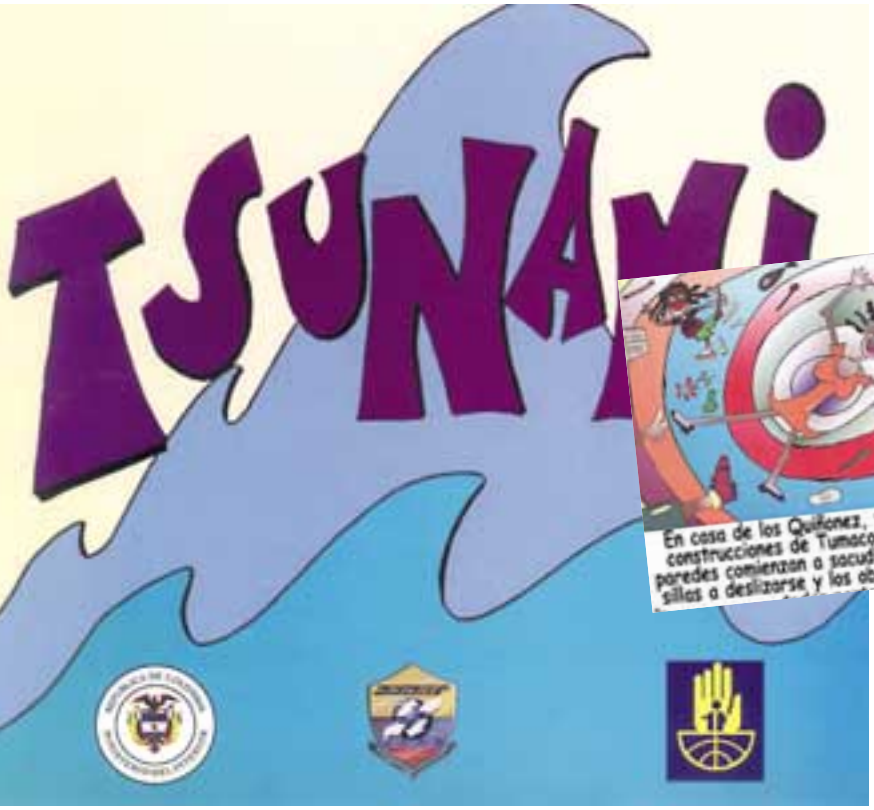
The Member States participating in TWS are focusing their activities on reducing tsunami impacts through the implementation of three key actions:

(i) hazard assessment (development of the tsunami inundation maps has become a common practice);

(ii) mitigation (awareness education – through publications, drilling exercises and courses – is being put into practice; for more information, visit the ITIC website: http://www.shoa.cl/oceano/itic/frontpage.html); and

(iii) warning guidance (modifications of observing and warning systems through the use of EMWIN and high-tech data collection and exchange instruments, such as TREMORS, real-time deep-ocean tsunami detectors etc).

The plan is to expand and implement these components in all tsunami-threatened areas around the world – including the Caribbean, Mediterranean and the Indian Ocean regions. The regional meeting on the IAS (Intra-Americas Sea) Tsunami Warning System was hosted 19-21 December 2000 by the University of Puerto Rico in Mayagüez. The participants of the meeting gave a clear indication of the potential tsunami danger in the region and strongly advised the governments to take action. The meeting recommended steps to be



Tsunami public information material produced in Columbia

taken for the finalization of the IAS TWS project proposal.

The year 2000 witnessed further progress in IOC's Tsunami Programme implementation based on the recommendations of the ITSU-XVII Session, held in the Republic of Korea in 1999. The main highlights of the activities included: (i) the conclusion of the Kuril-Kamchatka Project. (The project was successfully implemented with the installation of three tide gauges and the establishment of communication links between these places and the Pacific Tsunami Warning Center – PTWC); (ii) establishment of the Far-East Tsunami Warning Center in Japan; (iii) restructuring the *International Tsunami Information Center (ITIC) Newsletter* and publishing it in a new format; and (iv) the development of the Tsunami Glossary and Press Kit, which are due to be finalized in 2001. The 2000 Visiting Experts Programme was implemented and provisions have been made for a course in 2001.

Two international scientific conferences were held: (i) one in Moscow (Russia) in June 2000 on long-term tsunami risk assessment, and (ii) another in Chile to commemorate the 40th anniversary of the May 1960 earthquake and tsunami.

To improve the timeliness, accuracy and effectiveness of the warning centres' bulletins, two ad hoc working groups were established to make recommendations on the language

IAS TWS meeting in Mayagüez, Puerto Rico

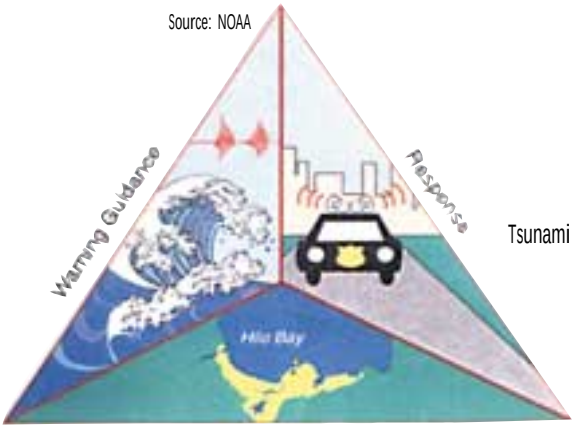
of bulletins, procedures and on criteria for issuing warnings, watches and cancellations.

Storm surges

In the last decade, IOC took a lead in developing, jointly with WMO, a project proposal on Storm Surge Reduction in the northern part of the Indian Ocean. The objective is the development of the infrastructure necessary for providing effective and timely storm surge forecasts and warnings.

Following the approval of the proposal by the IOC, IHP and WMO governing bodies in 1999, the focus was placed on negotiating with funding agencies and on organizing regional co-operation. The pre-project manager (PPM) from India took the responsibility for advertising the proposal, communicating with potential donors and persuading Member States to enter into a formal regional understanding for implementation of the project. The PPM reported on the progress achieved in carrying out his responsibilities to IOCINDIO-III, the 27th Session of the WMO/ESCAP Panel on Tropical Cyclones and the 33rd Session of the IOC Executive Council. All three meetings endorsed the need for consolidating efforts at the national and regional levels for providing support to the project.

Source: NOAA



Tsunami Hazard Mitigation

2.4 IODE-related meetings

Eighth Session of the IODE Group of Experts on Technical Aspects of Data Exchange (GETADE-VIII)	Greenbelt, Maryland, U.S.	13-17 March 2000
IODE/GOOS Data and Information Management Requirements Meeting	Greenbelt, Maryland, U.S.	20-21 March 2000
First Planning Workshop for the Ocean Data and Information Network for Africa-Second Phase (ODINAFRICA-II)	Dakar, Senegal	2-4 May 2000
EURASLIC 2000	Aberdeen, United Kingdom	3-5 May 2000
Meeting of the ad hoc Working Group on Oceanographic Data Exchange Policy	Paris, France	5-17 May 2000
First Meeting of ODINAFRICA-II (Ocean Data and Information Network for Africa) Regional Co-ordinators	Monbasa, Kenya	6-11 August 2000
26th Annual Conference of IAMSLIC – Tides of Technology	Victoria, British Columbia, Canada	30 Sept. – 5 Oct. 2000
Third Annual Ocean Data and Information Network for Eastern Africa Workshop	Lisbon, Portugal	25-27 October 2000
16th Session of the IOC Committee on International Oceanographic Data and Information Exchange (IODE-XVI)	Lisbon, Portugal	30 Oct. – 9 Nov. 2000

IODE publications

IODE Group of Experts on Technical Aspects of Data Exchange, Eighth Session, Greenbelt, MD, USA, 13-17 March 2000; Rep. Meet. Experts Equiv. Bodies, IOC

IOC-Flanders First ODINAFRICA-II Planning Workshop, Dakar, Senegal, 2-4 May 2000; IOC Workshop Rep. No: 167; Year: 2000

Meeting of the ad hoc Working Group on Oceanographic Data Exchange Policy, UNESCO Headquarters, Paris, France, 15-17 May, 2000, INF No: 1144; Year: 2000

IOC-Flanders-IPIMAR Workshop on Ocean Data Management in the IOCINCWIO Region (ODINEA Project), Lisbon, Portugal, 25-27 October 2000

IOC Workshop Rep. No: 172; prepared for publication (to be published in 2001)

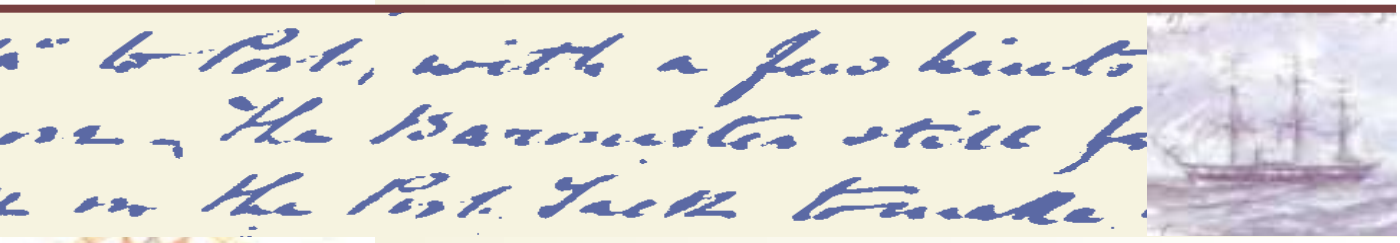
IOC Committee on International Oceanographic Data and Information Exchange, Sixteenth Session, Lisbon, Portugal, 31 October-8 November 2000;

Rep. Gov. Major Subsidiary Bodies IOC

Project/Event	Expenditure
ODINEA	$ 140,626
ODINAFRICA project office staff	$ 45,088
IODE consultant cost	$ 66,800
RECOSCIX (WIO + CEA)	$ 90,374
GETADE-VIII	$ 20,759
MEDAR/MEDATLAS meeting, Cyprus	$ 4,760
Data Policy meeting	$ 8,510
IODE-XVI	$ 60,533
Travel grants	$ 5,659
IAMSLIC/EURASLIC	$ 7,500
Public Awareness	$ 2,000
IOC ASFA input	$ 1,500
ODINAFRICA-2 planning workshop	$ 45,770
TOTAL	$ 499,879

Operational observing systems

3



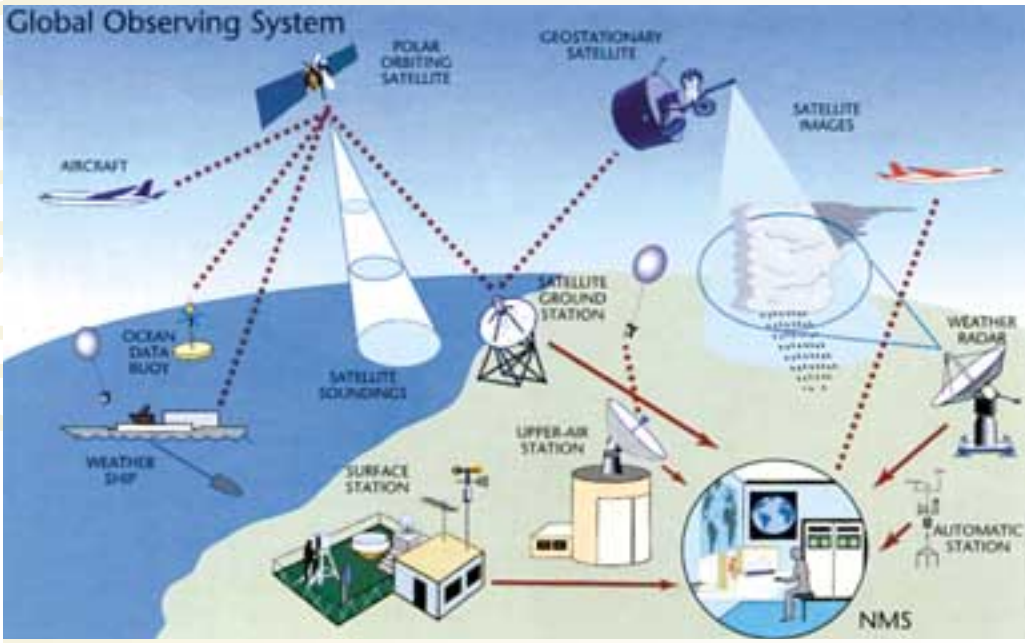
THE STORY OF GOOS

By Dr Angus McEwan
Senior Science Adviser (Oceanography), Australian Bureau of Meteorology

During the 1960's and 70's the feasibility of co-ordinated observations on the ocean was tested through several regional experiments involving international alliances between agencies. The first global-scale experiment specifically designed to test theories of climatic variability was the Tropical Ocean Global Atmosphere (TOGA) experiment (1985-1990). TOGA was followed by the far more ambitious World Ocean Circulation Experiment (WOCE) undertaken during the 90's, which called upon the commitment of many countries to a highly co-ordinated plan of deep and upper-ocean ocean observations covering the entire world ocean. TOGA and WOCE were both initiated by the joint IOC/SCOR Committee for Climatic Changes and the Ocean (CCCO) and became components of the World Climate Research Programme (WCRP).

The desire to sustain the observational systems established by these successful experiments, and recognition of the merits of shared and rapidly disseminated data, provided a powerful impetus for the long-held vision of ocean scientists throughout the world for a globally co-ordinated ocean observing system by which data would be gathered and exchanged freely for beneficial use. Supremely important too was the desire to exploit and continue the development of satellite remote sensing of the ocean.

This vision had been carried forward during the 1980s by the IOC Technical Committee for Ocean Processes and Climate (C/OPC), which, following on expert reports and an agreement between IOC and WMO to establish a global system of ocean observations, recommended to the 16th Assembly



From WMO brochure 'Weather and Climate: Their Variability and Change'

of IOC in 1991 the development of a Global Ocean Observing System (GOOS). To make possible the prediction of climatic evolution and variability, GOOS had been called for by the Second World Climate Conference in 1990. The same conference also resulted in the creation of the Global Climate Observing System (GCOS). This call was repeated at the United Nations Conference on Environment and Development (UNCED) in 1992, under its Agenda 21, in the context of sustainable development.

The following session of the IOC Executive Council (EC-XXV, 1992) transformed the C/OPC into the Intergovernmental (IOC) Committee for GOOS (I-GOOS), under the Chairmanship of Prof. Michel Glass. WMO agreed to co-operate in its development and a Joint Scientific and Technical Committee for GOOS (J-GOOS) with ICSU also as a co-sponsor was formed to advise I-GOOS on all scientific and technical aspects of GOOS development. Later UNEP also became a co-sponsor of GOOS.

The IOC had charged a high level expert 'Blue Ribbon Panel for GOOS', chaired by Prof. John D. Woods, to develop a 'Case for GOOS', in effect a prospectus defining GOOS and encouraging governments to support its development. The panel proposed that GOOS be developed in phases, ramping up to a permanent system. It also defined 'Modules' representing the principal categories of use of the system, which later reduced to: Climate, Coastal (seas), Health of the Ocean, Living Marine Resources and Marine Services.

With this as a framework, the first session of J-GOOS was convened in Nantes (France) in May 1994 with myself as interim Chair.

The Ocean Observing System Development Panel (OOSDP) under the chairmanship of Prof. Worth Nowlin, originally created by the CCCO, had been tasked to define the ocean observing requirements for climate monitoring and prediction on behalf of both GOOS and GCOS. This panel provided the initial design of the Climate Module of GOOS (also deemed to be the Oceans component of GCOS) and reported to J-GOOS II in 1995. It was then succeeded by the jointly sponsored Ocean Observing Panel for Climate (OOPC), chaired by Dr Neville Smith and serving GOOS, GCOS and the World Climate Research Programme.

Panels for the other GOOS Modules had been created at the First Planning Session of I-GOOS in Melbourne, 1994. This session also created a Strategy Sub-Committee to facilitate intersessional actions on behalf of I-GOOS. In particular, there was a pressing need to prepare a statement on 'The GOOS Principles' which would guide both the design of GOOS and the nature of involvement of intending national participants, in line with the concept that GOOS would be developed according to plans and designs rather than as an opportunistic assemblage of observations. Since there was not a common understanding of what the Modules would comprise, especially as there was no precedent for observing systems not defined by a scientific experiment or project, it was seen that a general Strategic Plan for GOOS was also needed.

The assumption of these tasks by the SSC raised the scope for duplication of some of the planning functions of J-GOOS, then chaired by Prof. O. Brown. In 1996 J-GOOS commissioned Dr P. Ryder for the preparation of a major planning document. Most of the

Shipboard research

content of the SSG Strategic Plan became incorporated in this document, ultimately published as 'GOOS 98', which became a detailed prospectus and guide for GOOS participation.

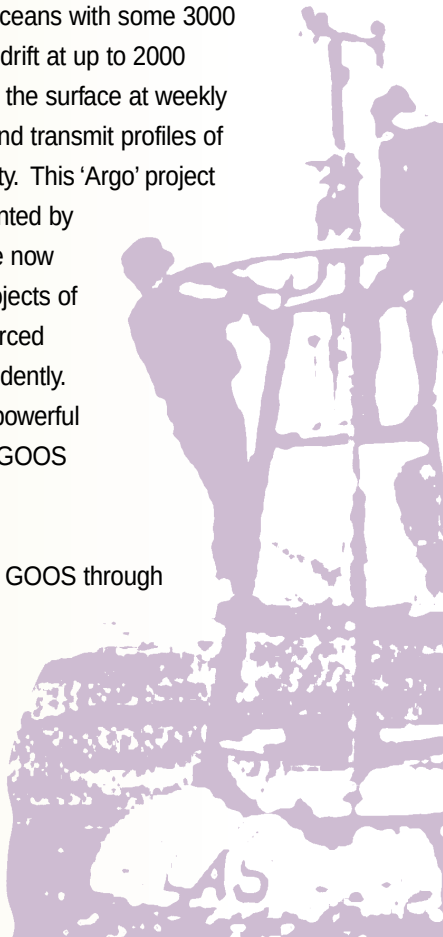
In 1997 the structure of GOOS was revised by merging the functions of the SSG and J-GOOS into a single GOOS Steering Committee (GSC) with a revised mandate and membership to oversee all scientific planning and implementation of GOOS and advise I-GOOS on matters requiring governmental action or sanction. A GOOS Sponsors Forum with representatives of IOC, WMO, ICSU and UNEP was established. The support office in IOC was consolidated and renamed the GOOS Project Office (GPO) and Dr Colin Summerhayes was appointed its Director. I became Chairman of I-GOOS in 1997.

The GSC was chaired by Prof. Nowlin and held its first session in 1998. Initial plans for the GOOS Modules were nearing completion and, seeking better co-ordination and national linkages, GSC proposed the reduction of the planning panels to two for the coming implementation phase: the OOPC, incorporating Climate and Services, and a Coastal Ocean Observations Panel (COOP), chaired by Prof. T. Malone, incorporating the Health of the Ocean, Coastal and Marine Living Resources Module.

Marking commencement of the implementation phase, ocean observations that could be considered 'operational' and meeting the general criteria of the GOOS Principles were designated in 1998 the GOOS Initial Observing system. However it had long been recognized that GOOS would depend on nations formally agreeing to the GOOS concept and principles and committing to the designation of part of their ocean observing activity as being part of GOOS. Conversely, some nations needed a formal international agreement in order to be able to make a national commitment. In 1999 the required agreement was formalized by Resolution at the 19th IOC Assembly. At the same time an 'Initial GOOS Agreements Meeting' was convened by I-GOOS, where 17 countries and four organizations reported on activities that would be regarded as linked to GOOS.

To test the feasibility of the fundamental GOOS vision of operationally delivering assimilated and model-generated products in a time-scale matched to purpose, drawing upon satellite remotely-sensed and *in situ* measurements from a global field of observations, the OOPC conceived the Global Ocean Data Assimilation Experiment (GODAE), whose field phase will be 2002-2005. Achievement of the *in situ* subsurface measurement objectives would have been ambitious indeed without the emergence of a bold proposal to seed the oceans with some 3000 floats, programmed to drift at up to 2000 metres depth, rising to the surface at weekly intervals to measure and transmit profiles of temperature and salinity. This 'Argo' project (mostly to be implemented by 2004) and GODAE are now nominated as Pilot Projects of GOOS although resourced and managed independently. They have become a powerful focus for international GOOS involvement.

The implementation of GOOS through 'regional alliances' (GRAs) focused on the specific obser-



vational requirements of a group of countries or agencies is proving to be an important means of recruiting national bodies into the GOOS process. The formation of North-East Asian Regional GOOS (NEAR-GOOS) and EuroGOOS pre-dated most GOOS plans, and several more such regional bodies are under development or consideration.

The building of capacity of less developed countries to benefit from and to participate in GOOS has always been a core objective. This is being advanced through a GSC Capacity-Building Panel and the issue in 2000 of a draft strategy. GOOS Regional Alliances (GRAs) offer a promising vehicle for regional capacity building.

Attention in both GOOS committees has turned to facilitation, especially in the context of Coastal GOOS planning. I-GOOS has functioned to endorse GSC actions, to facilitate governmental contact and to make recommendations to the IOC and other sponsoring agencies on behalf of GOOS. I-GOOS has recently addressed the formulation of a policy for GRAs and has recently decided to alternate its biennial meetings with regional forums in appropriate parts of the world. To improve intersessional effectiveness it has created an I-GOOS Board (of officers plus the GSC Chair) and has initiated an independent review of GOOS. In 2001 Dr S. Vallerga replaced me as the Chair of I-GOOS.

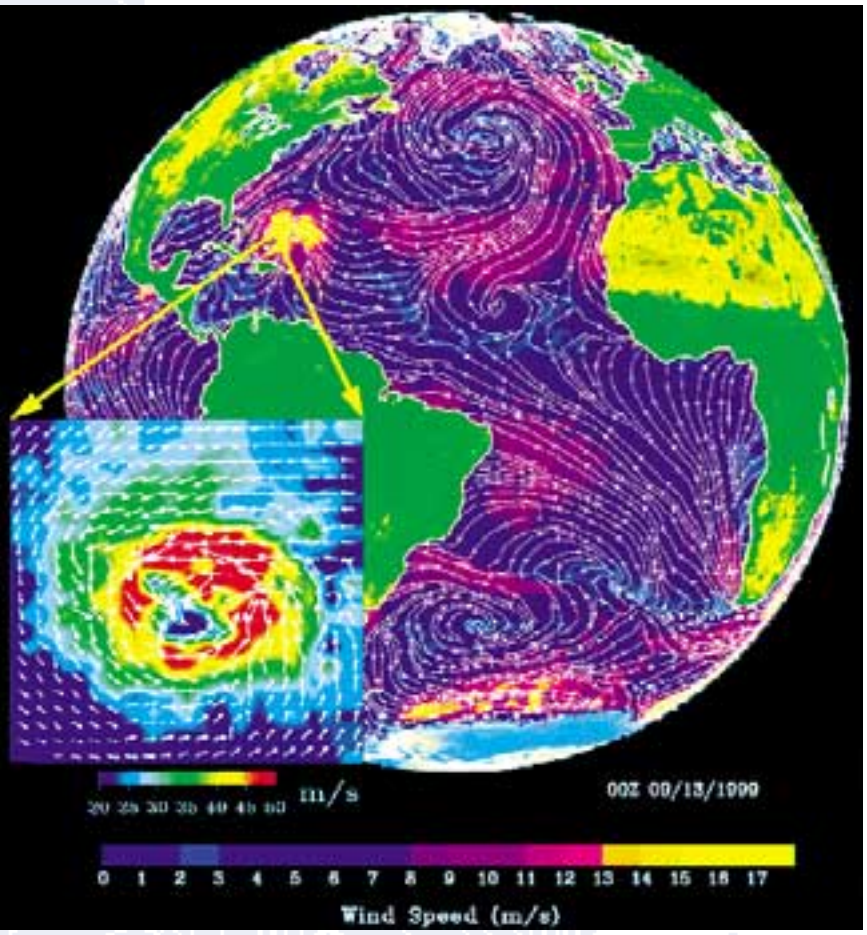
3.1 The Global Ocean Observing System (GOOS)

Overview

The Global Ocean Observing System (GOOS) is sponsored by UN Agencies [the IOC of UNESCO, the World Meteorological Organization (WMO), and the United Nations Environment Programme (UNEP), with help from the Food and Agriculture Organization (FAO)] together with the International Council for Science (ICSU). GOOS is designed to provide descriptions of the present state of the sea and its contents, and forecasts of these for as far ahead as possible, and to underpin forecasts of changes in climate. It is not solely operational, but includes work to convert research understanding into operational tools. It is designed to provide products useful to a wide range of users. Detailed descriptions of GOOS and its many components are available on the GOOS web site at: (http://ioc.unesco.org/goos).

Surface winds in the Atlantic Ocean as viewed by the QuikSCAT scatterometer, with the detailed structure of Hurricane Floyd (August 1999)

Image: courtesy of NASA



The approach to the design of GOOS was simplified and streamlined during the year. We now have an Open Ocean GOOS theme, devoted mainly to weather and climate forecasting and related issues, and a Coastal GOOS theme with a much higher density of observations that addresses a wider variety of issues including pollution and living marine resources. The details of the design will vary from one area to another, depending on local concerns.

The Coastal Ocean Observations Panel (COOP) is taking care of the design of the coastal theme. COOP was formed by merging the advisory panels for Coastal GOOS, Health of the Ocean (HOTO), and Living Marine Resources (LMR). Each of those panels had completed its work by drafting a design plan for publication on the GOOS web site. The primary task of COOP, which first met in Costa Rica on 15-17 November 2000, will be to integrate the three design plans into a single comprehensive design plan for coastal seas.

The Ocean Observations Panel for Climate (OOPC) is currently taking care of the design of the open ocean theme. The Panel's Terms of Reference changed during the year 2000 to reflect the expansion of its role from climate to include oceanic physical and biogeochemical processes. OOPC's tasks are currently:
(i) to monitor, describe, and understand the physical and biogeochemical processes that determine ocean circulation and its effects on the carbon cycle and climate variability; and, finally (ii) to provide the information needed for

ocean and climate prediction, including marine forecasting.

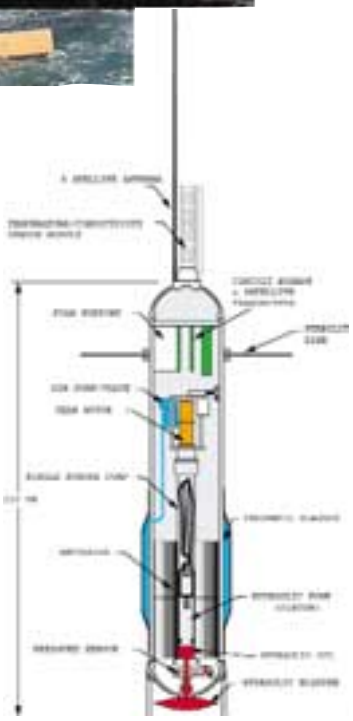
In order to ensure that the evolving GOOS designs are consistent with what users want, the user community was consulted through the First GOOS Users' Forum, held in association with the first COOP meeting, in Costa Rica on 13-14 November 2000.

GOOS implementation will depend to a fair extent on the success of the new Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). The structure and functions of JCOMM were defined in July 2000 by the 2nd JCOMM Transition Meeting, for consideration by the first meeting of JCOMM, which is planned for 19-29 June, 2001 in Iceland. (See pp. 87-89).

GOOS implementation is represented to a large extent by the GOOS Initial Observing System (GOOS-IOS). The GOOS-IOS, which was reported on in detail in the 1998 Annual Report and is set out on the GOOS website, is a collection of existing ocean observing sub-systems and pilot projects. It was expanded in 2000-2001 by the inclusion of the California Co-operative Fisheries Investigations (CalCOFI), and the Global Observing Systems Information Centre (GOSIC). The GOOS-IOS will expand into GOOS as a whole by the inclusion of new systems, and the adoption of many national systems whose incorporation is now under consideration. In that context, EuroGOOS is developing a European Directory of Initial Observing Systems (EDIOS), which will provide detailed information about the GOOS-IOS in Europe.

The major pilot project in the GOOS-IOS is the Global Ocean Data Assimilation Experiment (GODAE). A GODAE Strategic Plan has been published (http://www.bom.gov.au/bmrc/ocean/GODAE/Strategic_Plan.pdf), and an Implementation Plan has been drafted. The main development of GODAE will be in 2003-2005. A transition phase (2006-2007) has been added to accommodate the transition of GODAE systems to operational support. A GODAE High Resolution Sea Surface Temperature (SST) Pilot Project is underway to develop high-resolution SST data sets and products using all available remote and *in situ* measurements and scientifically defensible definitions of SST. The project will be developed following the method used for developing the Argo pilot project. A first step will be production of a Strategic Plan in mid-2001. The establishment of the GODAE Server, operated by the US Navy in Monterey, California, is the most significant recent development in taking GODAE forward. This site will provide access to all GODAE data (either directly or via distributed access) as well as providing a range of products. A similar facility is being established in France.

Argo float, illustrations from Argo brochure



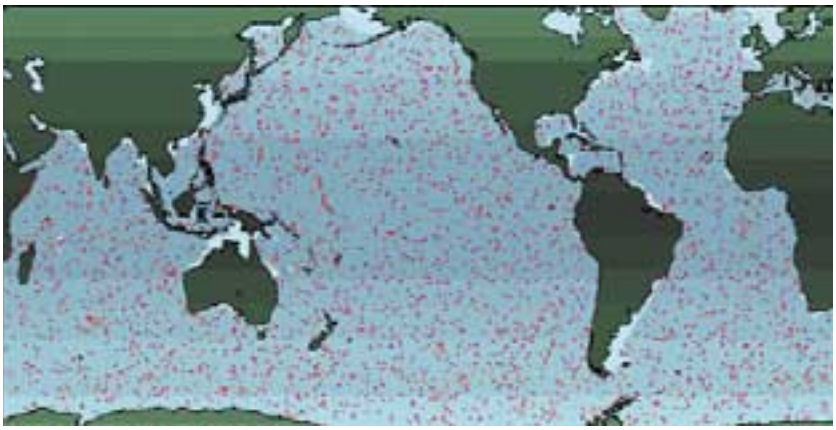
The Argo Pilot Project to seed the ocean with 3000 profiling floats to collect upper ocean temperature and salinity data is well underway, and will make a significant contribution to the success of GODAE. Around 900 floats are already funded and some 2500 floats are proposed over the next 3 years, making it likely that the 3000 target will be reached during the period 2003-2005. Countries with present or proposed commitments include Australia, Canada, China, Denmark, France, Germany, India, Japan, New Zealand, Republic of Korea, Spain, the UK, the USA, and the European Commission. Several countries have made financial commitments to the Argo project, including funds to support the

recruitment of an Argo Technical Co-ordinator to work at the Argo Information Centre in Toulouse.

Regional implementation planning meetings for Argo were held for the Atlantic (Paris) and Pacific (Tokyo) in 2000, and an Indian Ocean Argo meeting will be held in Hyderabad (India) in July 2001. The first meeting of the ad hoc committee addressing data management issues for Argo was held at the IFREMER Centre in Brest (October 2000).

The principal issue with Argo concerns global coverage. This will require nations to free some of their resources for use in remote regions. A second issue concerns deployment of floats in national Exclusive Economic Zones (EEZs).

Typical global coverage with 3,000 Argo floats



Argo is the next step in global ocean observations. Its subsurface data will complement our existing global satellite observations of sea surface temperature, topography and winds, to improve forecasts of all kinds.

Source: Argo brochure (www.argo.ucsd.edu)

Argo took advantage of the GOOS/GCOS Regional Workshop for the Pacific Islands in Apia (Samoa) in August 2000 to develop an approach with the Pacific island nations to address this issue. The South Pacific Geosciences Commission (SOPAC) is working with its member nations to secure permission to deploy floats within their collective EEZs, especially in the 'warm pool' associated with the El Niño-Southern Oscillation (ENSO); the 'warm pool' covers an area included within several (EEZs) of many island nations.

GOOS is also being implemented regionally. A Regional Policy has been drafted to cover the management of the fast developing group of regional GOOS bodies. It awaits the approval of the Intergovernmental Committee for GOOS (I-GOOS) at its 5th session in June 2001.

EuroGOOS in Europe, and North-East Asian Region GOOS (NEAR-GOOS) continued their progress. EuroGOOS held a major workshop on bio-ecological operational modelling, and is working towards implementing operational ecosystem models and forecasts, in conjunction with the International Council for the Exploration of the Sea (ICES), the Helsinki Commission (HELCOM), and the Oslo-Paris Commission (OSPAR). At the Fifth Session of the NEAR-GOOS Co-ordinating Committee (December 2000), it was agreed to embark on a strategic planning exercise that should ultimately lead to the inclusion of chemical and biological parameters, as well as to operational forecasting.

During November 2000 a series of meetings took place in Perth, organized by the IOC Perth Regional Programme Office. An Oceans and Climate 2000 seminar and reception, which included Hendy Cowen (the Western Australia Deputy Premier), John Zillman (Director of the Australian Bureau of Meteorology), Patricio Bernal (Assistant Director-General of UNESCO and Executive Secretary of IOC) and others, formed part of the series. Of the eight meetings held, five were of major interest to IOC and GOOS. These included the Sustained Observations for Climate in the Indian Ocean (SOCIO) meeting, the Southern Ocean observing meeting, the TAO Implementation Panel meeting, the Indian Ocean Climate Initiative meeting, and the Cockburn Sound Groundwater Discharge Workshop. The IOC Perth Office

presented an Indian Ocean observing strategy paper to the SOCIO meeting.

Over eight hundred participants attended the series of meetings, making them the largest marine science gathering ever convened in Western Australia. There was extensive TV, radio and press coverage, greatly enhancing the status of the Perth Office, IOC and UNESCO, and the Western Australian government's role in marine science. The case for establishing a regional ocean observing system for the Indian Ocean was supported by the press.

Also in Perth, several meetings were convened in August and September 2000 to explore interest in establishing a Western Australia GOOS project. The objectives were to determine the level of interest in the area for establishing a project, to spread the awareness of GOOS, and identify people and programmes to be called upon in the Indian Ocean and the Pacific to serve as resources for training and project implementation.

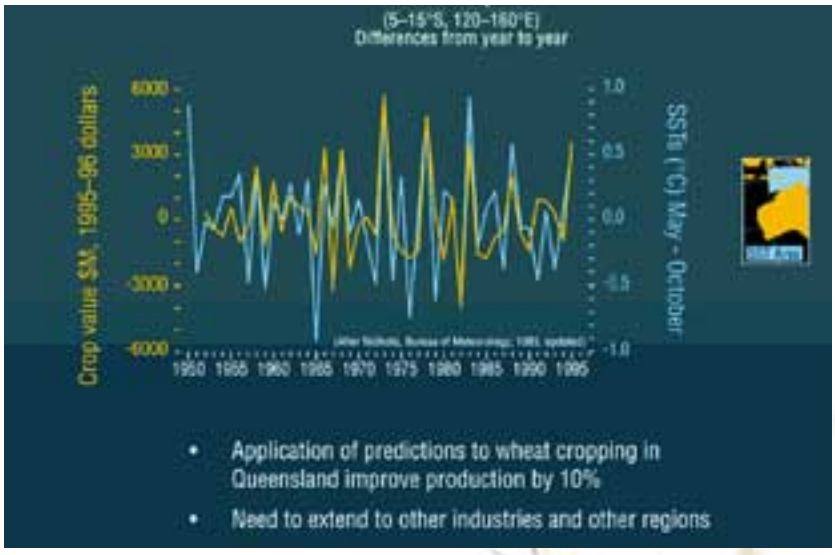
Meetings were held between GOOS bodies and both ICES and its north Pacific counterpart – PICES, to see how their ecosystem requirements could be met by GOOS developments. ICES, the IOC, EuroGOOS, and OSPAR will co-sponsor a workshop in Bergen (Norway) in September 2001 to develop an ecosystem approach to observations for fisheries management in the North Sea. A workshop co-sponsored by PICES, NEAR-GOOS and IOC will be held in Seoul (Republic of Korea) in August 2001 to develop a common approach to ocean forecasting in N.E. Asia.

Contacts were strengthened between GOOS and UNEP's Regional Seas Programme, through participation of the GOOS Project Office (GPO) in the 3rd meeting of the Regional Seas Conventions and Action Plans in Monaco in November 2000. UNEP will give a presentation at the IOC Assembly (July 2001) on these growing links, as a first step towards developing an IOC-UNEP Memorandum of Understanding on this topic. UNEP will also be participating in future in COOP meetings to help to cement this relationship. UNEP's Northwest Pacific Action Plan (NOWPAP) is now being tied in to NEAR-GOOS.

Regional meetings were held to take forward the development of PacificGOOS in the Pacific islands region (Apia, August, 2000), and IOCARIBE-GOOS in the Caribbean region (Havana,Cuba, November 2000), and were planned for Black Sea GOOS (May 2001), South-East Asia GOOS (SEA-GOOS) (August 2001), and GOOS-AFRICA (November 2001). MedGOOS submitted a major funding proposal to the European Commission (EC) to develop an observing network in the Mediterranean. Proposals for establishing a Western Indian Ocean Marine Applications Project (WIOMAP) and a South-East Asia Centre for Atmospheric and Marine Prediction (SEA-CAMP) await funding.
Continued implementation of GOOS at the national level is essential to

All-Australian crop value & SSTs

The rains also come when sea surface temperature is high off northern Australia. High rainfall correlates with high crop yields, underscoring the value of forecasts based on oceanic data. Note the drought of the major El Niño event of 1982-83, and the rain associated with the subsequent La Niña. Best forecasts come from combining El Niño and Indian Ocean Dipole effects.



Source: Australian Bureau of Meteorology

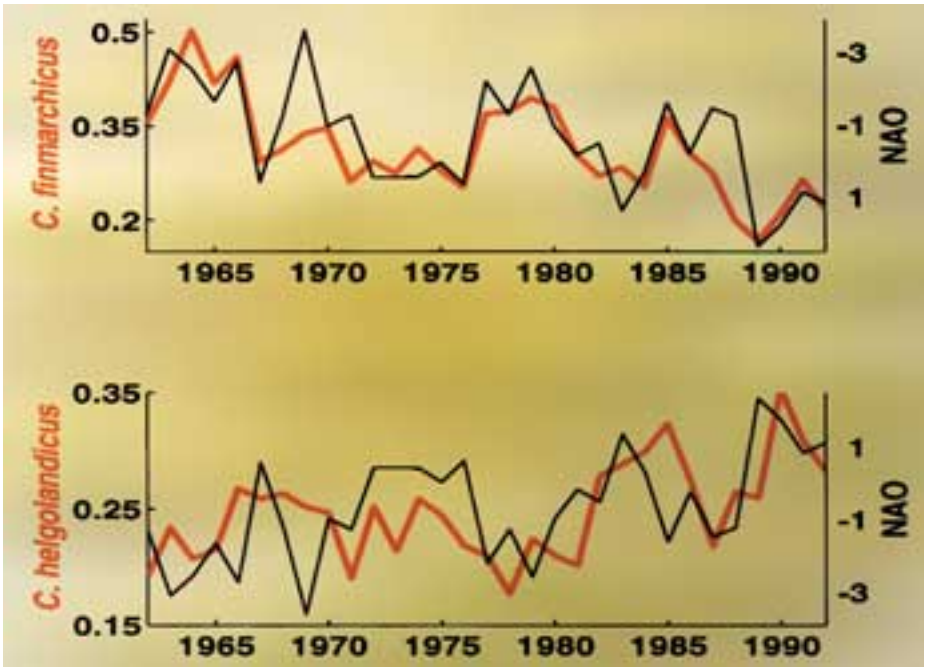
© NASA

facilitate GOOS development. Many coastal countries are planning or collecting their own coastal seas observations following GOOS Principles. All IOC Member States are encouraged to form National GOOS Co-ordinating Committees involving all stakeholders (advice on such a committee is given on the GOOS website at [http://ioc.unesco.org/goos/nat_com.htm]). A consultant will be hired in 2001 to collect information on commitments made by various countries to GOOS.

Both GOOS and the IOC, along with other organizations and the major space agencies, are members of the Partnership for an Integrated Global Observing Strategy (IGOS-P), which is focusing attention on what needs to be done to make such observations more cost-effective. At the end of the year the IGOS Partners published the Ocean Theme document, indicating the capabilities of and developments needed for better integrated ground-based and space-based measurements to make GOOS work. The IGOS Partners are now keen to develop an Integrated Global Carbon Observing Theme. The GPO was involved with the OOPC, the SCOR-IOC Advisory Panel on Ocean CO_2, and the wider scientific community in developing a background paper on an ocean observing system for carbon, which will inform on the development of such a theme.

A EuroGOOS Conference on Operational Ocean Observations from Space was held at Darmstadt in October 2000, and the proceedings will be published early in 2001. Co-ordination continues with EUMETSAT to promote the launch and funding of operational ocean-observing satellites. IOC was invited to join the Co-ordinating Group on Meteorological Satellites (CGMS), which is turning increasingly towards the use of ocean data by meteorological agencies.

The *GOOS Data Products and Services Bulletin* provides a user-oriented view of the kinds of products and services that GOOS can and will produce. The first edition is now available on-line at: http://ioc.unesco.org/gpsbulletin/.



Continuous Plankton Recorder data from the North Atlantic show clear correlations between the populations of different species of the plankton *Calanus* and the North Atlantic Oscillation (the difference in pressure between the Iceland 'low' and the Azores 'high'). This demonstrates the control of ocean biology by climate, and the need to continue observations over the long term in order to develop a predictive capability

Courtesy of SAHFOS.

From IGOSS to JCOMM

By Dieter P. Kohnke
Former Chairman of IGOSS and Co-President of JCOMM

In the late sixties IOC realized that there was a growing requirement for oceanic data on a global scale by a wide variety of users comprising researchers, engineers, shipping companies and fisheries as well as the forecasting services for the public. In response to this need the Commission investigated the possibility of establishing a global network of ocean data stations. A permanent Working Committee for the Integrated Global Ocean Station System (IGOSS) was established aiming at planning and co-ordinating a relevant IOC programme of studies and services in oceanic areas.

Following this action of IOC, WMO established an Executive Committee Panel on Meteorological Aspects of Ocean Affairs (MAOA). Meetings of IGOSS and MAOA were held jointly in most cases. The WC for IGOSS together with the EC/MAOA prepared a 'General Plan and Implementation Programme for IGOSS (1977-1982)'. The Plan was intended to serve as a guide for the further development of IGOSS.

The IOC Working Committee for IGOSS was re-structured several times. In 1977 it became the Joint IOC/WMO WC for the Integrated Global Ocean Services System (IGOSS). This was a major step forward in the development of ocean services. The word 'station' in the name of the Joint Committee was changed to 'services' to better reflect the ultimate goal of the Committee, namely providing services rather than just making observations. The most striking success was the *IGOSS Products Bulletin*, which is now available in an electronic form on the Internet.

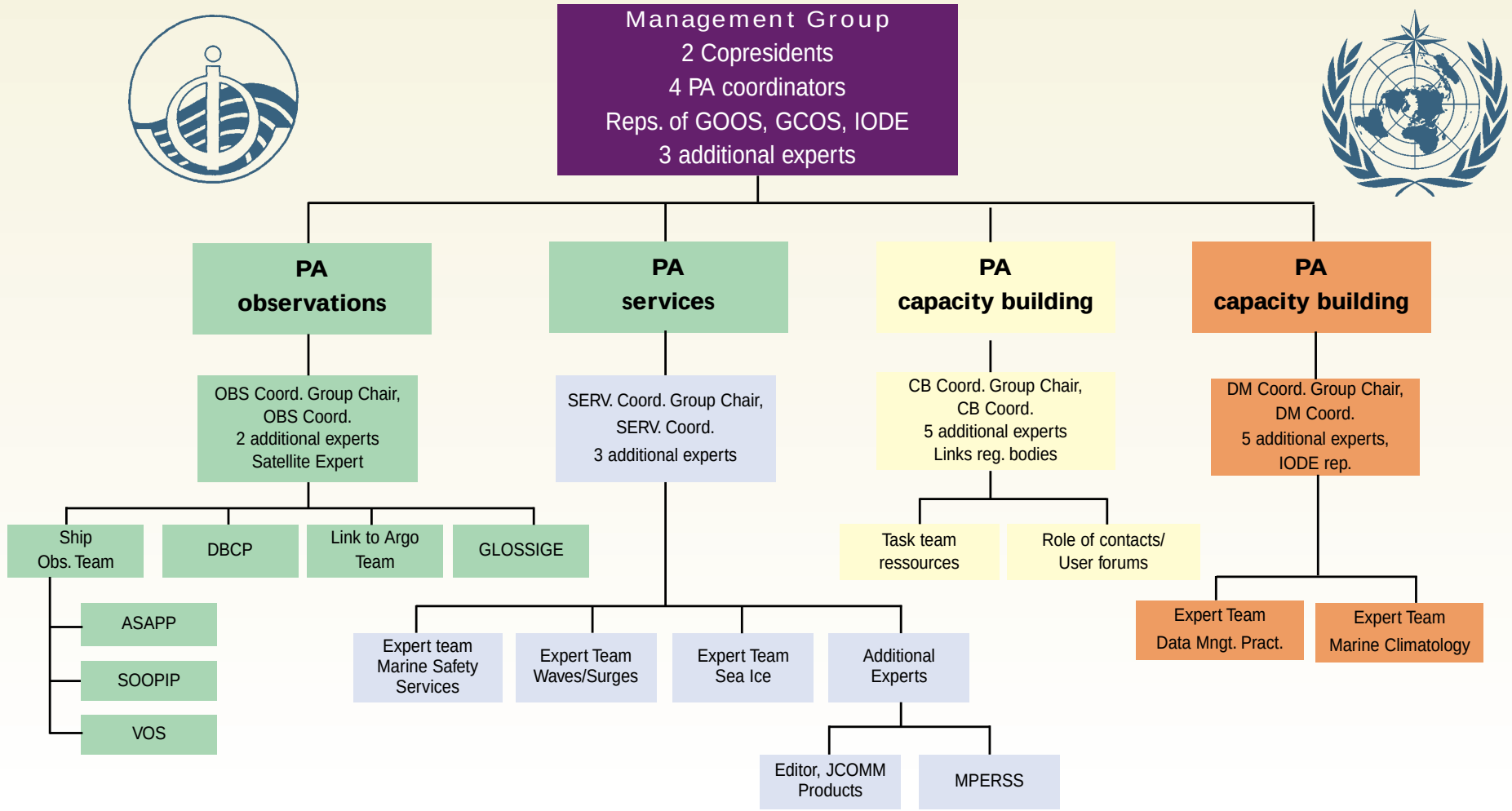
The essential elements of IGOSS, through which the activities were carried out, were:

(i) The IGOSS Observing System (IOS) consisting of various facilities and arrangements for obtaining oceanographic information from different platforms;
(ii) The IGOSS Data Processing and Services System (IDPSS) consisting of national, specialized and world oceanographic centres for the processing of data and the provision of products and services;
(iii) The IGOSS Telecommunication Arrangements (ITA) consisting of telecommunication facilities of the World Weather Watch (WWW), the Global Telecommunication System (GTS) and other arrangements.

IGOSS was an ocean-monitoring programme. It did play an important role in supporting the World Climate Research Programme (WCRP) by providing appropriate data and services. A pilot project for the operational exchange of sea-level data in the Pacific Ocean was started in 1984 in collaboration with the University of Hawaii.

In 1975 IGOSS commenced the Pilot Project on Marine Pollution (Petroleum)

Organizational structure of JCOMM



PA= Programme Area

Monitoring (MAPMOPP). This was an attempt to get an overview on the global coverage of the sea-surface with hydrocarbon residues (mainly oil and tar), with simple observation and measurement techniques. The results of the Pilot Project were published and presented to different forums.

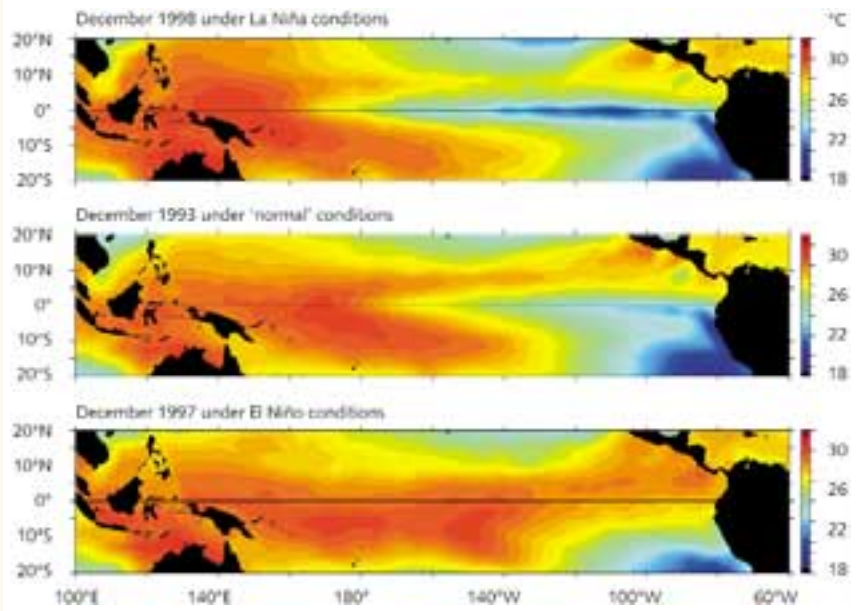
There was always a close relationship with the IOC WC on IODE. Each Committee was represented at meetings of the other's. In the last decade joint consultative meetings were held which co-ordinated and streamlined the real-time and non-real-time data flows. Joint projects were developed; the most important one was, and still is, the Global Temperature/Salinity Pilot Project (GTSPP) [now the Global Temperature/ Salinity Profile Programme].

IGOSS was always flexible enough to adapt to scientific and technical advances. It played a successful role in FGGE (First GARP Global Experiment, 1979), in TOGA (Tropical Ocean and Global Atmosphere study) and WOCE (World Ocean Circulation Experiment). The biggest challenges for operational oceanography now are the global observing systems for climate (GCOS) and the ocean (GOOS). Only fully coordinated and highly effective mechanisms to manage the observing systems, data quality assurance and data exchange, as well as the provision of user-oriented products and services will make these global programmes a success.

As a consequence, IOC and WMO decided to concentrate their efforts by merging the Joint IOC-WMO Working Committee for IGOSS and the WMO Commission for Marine Meteorology (CMM) into the Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM). Two Transition Meetings (St. Petersburg, Russia, 19-23 July 1999; and Paris, 14-16 June 2000) paved the way for the 1st Session of JCOMM which is to take place in Akureyri (Iceland) from 19 to 29 June 2001. The infrastructure to manage operational oceanography on a global scale is becoming effective. What is needed now are commitments by Member States for sustained contributions to the observing system as well as to marine monitoring and forecast services.

It is a big challenge for JCOMM in the future to maintain and further develop a global network of observing systems which provide the data necessary for user-oriented products and services which help in facilitating navigation, protecting the marine environment, saving lives and property, and assessing the impact of anthropogenic activities on the environment.

SST in the equatorial Pacific Ocean
(See scales to right of each map)



Qualitatively, there is a similarity between La Niña (top) and normal conditions (middle), with cool water (blue) extending along the equator, away from the cold upwelled water (blue) near the South American shore. Nothing similar occurs during an El Niño episode (bottom) in which a band of warm water (red) is observed along the equator from one side of the Pacific to the other.

Courtesy of the NOAA/PMEL/TAO Project Office

Global Sea Level Observing System (GLOSS)

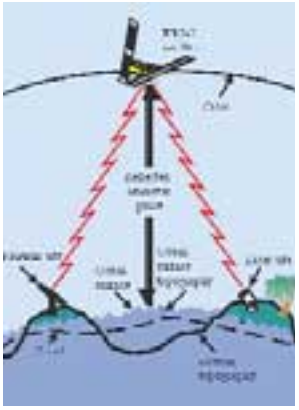
The GLOSS network of 300 tide-gauge stations is an integral part of GOOS. There has been no major GLOSS meeting since the sixth session of the GLOSS Group of Experts (GE) took place in Toulouse, France, in May 1999. One of the most important outcomes of that meeting was the decision to establish a Scientific Steering Group (SSG), initially as a sub-group of the Group of Experts – but eventually as a joint group with other GLOSS-related programmes (e.g. OOPC, CLIVAR-UOP, and IAPSO CMSLT). This group has since been formed, with Dr Gary Mitchum as Chairman, and with representatives of each of the main areas of research in GLOSS. The group will advise the Group of Experts as appropriate, as scientific priorities develop in future.

Traditional tide gauge, Ilfracombe, UK

From PSMSL, UK

The Permanent Service For Mean Sea Level (PSMSL) provides a summary of the status of the GLOSS Core Network (GCN), which reflects the status of the programme overall. As of October 2000 the status of the programme was nearly identical to that of 1999, being about two-thirds operational. Some countries have installed new tide-gauge equipment. Many GLOSS stations in other countries are being terminated or require major upgrades. As investments made in gauges for international programmes, notably the World Ocean Circulation Experiment (WOCE), are unlikely to be repeated, GLOSS status may have reached a plateau. This picture may change if the investment in regional networks of coastal tide gauges recommended by, for example, the Coastal Oceans Observations Panel of GOOS takes place. Nevertheless, investment in equipment and training is needed in many countries to maintain or improve GLOSS's operational status. The GLOSS altimetry subset (GLOSS-ALT) comprises tide gauges primarily on islands, and is used to calibrate satellite altimeters. This subset is largely operational.

Satellite monitoring system



From PSMSL, UK

The *GLOSS Handbook* is being updated. Its web pages at http://www.bodc.ac.uk/services/glosshb/ now provide links to the sea-level data from WOCE. Version 2.0 of the WOCE sea level data set is also available on a CD-ROM that also contains tidal constants from the WOCE sea level data set, the PSMSL monthly and annual mean sea level data set, and the *GLOSS Station Handbook*. Copies are available from PSMSL, the British Oceanographic Data Centre (BODC) or the University of Hawaii Sea Level Center (UHSLC).

GLOSS is beginning a data archaeology project to find and digitize historical sea level records with the aim of extending existing time series and gaining access to observations that are not in digital form. The activity is supported by the International Data and Information Exchange (IODE) programme. All countries are encouraged to assess their holdings of historical tide gauge data that can potentially be rescued, and to inform the GLOSS Secretariat about them.

Training in the taking and manipulation of sea level measurements continued with a GLOSS training course in April 2000 in Jeddah, Saudi Arabia. A workshop report is available.

An updated version of the third volume of the IOC Manuals and Guides No.14 on sea level measurement and interpretation can be down-loaded from the PSMSL training web page (http://www.pol.ac.uk/psmsl/training/training.html). Several sets of tidal analysis software continue to be widely distributed and play a major role in improving data quality and timely delivery.

The *GLOSS Bulletin* is also available on the web. Several issues of the *Afro-American GLOSS News* have been produced by the University of São Paulo, with recent editions on the web. All sea level centres (PSMSL, BODC, UHSLC, and the Australian National Tidal Facility) now have good web pages that serve to spread information to the public as well as to the scientific community. Two-page brochures advertising GLOSS are now available in English, Portuguese, Spanish and French and can be downloaded from the PSMSL training web page.

Several papers have been published using GLOSS and other sea level data. There is an important contribution in Chapter 11 of the Third Assessment Report (TAR) of the Intergovernmental Panel on Climate Change (IPCC) (January 2001). A report of the GE-6 workshop on 'Ocean Circulation Science derived from the Atlantic, Indian and Arctic Sea Level Networks' is available. Notable sea level publications in the past two years include a book on the history of tidal research by David Cartwright, and a book on sea level changes edited by Bruce Douglas, Steve Leatherman and M.S. Kearney. A review of global and European regional sea level changes has been published by David Smith and colleagues. GLOSS-related meetings in 2000 included a conference on Climate Change, Climate Variability and Sea-Level Rise (Rarotonga, Cook Islands, April 2000), and a co-ordination meeting of the MedGLOSS programme (Haifa, Israel, May 2000). MedGLOSS is a joint programme of the International Commission for the Scientific Exploration of the Mediterranean Sea (CIESM) and IOC, and aims to install and co-ordinate a network of gauges for the Mediterranean and Black Seas.

Four second-hand Ott R20 gauges (chart recorders) were donated to GLOSS by Singapore and eventually two were provided to Romanian authorities as a contribution to MedGLOSS development. The two others remain at the UK's Proudman Oceanographic Laboratory (POL), and could be made available if required.

Ship of Opportunity Programme (SOOP)

The SOOP is also an integral part of the GOOS-IOS. Information about it is available on the SOOP website (http://www.brest.ird.fr/soop-ip). SOOP was originally a part of the Integrated Global Ocean Services System (IGOSS), now merged into JCOMM.

SOOP uses ships of opportunity (mostly merchant vessels) to deploy expendable bathythermographs (XBTs) that collect subsurface temperature (and sometimes salinity) data along shipping lines. More than 24,350 XBT profiles were made during 2000 by SOOP operators from Australia, France, Germany, India, Japan, USA, and the Mediterranean Forecasting System Pilot Project (MFSPP). This includes 15,800 profiles in the Pacific Ocean; 1,750 in the Indian Ocean; 4,500 in the Atlantic Ocean; and 2,300 in the Mediterranean Sea. The Equatorial Atlantic and North Atlantic are well covered as is the North Pacific. The South Atlantic and Southern Oceans are

under-sampled. The Indian Ocean is partially sampled.

To optimize XBT deployments, SOOP operators are considering upper ocean thermal data requirements, available resources and other sources of data, and co-ordinating their efforts.

SOOP lines in 2000, indicating kinds of lines and degrees of sampling achieved

Source: IOC/WMO
Ship of Opportunity Programme

Since June 1999, SOOP has been served by a Co-ordinator, Mr Etienne Charpentier, who also serves as technical co-ordinator of the Data Buoy Co-operation Panel (DBCP). Based on input from SOOP operators and data users, the Co-ordinator maintains a programme database, evaluates available global programme resources (http://www.jcommops.org/soop/semestrial_survey.html) and real-time data flow, and, to some extent, data quality, and provides SOOP operators with information enabling them to improve co-ordination and overall network efficiency.

At its third meeting (San Diego, USA, 28-31 March 2000), the SOOP Implementation Panel (SOOPIP), endorsed recommendations from the Upper Ocean Thermal Review by the OOPC and CLIVAR, and adjusted its implementation plan accordingly. SOOP will gradually withdraw from broadcast (areal) sampling while the Argo float programme is implemented, and will at the same time ramp up its effort in repeat (transect) sampling. This transit sampling will include both frequently repeated lines providing intermediate resolution, and quarterly repeated (high-density) lines providing high resolution.

Recently, SOOP has been facing several problems, including (i) substantial increases in the cost of XBT probes (50% in 1999), (ii) financial constraints in the face of changing national priorities, (iii) logistical problems (e.g. availability of shipping, ships changing ownership, changes in ship crews), and (iv) concerns with regard to the Protocol on Environmental Protection to the Antarctic Treaty (Madrid Protocol) under which governments may restrict research activities south of 60° S where doubts exist on possible environmental impacts. SOOP is doing its best to find solutions to these problems, but could not avoid reducing activity in 1999 and 2000, especially in the Atlantic and Indian Oceans. About 22,000 XBT probes were dropped globally in 2000 (excluding the Mediterranean Sea with 2,300 drops). In contrast, about 35,000 probes would be needed every year to support the sampling recommended by the Upper Ocean Thermal Review.

Most SOOP data are submitted to and managed by the Global Temperature/Salinity Profile Programme (GTSPP). Users can access SOOP data through the Marine Environmental Data Service (MEDS), Canada, and NOAA's National Oceanographic Data Center (NODC). Quality is controlled annually by NOAA's Atlantic Oceanographic and Meteorological Laboratory (AOML), and the Joint Australian Facility for Ocean Observing Systems (JAFOOS), Australia. Monthly quality control checks are made by MEDS.

Data Buoy Co-operation Panel (DBCP)

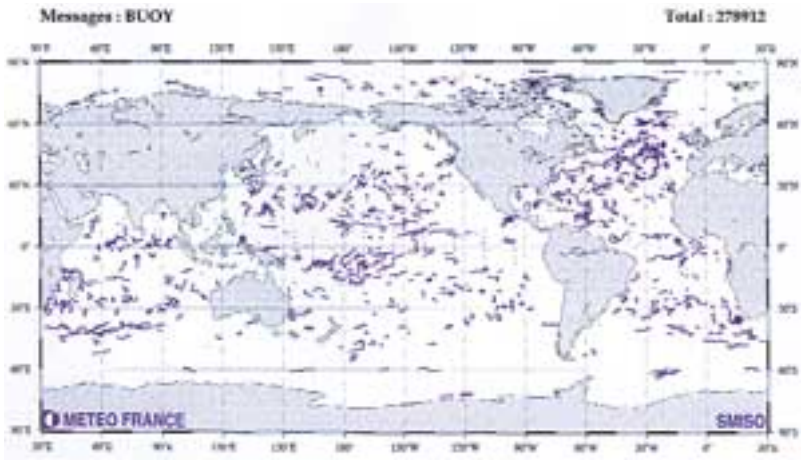
The DBCP is also an integral part of the GOOS-IOS and of JCOMM. It was established in 1985 by WMO and IOC to:
(i) achieve the optimum use of any data buoy deployments being undertaken worldwide and an increase in the amount and quality of buoy data available to meet the objectives of major IOC and WMO programmes; and
(ii) encourage and support the establishment of 'action groups' in particular programmes or regional applications to effect the desired co-operation in data buoy activities. It is served by a full-time Technical Coordinator.

In December 2000, data from over 1,300 drifting buoys were collected through Service Argos. Of those buoys, about 60% had their data distributed on the Global Telecommunications System (GTS) of the WMO. It is becoming increasingly difficult to distribute data via the GTS for the remaining 40%, either for practical reasons (short duration programmes, not relevant) or because the managers of the buoy programmes would not provide authorization (confidentiality). Of the moored and drifting buoys whose data was reported on the GTS in December 2000, 250 reported atmospheric pressure (mainly Lagrangian Barometer drifters), 688 reported SST (mainly Lagrangian drifters), 93 reported wind (mainly Tropical Atmosphere Ocean – TAO moorings), 153 reported air temperature, and 78 reported sub-surface temperatures (mainly TAO moorings) (see details at http://dbcp.nos.noaa.gov/dbcp/1sigm.html).

Buoy data are archived by the IODE Responsible National Oceanographic Data Centre (RNODC) for drifting buoys, operated by MEDS of Canada, and the JCOMM Specialized Oceanographic Centre (SOC) for drifting buoys, operated by Météo-France. The JCOMM Subgroup on Marine Climatology will be the overall repository of metadata for all ocean observing systems, including drifting and moored buoys.

Buoy programmes are implemented mainly through the seven DBCP Action Groups: the European Group for Ocean Stations (EGOS, North Atlantic); the International Arctic Buoy Programme (IABP); the International Programme for Antarctic Buoys (IPAB); the International South Atlantic Buoy Programme (ISABP); the International Buoy Programme for the Indian Ocean (IBPIO); the Global Drifter Programme (GDP); and the Tropical moored buoy Implementation Panel (TIP).

Mapping position plot chart of buoy data received during August 2000



SMISO = IGOSS, now JCOMM

A DBCP implementation strategy provides an overall framework for buoy deployments, in the light of developing requirements for marine observations, and especially buoy data, to support operational meteorology and oceanography, marine scientific research and global climate studies. The strategy was reviewed and revised at the 16th session of

the Panel, which was held in Victoria, Canada, 16-20 October 2000, to take into consideration factors like the development of JCOMM, and the emergence of new regional programmes (e.g. in the Black Sea). Integration of buoy deployment opportunities in the context of the formation of JCOMM began through the operations of an interim JCOMM *in situ* Observing Platform Support and Operations Centre (JCOMMOPS, http://www.jcommops.org/). JCOMMOPS offers a single point of logistical information for the DBCP, SOOP, and Argo programmes as well as for the Automated Shipboard Aerological Programme (ASAP) and the Voluntary Observing Ship (VOS) programme of the WMO.

Deferred-time Quality Control (QC) of GTS buoy data is achieved through the so-called DBCP QC Guidelines. Principal Meteorological or Oceanographic Centres (PMOCs) responsible for GTS buoy data quality control routinely provide buoy operators with information regarding the quality of their buoy data. Recent statistics show that the root mean square (RMS) of the difference between observed data and the meteorological model first guess field of the European Centre for Medium Range Weather Forecasting (ECMWF) is low, in the order of 1.2 hPa for air pressure buoy data, and between 2 and 3 m/s for wind speed buoy data.

Efforts have been made to bring the problem of the vandalism of buoys to the attention of the global maritime community. The International Hydrographic Organization (IHO) issued a special 'Hydrogram' on the presence of data buoys in the seas and the necessity of their safety for assistance to mariners, in particular during bad weather times. Hydrograms will be published by national Hydrographic Services at least once per year in their 'Notices to Mariners' (http://dbcp. nos.noaa.gov/dbcp/vandalism.html).

The Argos Joint Tariff Agreement (JTA) meeting promotes the use of the Argos system for the location and collection of data from buoys and other platforms, both ocean- and land-based, by securing a preferential tariff for government users. The 20th session of the Argos Joint Tariff Agreement meeting was held in Victoria, BC, Canada, 23-35 October 2000 to fix the tariff for 2001.

Tropical Atmosphere Ocean (TAO) Implementation Panel (TIP)

The Tropical Atmosphere Ocean (TAO) Implementation Panel was formed in 1992, under the auspices of the international Tropical Ocean Global Atmosphere (TOGA) programme, to define strategies that will ensure uninterrupted implementation and long-term maintenance of the TAO array of buoys that monitor El Niño events in the equatorial Pacific. The Panel is also involved with the PIRATA array of buoys in the tropical Atlantic. The Panel is sponsored by the World Climate Research Programme's international Climate Variability and Predictability Project (CLIVAR), the Global Ocean Observing System (GOOS) and the Global Climate Observing System (GCOS), with management of the TAO project being carried out by NOAA's Pacific Marine Environmental Laboratory (PMEL) in Seattle, USA. The Panel met most recently in its 9th session in Perth, Australia (16-17 November 2000), and addressed specific issues related to the design and development of a moored buoy programme for Indian Ocean climate studies. New TAO web pages (http://www.pmel.noaa.

gov/tao/) provide easier access to TAO and PIRATA data sets, as well as updated technical information on buoy systems, sensor accuracies, sampling characteristics, and graphical displays.

In January 2000, responsibility for moorings west of 165ºE longitude moved from PMEL to the Japan Marine Science and Technology Centre (JAMSTEC), hence the moored array is now named the TAO/TRITON (Triangle Trans-Ocean buoy Network) array. The TAO/TRITON array in the tropical Pacific consists of nearly 70 ATLAS, TRITON and current meter buoys, which transmit basic marine meteorological, surface, and subsurface data to base in near real-time via satellite. Moorings are typically deployed for one-year, after which the instrumentation is recovered for calibration and refurbishment. The moorings are located between 8ºN and 8ºS from 95ºW to 137ºE and are maintained primarily through the efforts of the United States and Japan. Approximately 350 days at sea are required to maintain the array.

Standard sensors measure surface winds, air temperature, relative humidity, sea surface temperature and ten subsurface temperatures in the upper 500 metres. Ocean currents are measured at five sites along the equator and at all TRITON sites. Additional sensors, including those which measure rainfall, short-wave radiation, and surface salinity, can be added as required by collaborative programmes.

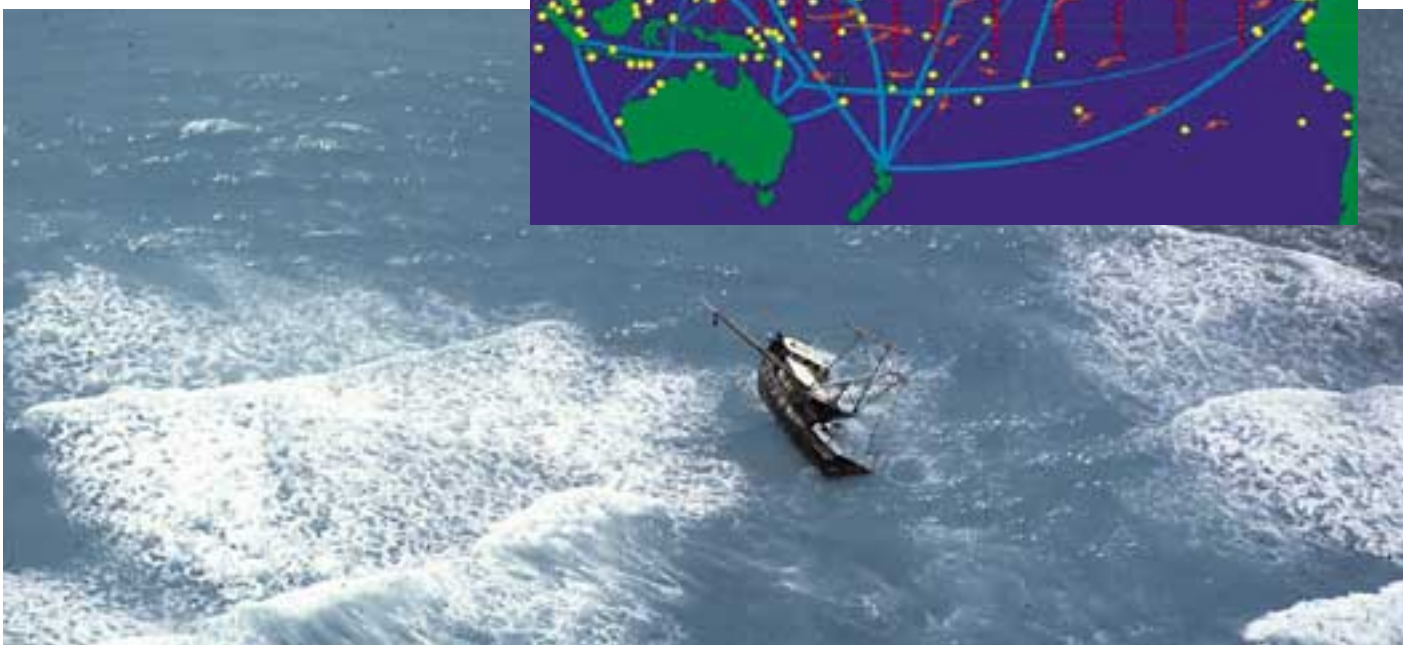
Observations from the TAO/TRITON moorings are transmitted to shore in real time via NOAA's polar orbiting satellites. Data are processed and encoded into BUOY code by Service Argos, using calibrations and algorithms supplied by PMEL and JAMSTEC. Daily averaged subsurface data and several hourly values of surface data are available in real time each day from the moorings. The TAO and TRITON Project Offices work with

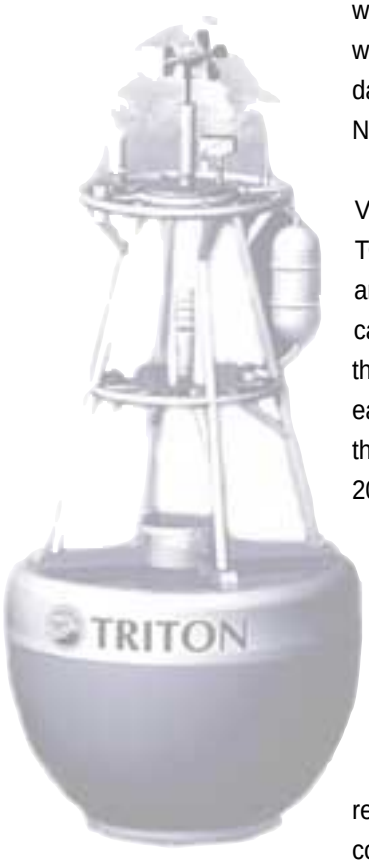
ENSO Observing System

Red dots are fixed buoys (for oceanographic & meteorological observations); yellow dots are drifting buoys (for surface currents and properties); blue lines are commercial vessel tracks (measuring subsurface temperatures by XBTs).
All supplemented by satellite data, especially temperature, topography and winds.

(Source: NOAA)

Photo: © UNESCO





the DBCP and Service Argos in quality controlling real-time TAO/TRITON data. Quality control checks are performed daily to detect instrumentation failures or calibration problems. In addition to the GTS submission, TAO/TRITON data are also processed and quality controlled by the TAO and TRITON Project Offices and made available as a unified data set via the World Wide Web (http://www.pmel.noaa.gov/toga-tao/ and http://www.jamstec.go.jp/jamstec/TRITON/). All TAO data are submitted annually to the US National Oceanographic Data Center.

Vandalism continued to plague the TAO/TRITON array in the Pacific and the PIRATA array in the Atlantic. Data return was significantly lower in regions of high tuna catch in the eastern and western Pacific, and in the eastern Atlantic. In addition, over the past three years (October 1997 – September 2000), 17 of 220 ATLAS moorings deployed in the Pacific between 95° W and 137° E broke free from their anchors and drifted away from their deployment sites. Of these, 9 systems disappeared while 8 partial systems were later recovered. While not all of these losses can be attributed to vandalism, physical evidence from recovered systems suggests it is a major contributor. In addition, of 10 TRITON moorings deployed between 138° E and 156° E in the past year, 9 showed signs of vandalism, though fortunately no TRITON buoys were completely lost.

Efforts to combat vandalism continue, though it is not clear they are making much impact. These efforts included distribution of information brochures to national fishing agencies, fishing boats in ports of call, and industry representatives. Also, presentations on the effects of vandalism were made recently in Martinique (International Fish Aggregation Device Conference, September 1999), Lake Arrowhead, California (Inter-American Tropical Tuna Commission, May 2000), and Monaco (International Hydrographic Organization, June 2000). Engineering efforts to make moorings more robust and vandal-resistant are under development.

The Pilot Research Moored Array in the Tropical Atlantic (PIRATA), which is jointly sponsored by Brazil, France, and the USA, will move to a 5-year 'consolidation' phase intended to run from 2001 to 2006. The consolidation phase will allow time for demonstrating the utility of PIRATA data in climate forecasting and applications. Success during the consolidation phase could lead to consideration of PIRATA as a permanent feature of the global ocean observing system and global climate observing system. PIRATA data are available at: http://www.pmel.noaa.gov/pirata/. The design for the consolidation phase eliminates two ATLAS sites at 10°W, where intense fishing vandalism has significantly limited data and equipment return.

During 2000, NOAA funded an extension of PIRATA in the northwest basin with a Woods Hole flux mooring to be deployed in April 2001 at 16° N, 51° W. Other possible extensions in the next few years are under discussion.

In 2001, a new Tropical Moored Buoy Implementation Panel (TIP) will be inaugurated under the auspices of the Climate Variability (CLIVAR) research project, GOOS and GCOS to cover buoy array requirements in all the tropical oceans, with an emphasis on technical and logistical issues related to implementing and sustaining buoy programmes in support of climate studies. As a consequence, the Tropical Atmosphere

Ocean (TAO) Implementation Panel dissolved itself at the conclusion of its last meeting (November 2000). The Panel emphasized the importance of having a moored buoy programme for climate in the equatorial Indian Ocean, and recommended that a working group be formed to develop provisional plans for an array there. The new TIP will become a sub-group under JCOMM.

Global Temperature and Salinity Profile Programme (GTSPP)

The GTSPP continues to be an important participant in the evolving ocean observing system. It demonstrates how international collaboration between data centres and scientific and operational programmes can help the collection, processing, quality, distribution and utility of data.

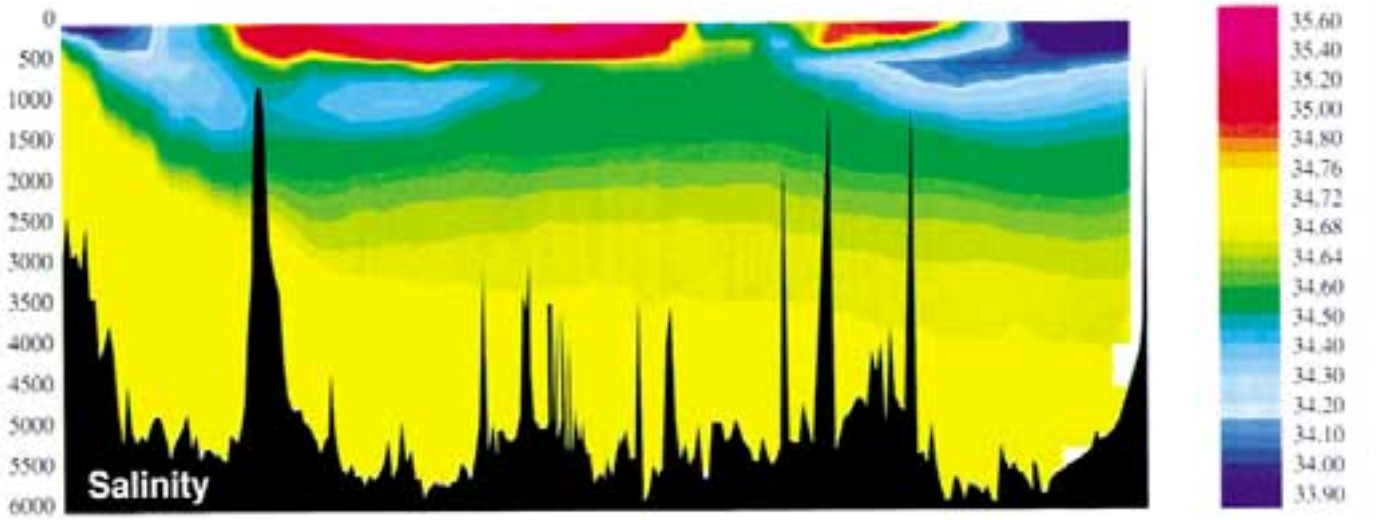
The Canadian Marine Environmental Data Service (MEDS) and the US National Oceanographic Data Center (NODC) continue to handle the real-time data flow and the continuously managed database, respectively. Data exchange occurs regularly three times a week. Once a year, all data collected two years previously are divided into three oceans and forwarded for scientific quality control to the Atlantic Oceanographic and Meteorological Laboratory (AOML), the Scripps Institution of Oceanography (SIO) and the Joint Australian Facility for Ocean Observing Systems (JAFOOS). The results are returned to the US NODC to update the archives.

The total number of stations treated annually has increased from the previous report to over 100,000. Much of the increase reflects the increasing number of profiling floats, including those from the Argo programme. In December 2000 there were approximately 250 floats reporting about 1000 profiles.

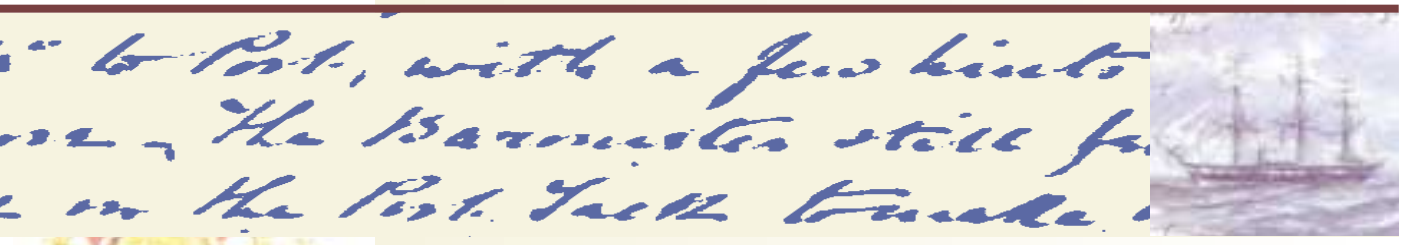
GTSPP played a key role in the WOCE Upper Ocean Thermal (UOT) programme, and was responsible for production of the master CD-ROM for UOT, with all data from 1990-1996 having passed through scientific quality control. GTSPP is also directly linked to the Ship-of-Opportunity Programme (SOOP).

General note: see annexes for a summary of meetings, a list of outputs, web sites and donors for GOOS.

Meridional WOCE section through the mid-Pacific Ocean



Taken from: *Ocean Circulation and Climate*, edited by G. Siedler, J. Church and J. Gould. Published in 2001 by Academic Press.



IOC and POGO

By Dr Shubha Sathyendranath, *Executive Director, POGO* and Gary Wright, editor of this report

The IOC was represented at the second meeting of the Partnership for Observation of the Global Oceans (POGO), held at the University of São Paulo, Brazil, in late November 2000. The event was hosted by the university's Instituto Oceanográfico. The meeting focused on issues pertinent to the Southern Ocean, given that global coverage of oceanic processes presupposes adequate coverage of the Southern Hemisphere.

POGO is a forum created in 1999, the groundwork having been laid in March of that year at a planning meeting held at IOC, UNESCO Headquarters. Present at that meeting were the directors of Scripps Institution of Oceanography, Woods Hole Oceanographic Institution (both in the USA) and the Southampton Oceanography Centre (UK). The first formal POGO meeting was held at the Scripps Institution of Oceanography in early December of 1999.

POGO's purpose is to promote a partnership of institutions, departments and their consortia involved in oceanographic observations, scientific research, operational services, education and training. As the scale of these activities becomes increasingly global, there is a need for more coordination among the institutions involved. POGO aims to bring these institutions together under a single umbrella. Through joint planning and exchange of information, the oceanographic community can make better use of the limited resources available.

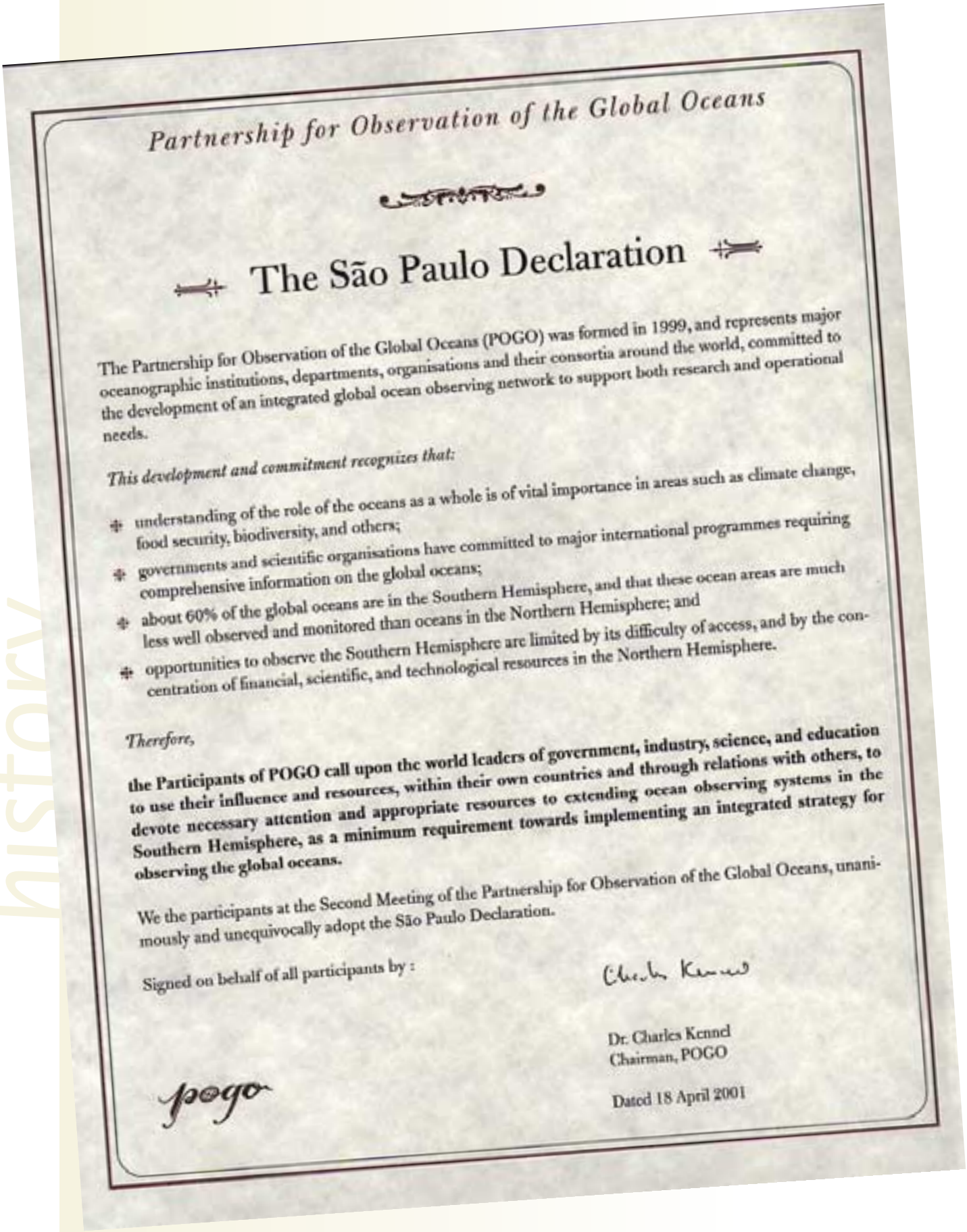
Brazil meeting

The Southern Hemisphere's oceans present a knotty problem, given that they represent two thirds of the world's oceans, and yet most of the oceanographic institutions and nations are located in the Northern Hemisphere. The cost of operations, the inaccessibility of the area and the harshness of the environment limit observations in this huge ocean area. The meeting adopted a declaration (see adjacent page) to promote observations in the Southern Hemisphere, and to make a concerted effort to identify the gaps in the observations and the means for covering the gaps, in co-ordination with programmes that are already active in the area.

Means and ways of promoting training, education and capacity building in oceanic observations also received much attention at the meeting. Some of these measures, especially a fellowship programme, include the participation of the IOC. IOC (OOPC and COOP) also collaborated with POGO and WCRP (CLIVAR) in setting up a Time Series Working Group, whose first meeting was held in the Woods Hole Oceanographic Institution in May 2000.

For further news and information on POGO, visit: www.oceanpartners.org, or contact:
Dr Shubha Sathyendranath,
Executive Director, POGO,
Bedford Institute of Oceanography,
Dartmouth, Nova Scotia, B2Y 4A2, Canada.
E-mail: Shubha@is.dal.ca

history



Partnership for Observation of the Global Oceans

The São Paulo Declaration

The Partnership for Observation of the Global Oceans (POGO) was formed in 1999, and represents major oceanographic institutions, departments, organisations and their consortia around the world, committed to the development of an integrated global ocean observing network to support both research and operational needs.

This development and commitment recognizes that:

- understanding of the role of the oceans as a whole is of vital importance in areas such as climate change, food security, biodiversity, and others;
- governments and scientific organisations have committed to major international programmes requiring comprehensive information on the global oceans;
- about 60% of the global oceans are in the Southern Hemisphere, and that these ocean areas are much less well observed and monitored than oceans in the Northern Hemisphere; and
- opportunities to observe the Southern Hemisphere are limited by its difficulty of access, and by the concentration of financial, scientific, and technological resources in the Northern Hemisphere.

Therefore,

the Participants of POGO call upon the world leaders of government, industry, science, and education to use their influence and resources, within their own countries and through relations with others, to devote necessary attention and appropriate resources to extending ocean observing systems in the Southern Hemisphere, as a minimum requirement towards implementing an integrated strategy for observing the global oceans.

We the participants at the Second Meeting of the Partnership for Observation of the Global Oceans, unanimously and unequivocally adopt the São Paulo Declaration.

Signed on behalf of all participants by :

Dr. Charles Kennel
Chairman, POGO

Dated 18 April 2001

pogo

3.2 Global Climate Observing System (GCOS)

The past year has involved active efforts by many to further the cause of global observing systems for climate. GCOS, which is co-sponsored by WMO, the IOC, UNEP and ICSU, and led by WMO, is focusing its attention on improvements in the planning and implementation of global observing systems for climate. To this end, GCOS has developed a new Implementation Strategy, which was endorsed by the GCOS Steering Committee at its Ninth Session in Beijing, China (12-14 September 2000). The strategy is built on the following principles:

- Build on existing operational and scientific observing, data-management and distribution systems, but use GCOS standards based on established principles;
- Obtain commitments from national governments for the implementation of the global climate observing system. This will require extensive involvement with intergovernmental processes of the UNFCCC and GCOS sponsors and with national entities;
- Address deficiencies in the current implementation of GCOS networks at the regional level, where many known deficiencies in observing systems occur;
- Keep GCOS relevant to the user communities and maintain its cost-effective nature by incorporating new understanding and new technology to address requirements across domains.

Aftermath (in Honduras) of Hurricane Fifi in 1974 (La Niña episode). A consequence of climate change could be the increased frequency and intensity of such extreme weather.

Photos: UNESCO/Michel Giniés

Solid progress was made in establishing an operational ocean observing system for climate, through the activities of the Ocean Observations Panel for Climate (OOPC), which is jointly sponsored by GOOS, GCOS, and WCRP, and through the development of an Ocean Theme Report by the partners of the Integrated Global Observing Strategy (IGOS), which defines the satellite requirements for ocean observations.

The GCOS Secretariat continued its interaction with the Conference of Parties, the UNFCCC and its Subsidiary Body for Scientific and Technological Advice (SBSTA). Following the advice of GCOS, the 12th session of SBSTA in June 2000 noted with concern continued degradation in some components of the Global Climate

Observing System, and recognized the need for Parties to work actively to reverse that situation.

In response to a decision of the 5th Conference of the Parties, GCOS has launched a programme of ten regional capacity-building workshops and follow-up activities, including development of regional action plans. The first regional workshop was held in August 2000 in Apia (Samoa), in co-operation with the South Pacific Regional Environment Programme (SPREP) and the WMO Sub-regional Office for the Southwest Pacific. It focused on needs in the South Pacific. A regional action plan is now being drafted. The second workshop will be held in 2001 to focus on the needs for climate observations in Africa. The workshops will address regional needs in meteorological, atmospheric, oceanographic, and terrestrial observing systems for climate, train national experts to prepare reports for National Communications to the UNFCCC, and identify training needs for systematic observations to predict and provide 'early' warnings of future climate changes, to assess both current and future climate, and to plan adaptation measures. Funds for the workshops are being sought from the Global Environment Facility (GEF).
The full report of the 9th session of GCOS in Beijing can be seen on the GCOS homepage (http://www.wmo.ch/web/gcos/gcoshome. html).

Photo: E. Kozlova

3.3 List of GOOS outputs

Regional Planning Meeting for GCRMN South Asia Phase II	Colombo, Sri Lanka	Jan 7-14
EuroGOOS Directory of Initial Observing Planning Meeting	Issy-les-Moulineaux, France	Jan 14
UN CSD Sub-committee on Oceans & Coastal Areas Meeting	The Hague, The Netherlands	Jan 19-21
3rd NEAR-GOOS Data Management Training Course	Tokyo	Jan 24-Feb 4
Submarine Groundwater Discharge Working Group	Paris	Feb 2-4
9th HAB Conference (attended by Y. Halim)	Hobart	Feb 7-11
Argo Science Team Meeting	Southampton, UK	Mar 7-9
6th Earthwatch Working Party	Geneva	Mar 13-14
WCRP JSC Meeting	Tokyo	Mar 13-17
IODE-GOOS Data and Information Management Plan Meeting	Greenbelt, MD USA	Mar 20-21
3rd Session of the Ship-of-Opportunity Programme Implementation Panel (SOOPIP)	San Diego	Mar 28-31
Workshop on the Regional Extension of PIRATA	Casablanca	Mar 29-31
7th Session of the PIRATA Steering Group	Natal, Brazil	Apr 11-13
1st Session of the CLIVAR Atlantic Panel	Natal, Brazil	Apr 14-15
GLOSS Training	Jeddah, Saudi Arabia	Apr 15-20
LMR-GOOS-HOTO Merger Pre-implementation Meeting	Washington, DC	Apr 17-18
Expert Group Meeting to prepare the 1st Intergovernmental Review Meeting on Implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities	The Hague	Apr 26-28
LMR Panel IV	Honolulu, USA	May 1-4
CLIVAR Scientific Steering Group meeting	Honolulu	May 1-5
Coastal GOOS-V	Gdansk, Poland	May 2-5
3rd Session of the GOOS Steering Committee	Paris	May 10-12

IOC Oceanographic Data Exchange Policy Meeting	Paris	May 15-17
4th Meeting of the International GODAE Steering Team	Southampton	May 15-18
MedGLOSS meeting	Haifa, Israel	May 15-17
ICRI CPC meeting	Nouméa, N.Caledonia, Fr.	May 24-27
WMO Executive Council	Geneva	May 16-26
G3OS Directors, G3OS Sponsors & IGOS Partners meetings	Geneva	Jun 6-7
JCOMM 2nd Transition Meeting	Paris	Jun 14-16
OOPC-V Meeting	Bergen, Norway	Jun 20-23
Argo Atlantic Implementation Planning Meeting	Paris	Jul 10-11
PacificGOOS Coastal Workshop	Apia, Samoa	Aug 16-17
EU Conference EUROCEAN 2000	Hamburg, Germany	Sep 1
IOC-JGOFS Advisory Panel on CO2	Paris	Sep 4-6
Workshop on Ocean CO2	Paris	Sep 6-8
PIRATA Western Expansion Meeting	Fortaleza, Brazil	Sep 11-15
9th Session of the GCOS Steering Committee	Beijing	Sep 12-14
HOTO-V (subset) Meeting for Implementation Planning	Paris	Sep 25-29
IGOS Disaster Theme	Paris	Sep 28
28th Meeting of Co-ordinating Group on Meteorological Satellites	Woods Hole, USA	Oct 16-20
DBCP-XVI	Victoria, Canada	Oct 16-20
PICES Annual Meeting	Hakodate, Japan	Oct 20-21
JTA-XX	Victoria, Canada	Oct 23-25
International Coral Reef Initiative Co-ordination & Planning Committee	Bali, Indonesia	Oct 23-29
ICES-IOC Steering Group for GOOS Meeting	Southampton	Oct 23-25
WOCE SSG and Workshop	Fukuoka, Japan	Oct 17-22
IODE-XVI	Lisbon	Oct 30-Nov 10
3rd Global Meeting of Regional Seas Conventions and Action Plans	Monaco	Nov 6-10

IGOS Partners	Rio de Janeiro	Nov 7
CEOS Plenary	Rio	Nov 8-10
Perth Indian Ocean Meeting	Perth, Australia	Nov 13-15
1st GOOS Users Forum	Costa Rica	Nov 13-14
1st Coastal Oceans Observations Panel	Costa Rica	Nov 15-17
COP-6	The Hague	Nov 13-24
TAO-IX Meeting	Perth	Nov 16-17
4th NEAR-GOOS Data Management Training Course	Tokyo	Nov 27-Dec 8
POGO Meeting	São Paulo, Brazil	Nov 28-30
2nd Meeting of IOCARIBE-GOOS Advisory Group	Havana	Nov 29-Dec 1
EuroGOOS Annual Meeting	Brest	Nov 30-Dec 1
MARCUBA 2000	Havana	Dec 4-8
5th Session of the Co-ordinating Committee for NEAR-GOOS	Seoul, Republic of Korea	Dec. 7-8

GOOS- REPORTS

THE REPORTS PUBLISHED IN 2000

GOOS-66:	Global Ocean Observations for GOOS/GCOS: An Action Plan for Existing Bodies and Mechanisms
GOOS-70:	GCOS/GOOS/GTOS Joint Data and Information Management Plan
GOOS-71:	IOC Group of Experts on the Global Sea Level Climate Observing System (GLOOS) Sixth Session (Toulouse, France, 12-14 May 1999)
GOOS-72:	IOC-WMO-UNEP Committee for the Global Ocean Observing System (I-GOOS-IV) Fourth Session (Paris, France, 23-25 June 1999)
GOOS-73:	IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS) Second Session (Beijing, China, 26-29 April 1999)
GOOS-74:	IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS) Second Session (Montpellier, France, 22-24 March 1999)
GOOS-75:	GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) Fourth Session; WCRP CLIVAR Upper Ocean Panel (UOP) Fourth Session; and Special Joint Session of OOPC and UOP (Woods Hole, USA, 17-21 May 1999)
GOOS-76:	IOC-WMO-UNEP-ICSU Coastal panel of the Global Ocean Observing System (GOOS) Third Session (Accra, Ghana, 13-15 April 1999)
GOOS-77:	IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional-Global Ocean Observing System (NEAR-GOOS) Fourth Session (Tokyo, Japan, 28 September –1 October 1999)

GOOS-80:	Initial Global Ocean Observing System (GOOS) Commitments Meeting (Paris, France, 5-6 July 1999)
GOOS-81:	GOOS Status Report 1999
GOOS-82:	IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS) Fourth Session (Tianjin, People's Republic of China, 2-5 November 1999)
GOOS-83:	IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS) Third Session (Talcahuano, Chile, 8-11 December 1999)
GOOS-84:	The IOCARIBE Users and the Global Ocean Observing System (GOOS) Capacity Building Workshop (San Jose, Costa Rica, 22-24 April, 1999)
GOOS-86:	IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS) Fifth Session (Gdansk, Poland, 2-6 May 2000)
GOOS-88:	The ad hoc Advisory Group for IOCARIBE-GOOS First Session (Caracas, Venezuela, 3-5 November 1999)
GOOS-89:	Third IOC/WESTPAC Training Course on NEAR-GOOS Data Management (Tokyo, Japan, 24 January-4 February 2000)
GOOS-90:	Strategic Design Plan for Coastal Component of the Global Ocean Observing System (GOOS)
GOOS-91:	IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS) Fourth Session (Honolulu, Hawaii, 1-4 May 2000)
GOOS-96:	Pacific GOOS (Apia, Western Samoa, 14-15 August 2000)

THE REPORTS PREPARED IN 2000 FOR ISSUE

GOOS-85:	IOC Workshop on the Benefits of the Implementation of the Global Ocean Observing System in the Mediterranean Region (Rabat, Morocco, 1-3 November 1999)
GOOS-87:	IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS) Third Session (Paris, France, 10-12 May 2000)
GOOS-92:	The First GOOS Users Forum (Costa Rica, 13-14 November 2000)
GOOS-93:	The ad hoc advisory group for IOCARIBE-GOOS Second Session (Havana, Cuba, 29 November-1 December 2000)
GOOS-94:	The Strategic Design Plan for the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS)
GOOS-95:	Coastal Ocean Observation Panel First Session (Costa Rica, 15-17 November 2000)
GOOS-98:	GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC) Fifth Session (Bergen, Norway, 20-23 June 2000)
GOOS-99:	Design Plan for Health of the Oceans (HOTO)
GOOS-100:	IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional-Global Ocean Observing System (NEAR-GOOS) Fifth Session (Seoul, Republic of Korea, 7-8 December 2000)

GOOS-RELATED PUBLICATIONS

GOOS. *Nature Science and Technology Yearbook*, 2001

An Ocean Theme for the IGOS Partnership. (co-author) *Final Report of the Ocean Theme Team,* published by NASA, January 2001

Remote-sensing imperatives of GOOS. By Summerhayes, Desa and Swamy. *Proc PORSEC*, English edition, pp 389-396, 2000

GOOS 1999. *ICSU Annual Report*, 2000

The Global Ocean Observing System (GOOS). *The Encyclopaedia of Global Environmental Change*, Volume 1, John Wiley & Sons, Chichester, 2000

The Global Ocean Observing System (GOOS) in 1998. *Proc EuroGOOS Conf*. Rome, March 1999 (in press)

The role of European marine science in building the capacity of developing countries. *Proc Eurocean 2000 Conf*., Hamburg, September 2000 (in press)

GOOS and the Atlantic Ocean: Paper for IOCEA meeting, Dakar, 5-11/5/2000 (unpublished)

Operational Oceanography. Summerhayes and Rayner. In: *Oceans 2020 – Science for Future Needs*. Proc. IOC-SCOR-SCOPE Workshop, Potsdam, October 1999 (in press)

BROCHURES

GOOS News 9 and 10

List of GOOS websites

GOOS: http://ioc.unesco.org/goos

GCOS: http://193.135.216.2/web/gcos/gcoshome.html

GLOSS: http://www.pol.ac.uk/psmsl/programmes/gloss.info.html.

PSMSL: http://www.pol.ac.uk/psmsl/psmsl.info.html.

SOOP: http://www.ifremer.fr/ird/soopip/doc/review/review.zip

DBCP: http://dbcp.nos.noaa.gov/dbcp/

JCOMM Electronic Products Bulletin (EPB):

http://iri.ldeo.columbia.edu/climate/monitoring/ipb/

JCOMM: http://ioc.unesco.org/goos/jcomm.htm.

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

OOPC: http://www.BoM.GOV.AU/bmrc/mrlr/nrs/oopc/oopc.htm

Argo: http://www.argo.ucsd.edu/

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

NEAR-GOOS: http://ioc.unesco.org/goos/neargoos.htm

IGOS Partners: http://ioc.unesco.org/igospartners

List of GOOS donors in 2000

Australia for PacificGOOS

Australia for Perth Office

FAO for LMR

France (IRD) for PIRATA

France for PacificGOOS

ICSU for GOOS in general

Japan for NEAR-GOOS

PERSGA for GLOSS Training

Holland NWO for Coastal GOOS

Holland NWO or IOCARIBE-GOOS

Holland NWO for PacificGOOS

SOPAC for PacificGOOS

UK Met Office for GOOS Data Post

UK-NERC for GLOSS

UK-NERC for MedGLOSS

USA-NOAA for GODAE

USA-NOAA for Coastal GOOS

USA-NOAA for GOOS Data Post

USA-NOAA for JCOMM Transition Meeting

USA-ONR for Coastal GOOS

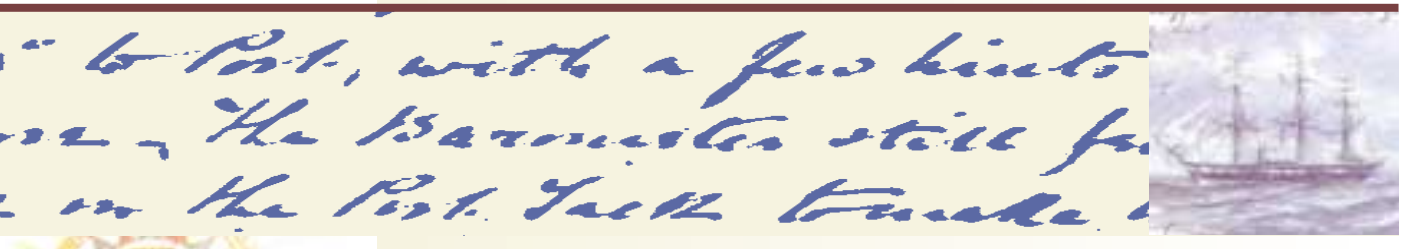
UNEP for Coastal GOOS

Western Australia for Perth office

WMO for GOOS in general

Capacity building in marine science, services and observations

4



The role of IOC

By Geoffrey Holland,
Former Chairman, IOC

The ocean is unique in its very magnitude, its contribution to the planetary life support system and its position as a global commons. Due to its international nature, it has to be considered globally for certain purposes (as was the case with the UN Convention on the Law of the Sea). In particular, the opportunity for all countries to co-operate in obtaining sufficient knowledge to understand, predict and manage wisely the global commons – specifically the oceans, seas and their resources – represents an immense but achievable goal.

Research efforts have greatly increased our understanding of the ocean system in recent decades. Modelling and forecasting are playing rapidly increasing roles, complementing the largely observational nature of ocean science of the past. Society, however, is not yet fully benefiting from the results of ocean science. Considering the major issues currently facing society it is imperative that optimum use be made of scientific and technological progress. Solving society's needs requires building the capacity for making observations, and also the capacity to analyse the data, generate forecasts and other products, and communicate the results to the public, managers and policy makers. One element of any ocean governance model must be an adequate ocean observing system, built with the support of all nations.

All too often, those coastal countries with the lowest capacity for marine research and technology are also the ones most vulnerable to the potential effects of climate change – such as rising sea levels – to the consequences of coastal disasters and to marine pollution etc.

Photo: Salif Diop

Research and training in water chemistry in the Senegal River Estuary during an exercise of an early UNESCO project for coastal marine capacity building. IOC carries on with this general tradition.

Sound advice from indigenous experts is essential for policy makers in such countries. To develop local expertise requires a series of successive and interlinked approaches, including science education, the training of technicians, a knowledge of – and framework for – integrated management, a research ability and an operating ocean service system that is fully integrated into a global network. All in all, this is a challenging assignment.

The IOC's TEMA (Training, Education and Mutual Assistance in marine sciences) capacity-building programme is central to the

overall IOC role and supports the capacity-building efforts that are focused within the IOC's scientific programmes. A strong TEMA policy ensures that the capacity-building process is linked to existing and planned national and regional programmes, thereby enhancing the success rate of capacity-building activities.

The Commission's regional subsidiary bodies can help to make national efforts more sustainable and effective and can provide mechanisms to stimulate the IOC's capacity-building programmes. They formulate and agree on co-operative regional projects built on national actions and addressing identified national and regional needs and priorities. They aim at regional pooling of resources and joint capacity building, and draw upon the global programmes of the IOC – for expertise, results, and advice.

The IOC is not a funding agency and has limited resources. It acts as a link with potential donor agencies, although it has had limited success to date, and co-operates with regional intergovernmental subsidiary bodies and with the analogous mechanisms of sister organizations such as WMO, UNEP, UNDP and ICSU. TEMA funding is mostly by a combination of the IOC funds and contributions from Member States. More substantial support must be found from donor agencies (including the private sector) and from other appropriate and creative means. The IOC is elaborating principles and a programme to develop national capabilities in marine sciences and services. This programme for the building of capacity involves a wide range of activities, depending on the starting capacity (level of ability) of the nation concerned.

The TEMA process

Developing and strengthening capacities in marine research, observations and the effective use of services that organizations, such as IOC, can offer involves human resources, the necessary institutions and a framework that supports and sustains marine activities. These components must be integrated into a network, but the implementation can be difficult, because of the complexity of jurisdictions within and amongst nations and the large differences in ability and capacity between countries. Because of these differences, capacity-building activities must be tailor-made to the specific needs of a country or a region.

The nature of capacity building

- It is a long-term process.
- The involvement of the recipient government is crucial.
- Approaches must be tailored to specific country or regional needs.
- Active involvement of the community in the recipient countries is necessary for building indigenous capacity.
- Partners in developing countries are the most effective and persistent advocates for marine science and technology.
- Capacity-building activities can vary from a single training course to the installation of a complete environmental monitoring system.
- The best instruments for capacity building are activities in which scientists, engineers, socio-economists, and users work closely together (learning by doing, teaching the teachers) in the execution of projects, programmes, and partnerships.
- Governments, international organizations, the private sector, and donors should join forces in capacity building. Interaction is needed between science agencies and

As early as the mid-1980s, the IOC became involved in capacity-building efforts, especially for developing countries.

No. 2 in the IOC Ocean Forum Series, launched to increase public awareness about the oceans

donor organizations, because most donor organizations are unsure of marine issues.
- Creation of awareness in the minds of the public and policy makers is essential for raising national and international support.
- All participants must recognize the need to sustain capacity once it has been built.

Capacity building can involve a broad range of activities, many not yet exploited to the full by the IOC.
- On-the-job training of individuals in both home and externally;
- Fellowships to individuals for scientific, technical, and engineering training/formal education;
- Regional co-operative development projects directed at limited attainable objectives; this may be more cost effective than via individual national projects;
- Assistance in securing resources needed for developing/enhancing infrastructure needed for specific activities;
- Short-term residential courses/workshops dealing with specialized subjects, which may result in the award of appropriate accreditation (e.g. limited diploma) or international recognition from an international institution or a research or academic institution;
- Courses taught by distance learning methods;
- Including strong capacity-building components in global and regional research programmes; and
- Creating awareness of the importance of IOC's programme activities and of the need for capacity building.

Capacity-building in a general context

Capacity building, as discussed in the preceding article, can take a number of forms and cover a multitude of types of activities. IOC adheres to a general UNESCO mandate whereby a large part of the Organization's activities are designed with some sort of capacity-building element or thought in view. Many have a ripple and/or counter-ripple effect – catalyzing or sometimes being influenced by other international programmes or by Member States themselves who carry out their own programmes and, in doing so, spread the knowledge and skills desired. It's the end result that counts.

Port-de-Paix, north coast of Haiti

Photo UNESCO

IOC's ICAM, for example and following the advice set forth in UNCED's Agenda 21, participates in activities, the goal of which is to develop scientific guidelines to assist all States in their efforts towards the sustainable development of their coastal resources. In addition to workshops and specific training activities, the Commission co-sponsors books and other reference materials for local use in the training of marine scientific and coastal specialists.

Activities with TEMA components * 4.1

During 2000, IOC contributed to the implementation of 34 activities with planned capacity-building input. These activities were hosted in 29 Member States and included 16 specific training events, 11 workshops and 5 major thematic conferences, support to two UNESCO/IOC Chairs in Concepción (Chile) and Moscow (Russia) as well as one exercise for secondary teachers and the promotion of public awareness concerning the marine sciences in Central America, developed jointly with the Education Sector of UNESCO. Also a special group of activities, managed by the IOC's Ocean Services (IODE) section, provided benefit to a considerable number of African scientists and students, helping them to obtain institutional access to scientific literature facilities and training tools, access to the Internet and ASFA (Aquatic Sciences and Fisheries Abstracts – sponsored by FAO, IOC and the UN), acquisition of computer equipment and support for operational expenses.
Details of the above-mentioned activities can be found in the relevant IOC sectors' sections of this report. Seventy-six persons (55 men and 21 women) benefited from individual IOC grants or through IOC's support to 5 major marine science-related conferences (71 travel grants and 5 research/study grants). In summary, more than 1,100 people (approximately 26% of them being women) from 105 Member States participated in the ensemble of activities.

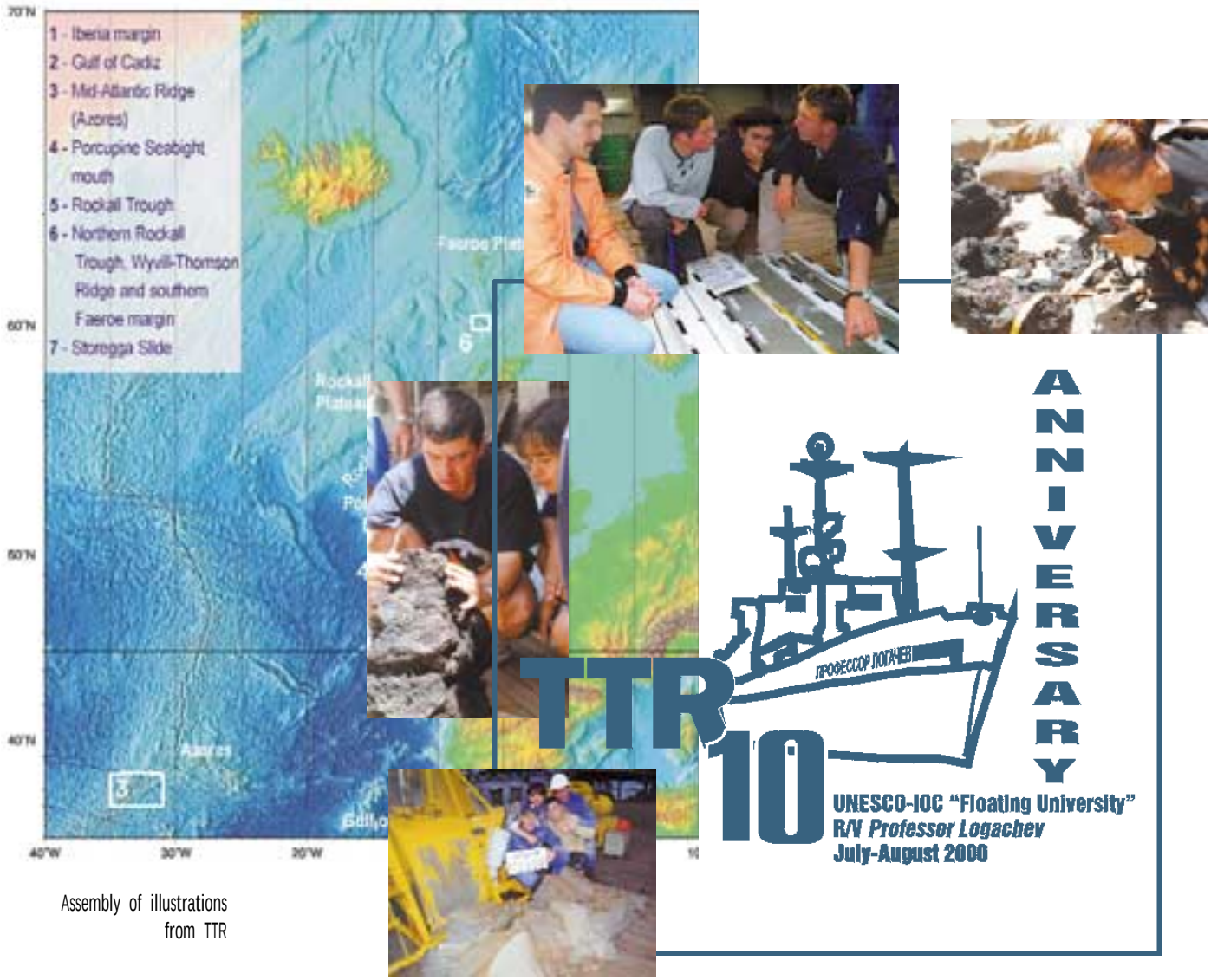
Total funding for capacity building amounted to $851,274 of which approximately 60% was obtained from extra-budgetary sources. From the total amount, 47% covered activities relating to the Ocean Science programme, 32% to the Ocean Services sector and 17% to the Ocean Observing Systems sector (GOOS). It should be noted that the Training-through-Research (TTR) project's cruises received direct contributions from outside IOC, amounting to more than $280,000 (not counted in calculating the percentage corresponding to extra-budgetary funding).

Training-through-Research programme 4.2

The Training-through-Research programme is an international co-operative endeavour, which combines shipboard research and training, with annual oceanographic cruises, conferences and exchanges of students and researchers. It is a joint effort of IOC's TEMA and various European programmes, universities and institutions. The 'Floating University' (a term often used earlier in the programme) is a facility which was launched in 1991 as an experiment operating within a concept based on training through research - carried out both on board Russian research vessels and during training or review sessions on land. In fact, the broader programme or approach has since taken on the name of 'Training-through-Research' (TTR).

The TTR activities stem from an initiative of a group of ocean scientists in Moscow State University, Free University of Amsterdam (the Netherlands) and Institute of Marine Geology (Bologna, Italy) which was first encouraged and then co-sponsored by UNESCO (now by

** See listing at the end of the section*



Assembly of illustrations from TTR

the Organization's IOC) and the European Science Foundation. It soon caught on to the extent that it has evolved into a truly international undertaking. It basically provides a dual function: (a) shipboard training of young scientists (including advanced students) specializing in ocean sciences and (b) providing for the advancement, through research, of general scientific knowledge concerning the seabottom processes, structure and history. Initially concentrating on geological/geophysical phenomena related to marine petroleum geology, the scope of study has enlarged to include other disciplines.

TTR, a decade of efforts

In 2000, the TTR programme celebrated its 10th anniversary. In the period 1991-2000, ten annual cruises were conducted in the Mediterranean and Black Seas, and in the northern Atlantic. As of the end of 2000, over 500 scientists and students (from Europe, the Mediterranean Region and South America) had taken part in the cruises. TTR has helped indeed to trigger some of the more recent European programmes. Last but not least is that, after ten years of operations, the TTR programme is privileged to report that it has reached its

primary objective: contributing to the result that many young, well-trained specialists continue successfully working in the marine geo-science field – in universities, research institutions, geophysical companies and oil industries.

On board the 'Floating University'

The 10th TTR cruise (July-August 2000) on board the usual 'Floating University' research vessel *Professor Logachev* (Russia) was carried out in the North Atlantic, with participants from Belgium, Brazil, Georgia, Italy, Morocco, Portugal, Russia, Spain, Switzerland and the UK. All together fifty-eight researchers and students took part in the cruise. Daily seminars, lectures and discussions, on the very interesting data that had been collected, all facilitated high-level on-the-job training. Among the research objectives of the cruise were studies of the effects of the Mediterranean Undercurrent on sedimentation patterns, as well as geosphere-biosphere coupling processes (such as diapirism and mud volcanism, cold seeping and gas venting, deep-water corals and carbonate mud mounds, chemosynthetic communities and gas hydrates) in the Gulf of Cadiz, on the Portuguese margin and in the North Atlantic.

For the first time, TTR studied hydrothermal processes on the Mid-Atlantic Ridge. The Training-through-Research principles guided the work carried out during the summer 2000 cruises of the RVs *Belgica* (Belgium) and *Pelagia* (The Netherlands) to the NE Atlantic.

Two meetings of the TTR Executive Committee (October 2000 and January 2001) summarized the programme results and planned for the 2001 training and research operations. TTR organized an IOC-sponsored international conference entitled 'Geological Processes on Deep-water European Margins' which was held in Moscow (January 2001). The TTR results have also been presented at various other international fora, such as those organized by the International Commission for the Scientific Exploration of the Mediterranean – CIESM (Tunisia, November 2000), American Geophysical Union (San Francisco, December 2000), European Geological Union (Strasbourg, April 2001), etc. The results of the 1999 cruise were published in the IOC Technical Series as No. 56 (2000), in addition to the Floating University Annual Reports for 1999 and 2000, also published by IOC.

Plans are underway to extend TTR operations to western Africa and to South America.

R/V *Professor Logachev* (Russia), utilized for TTR cruises

IOC Activities with capacity-building (TEMA) components carried out during the year 2000

(see codes at end of tables, p. 119)

Activity	Host country	Date	IOC Section	M*	F*	RP	EB funds	Scope/countries of participants
3rd NEAR-GOOS Data Management Training Course	Japan	Jan.-Feb.	OOS	2	3	2,000	20,000	NE Asia/ru, kr, my, id, cn, vn
4th NEAR-GOOS Data Management Training Course	Japan	Nov.-Dec.	OOS	5		2,000	27,000	NE Asia/ru, kr, my, id, cn
GLOSS Training Workshop on Sea Level Measurements	Saudi Arabia	April	OOS	25		2,000	28,000	Arab States region
IOC-DANIDA training course on taxonomy and biology of harmful marine microplankton	Denmark	August	OSC/HAB	10	11	10,000	30,000	global / bb, bd, cn, de, es, ht, it, kr, kw, my, nl, ph, pt, ru, th, vn, za
IOC-IEO-AECI training course on toxic phytoplankton	Spain	July	OSC/HAB	5	8	21,000		global/ar, br, uy, co, gt, ec, cl, it, cu, ve, mx, ht, pr
IOC-DANIDA training course on taxonomy and biology of harmful marine microplankton	Ireland	September	OSC/HAB	7	5	12,500		Global / bg, br, cl, hr, mx, pe, ro
IOCARIBE ANCA-CIBNOR HAB training course	Mexico	November	OSC/HAB	6	6		25,000	Central America / mx, gt, hn
Mediterranean Course on Integrated Coastal Area Management	France	September	OSC/ICAM	27	27	30,000	120,000	Mediterranean / be, es, fr, gr, de, it, uk, bu, lt, ro, ru, yu, al, eg, lb, mc, tn, tr
Training Programme in Modelling and Monitoring of Coastal Marine Processes (MAMCOMP-2000)	India	November	OSC/ICAM	15	7		18,000	Indian Ocean
Workshop on primary/secondary level training & public awareness regarding marine sciences	Costa Rica	July	OSC/EDU	3	5	4,000		Central America/ni, hn, pa, cr, gt, sv
Training-through-Research (Floating University)	On-board training	July	OSC/FU	400	100	10,000	280,000	Mediterranean/Black Sea/North Atlantic/ al, be, bg,br, cl, dk, fr, ge, de, gr, ir, il, it, mo, nl, pk, pl, ru, es, ch, tn, tri, uk, us
Course on Integrated Coastal Area Management	Italy	June	OSC/ICAM	3	2	4,000		n
First Latin American School in Ocean Climate and Modelling	Chile	October	OSC	30	7	15,000		LAC / cl, ar, uy, br
Training Course of Ocean Cartography	Mauritius	July	OSE/OM	19	5	6,000		IOCINCWIO/mu, ma, sy, ky, sa
Tsunami Risk Assessment Beyond 2000,								
Training Workshop	Russia	July	OSE/ITSU	8	2	15,145		global /Pacific Ocean
Visiting Experts Programme Activity on Tsunamis	USA (Hawaii)	November	OSE/ITSU	3		5,000		Pacific Ocean
UNESCO Chair in Marine Geosciences								
Moscow State University	Russia	February	OSC/TTR	n	n	5,000		ru
UNESCO Chair Coastal Oceanography Courses University of Concepción, Chile	Chile	Aug.-Dec.	OSC	4	3	6,000		LAC/uy, br, ar, cl, co, ec

* Participant's gender

IOC workshops

Activity	Host country	Date	IOC Section	M	F	RP	EB funds	Scope/countries of participants
PacificGOOS Coastal Workshop	Samoa	August	OOS	14	10	5,000	35,000	South Pacific: ws, sb, to, ck, fj, gu, ki, mh, nr, pg, nz, tv, vu
First GOOS Users Forum, Costa Rica	Costa Rica	November	OOS	16	5	10,000	5,000	global: cr, po, cu, no, nz, ru, tt, co, ca, us, mt, sp, ve, ch, pe, gr, ar
2nd Meeting IOCARIBE GOOS	Cuba	December	OOS	5	3	5,000	8,000	us, cu, ve, mx, tt, ba
PIRATA NW-Regional Extensions Meeting	Morocco	March	OOS	50	11		8,000	ma,fr, ci, sn, pt,no,es,ch,es, cv, gn, za, mq, it
PIRATA NE-Regional Extensions Meeting	Brazil	September	OOS	37	9	5,000		br, us, de, fr
IV Regional Workshop on Harmful Algal Blooms in South America	Brazil	January	OSC/HAB	14	10	10,000		LAC / ar, cl, uy, br, ec, co
IOC/IOCINDIO Research on HAB	La Reunion	March -August	OSC/HAB	n	n		4,847	Western Indian Ocean / ke, mg, mu, tz, re
Workshop on ICAM	Russia	September	OSC/ICAM	n	n	7,000		n
ODINEA Data Management Workshop	Portugal	October	OSE/IODE	60	7	33,307		ao, au, be, br, ca, cl, co, hr, ec, fi, fr, de, gr, gn, in, ir, jp, ke, kr, mg, my, mt, mu, mz, nl, no, pt, ru, sn, za, es, tz, tr, ua, uk, us
2 national workshops to increase capacity of National Oceanographic Data Centres	Kenya and Madagascar	July & Nov.r	OSE/IODE	n	n		8,000	ke, mg

Support to thematic conferences (considered as travel grants, as funds allowed the participation of regional scientists)

Activity	Host country	Date	IOC Section	M	F	RP	EB funds	Scope/countries of participants
IRI for Climate Fisheries Workshop	France (New Caledonia)	November	OSC	4	2	10,000	global	
9th coral reef symposium	Indonesia	October	OSC/ GCRMN	14	2		5,000	in, ma, sc
HAB2000 conference and seminar on future HAB research	Tasmania	February	OSC/HAB	18	8	10,000	19,000	global
3rd International Conference on Molluscan Shellfish Safety	USA	June	OSC/HAB	8	4	10,000		global
MARCUBA 2000	Cuba	December	OSC	4	4		7,000	ve, co, mx
Geological Processes on European Continental Margins	Spain	January	OSC/TTR	24	16	5,000		dk, it, ma, pt, ru, es, tn, uk, us

IODE Capacity-building in Africa

Activity	Host country	Date	IOC Section	M	F	RP	EB funds	Scope/countries of participants
Infrastructure: computer equipment and software		Feb. - Nov.	OSE/IODE	na	na	21,750	18,916	ODINAFRICA / ke, me, mg, mu, za, sc, gn, tg, tz, cu
Operational expenses: data and information products development, Internet access, data centres, services centres, newsletter		March – July	OSE/IODE	na	na	33,700	30,989	ODINAFRICA / ci, cm, gn, sn, mu, tz, ke, mg, sc, za, mz
Information services: website development, access to scientific literature, subscriptions to scientific journals, libraries agreements, access to ASFA WODIR and other databases development/updating		March - Dec.	OSE/IODE	na	na	4,500	61,565	ODINAFRICA / ke, mg, mu, mt, sc, tz, za
Development of training material (IODE resource kit)		Nov.-Dec.	OSE/IODE	na	na	5,000	13,000	ODINAFRICA / ke, mu, mg, mz, za, sc, tz
Methodological guide coastal mapping		April	OSC/ICAM	na	na		14,200	West Indian Ocean

Individual grants

Names	Country of origin	Date	IOC Section	M	F	RP	EB funds	Scope / host country
3 participants to ERASLIC2000 (Konjevic, Sofija; Kalenchits, Maria; Akimova, Olga)	hr/ee/ua	May	OSE/IODE		3	4,000		Marine Science Libraries and Information Services conference/uk
Savanelli, Zurab	Georgia							
	Oct. -Nov.	OSC		1		5,000		Oceanographic data management/gr
Nazarian, Mohammad	Iran	June	OSC	1		3,200		Oceanographic data management/in
Adegbie, Adesina	Nigeria	Jan.-July	OSC	1		6,000		PhD thesis in marine geomorphology/de
Kamau, Joseph	Kenya	June	OSC	1		2,655		Marine environmental issues/il
Riviere, Sebastian	Dominica	June	OSE/ICAM	1		4,000		ICAM Summer Institute, University of Rhode Island/us

Country codes:

al = Albania; ar = Argentina; au = Australia; ba = Bosnia and Herzegovina; bb = Barbados; bd = Bangladesh; be = Belgium; bg = Bulgaria; br = Brazil; ca = Canada; ch = Switzerland; ci = Ivory Coast; ck = Cook Islands; cl = Chile; cm = Cameroon; cn = China; co = Colombia; cr = Costa Rica; cu = Cuba; cv = Cape Verde; cy = Cyprus; de = Germany; dk = Denmark; dm = Dominica; ec = Ecuador; ee = Estonia; eg = Egypt; es = Spain; fj = Fiji; fr = France; uk = United Kingdom; ge = Georgia; gi = Gibraltar; gn = Guinea; gr = Greece; gt = Guatemala; gu = Guam; hr = Croatia; ht = Haiti; hn = Honduras; id = Indonesia; ie = Ireland; il = Israel; in = India; ir = Iran; it = Italy; jp = Japan; ke = Kenya; ki = Kirbati; km = Comoros; kr = ROK (South Korea); lb = Lebanon; lt = Lithuania; ma = Morocco; mc = Monaco; mg = Madagascar; mh = Marshall Islands; mq = Martinique; mt = Malta; mu = Mauritius; mx = Mexico; my = Malaysia; mz = Mozambique; nc = New Caledonia; ni = Nicaragua; nl = Netherlands; no = Norway; nr = Nauru; nz = New Zealand; pa = Panama; pe = Peru; pg = Papua New Guinea; pk = Pakistan; ph = Philippines; pl = Poland; pr = Puerto, Rico; pt = Portugal; re = Reunion; ro = Romania; ru = Russian Federation; sa = Saudi Arabia; sb = Solomon Islands; sc = Seychelles; sn = Senegal; sv = El Salvador; sy = Syria; tg = Togo; tn = Tunisia; to = Tonga; tr = Turkey; tt = Trinidad and Tobago; tv = Tuvalu; tz = Tanzania; ua = Ukrania; uk = United Kingdom; us = United States of America; uy = Uruguay; ve = Venezuela; vu = Vanuatu; ws = Samoa; yu = Yugoslavia; za = South Africa.

Other codes:

EB = Extra-budgetary funds
EDU = UNESCO Education Sector
F = female
FU = Floating University
M = male
n = information not available
na = item not applicable
OOS = Ocean Observing Systems section of IOC
OSC = Ocean Sciences section of IOC
OSE = Ocean Services section of IOC
RP = Regular Programme funds

Other acronyms can be found in Acronyms annex to this report, p. 190.

Regional activities

5

OVERVIEW

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

Regional Sub-commissions:

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

Secretariat support for a regional sub-commission shall be provided by the IOC Secretariat (headquarters staff and staff out-posted in the region), and by Member states…' (IOC Manual, Part I)

Regional Committees:

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

The IOC has established the following regional subsidiary bodies:

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

The Secretariat is based in Cartagena, Colombia.

Heads of the Office: . . . . . R. Steer-Ruiz; A. Duncan

IOCARIBE Officers:

Chairman:. . . . . Dr Bradford Brown, USA

Vice-Chairmen:. . . . . Lic. Marco Polo Bernal, Mexico

. . . . . Dr Leonard Nurse, Barbados

. . . . . Dr José Vargas, Costa Rica

Most recent session:

IOCARIBE-VI, San José, Costa Rica

26-29 April 1999

IOC Sub-commission for the Western Pacific (WESTPAC)

The Secretariat is based in Bangkok, Thailand.

Head of the Office: . . . . . S. Mitsumoto

Officer: . . . . . M. Kuijper

WESTPAC Officers:

Chairman: . . . . . Dr Keisuke Taira, Japan

Vice-Chairmen: . . . . . Prof. M. Hungspreugs, Thailand

. . . . . Dr H. Tack Huh, Rep. of Korea

Most recent session:

WESTPAC-IV, Seoul, Rep. of Korea

22-26 March 1999

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

A project Office, headed by Mika Odido (who served as IOC Coordinator), is housed in the Kenya Marine and Fisheries Research Institute, Mombasa

Most recent session:

IOCINCWIO-IV, Mombasa, Kenya

6-10 May 1997

IOC Regional Committee for the Central Eastern Atlantic (IOCEA)

IOCEA Officers:

Chairman: . . . . . Dr J. Wellens-Mensah, Ghana

Vice-Chairman: . . . . . Dr J. Follack, Cameroon

Most recent session:

IOCEA-V, Dakar, Senegal

5-10 May 2000

IOC Regional Committee for the Southern Ocean (IOCSOC)

IOCSOC Officers:

Chairman: . . . . . Dr M. Tilzer, Germany

Vice-Chairmen: (replaced by Advisory Group:)

. . . . . Mr C. D. Carbone, Argentina

. . . . . Dr J. Chrurcj, Australia

. . . . . Dr A. Klepikov, Russian Fed.

. . . . . Dr E. Lindstrom, USA

. . . . . Dr J. Priddle, United Kingdom

Most recent session:

IOCSOC-VI, Bremerhaven, Germany

9-13 September 1996

IOC Regional Committee for the Central Indian Ocean (IOCINDIO)

A GOOS Project Office, headed by W. Erb and based in Perth, Australia, covers the whole Indian Ocean Region

IOCINDIO Officers:

Chairman . . . . . Dr Muthunayagam, India

Vice-Chairman . . . . . Dr H. Zommorrodian, I.R. Iran

Most recent session:

IOCINDIO-III, Teheran, Islamic Republic of Iran

21-23 February 2000

IOC Black Sea Regional Committee (BSRC)

BSRC Officers:

Chairman: .....Prof. Valery Eremeev, Ukraine

Executive secretary: .....Dr Michael Ganchev, Bulgaria

Most recent session

BSRC-II, Istanbul, Turkey

5-6 May 1999

In addition to the Regional Subsidiary Bodies, the IOC has specific regional programmes in some other regions: i.e. South East Pacific in coordination with the CPPS, South West Atlantic, Mediterranean Sea, Persian Gulf, Red Sea and Gulf of Aden.

Although most regional activities are reported under the preceding 'programme' sections, particular attention is given this year to activities of the: IOC Subcommissions for the Western Pacific (WESTPAC) and the Caribbean and Adjacent Region (IOCARIBE); the IOC Regional Committee for the Co-operative Investigation in the North and Central Western Indian Ocean (IOCINCWIO); and the Regional Committees for the Central Eastern Atlantic (IOCEA) and the Central Indian Ocean (IOCINDIO) as well as programmes for the Black Sea and Mediterranean regions.

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

The IOC Sub-Commission for the Western Pacific has, since its establishment in 1989, advanced the implementation of IOC activities in the Western Pacific region, through both IOC's global programmes and specific programmes tailored to the region.

In the year 2000, IOC/WESTPAC saw progress in the implementation of the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS). Not only was there a steady increase in the number of users and volume of data contained in the system, but also there was a move towards more parameters, new technologies, and closer collaboration with related organizations in the region such as PICES and UNEP's Northwestern Pacific Action Plan. At the fifth Session of the NEAR-GOOS Coordinating Committee, held in Seoul (Republic of Korea) in December 2000, NEAR-GOOS embarked on a strategic planning exercise, which in essence marks the commencement of the second phase.

The Japan Oceanographic Data Centre (JODC) continued to give annual training courses on NEAR-GOOS Data Management, which is open to trainees from all WESTPAC Member States. Two training courses were held in January and December, involving some 10 trainees of 6 nationalities.

Under the IOC/WESTPAC International Cooperative Study of the Gulf of Thailand, a website (http://www.start.or.th/got) was set up. It functions as an on-line regional data management and information system for the Gulf of Thailand and surrounding waters.

IOC/WESTPAC co-sponsored the SCOPE workshop on Land-Ocean Nutrient Fluxes held in Nha Trang, Vietnam, in September 2000. The workshop focused on silicate input to the marine environment in relation to changes in the hydrology of rivers.

The WESTPAC-HAB programme continued to organize activities in the region. This included a seminar on 'Future Research Direction of HAB in WESTPAC', held in conjunction with the Ninth International Conference on Harmful Algal Blooms (Hobart, Australia, February 2000).

Adapted from photo, by J. Croze, of IOCARIBE historical building façade

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

During the period under review, there were two changes in the administrative head of this regional sub-commission. On 10 April Rafael Steer, IOC consultant, passed the direction of the IOCARIBE Office to Stefan Anderson, also an IOC consultant. Then on 1 May, Alan Duncan was designated Acting Assistant Secretary for IOCARIBE, the responsibilities for which he maintained for the rest of the year.

The draft proposal entitled 'Monitoring Assessment and Sustainable Programme for the Caribbean Large Marine Ecosystem (CLME)' was endorsed by several of the region's countries that were eligible for GEF funding.

A meeting to organize and establish the IOCARIBE-GODAR Group of Experts was

held 21-23 February at IOCARIBE Headquarters in Cartagena (Colombia). This meeting was attended by experts from Colombia, Costa Rica, Cuba and Trinidad and Tobago.

The IOCARIBE-GOOS ad hoc Advisory Group was established. During the year the ad hoc Advisory Group held two sessions (San José, Costa Rica, 13-14 November; and Havana, Cuba, 29 November–1 December). These meetings were devoted to the drafting of a strategic plan for GOOS in the IOCARIBE region.

In response to IOC Resolution EC-XXXIII.5, a meeting on the Intra-Americas Sea (IAS) Tsunami Warning System was held 19-21 December in Mayagüez (Puerto Rico), hosted by that city's Campus of the University of Puerto Rico. The meeting brought together tsunami experts from the ICG/ITSU and the IOCARIBE Tsunami Group of Experts. The meeting formulated a plan of action for the development of the revised version of the IAS Tsunami Warning System project proposal.

The IOCARIBE Website was updated. Interactive 'Yellow Pages' data capture forms are now available on-line.

IOC Regional Committee for the Central Indian Ocean (IOCINDIO) 5.3

In response to Resolution XX-16 of the IOC Assembly, the Third Session of the IOC Regional Committee for the Central Indian Ocean (IOCINDIO-III) was convened in Tehran, Islamic Republic of Iran from 21-23 February 2000 under the auspices of the Iranian National Centre for Oceanography. It was preceded by a Regional Workshop on Coastal Management and Marine Pollution. The recommendations of the workshop, adopted by the Regional Committee, called for the development of a broad regional strategic ICAM action plan and identified the necessary steps to reach this objective.

Among issues discussed during IOCINDIO-III were in-depth considerations of the implementation of the programme adopted by IOCINDIO-II, with emphasis on the programmes on storm surges, marine pollution studies and coastal zone management. The establishment of the IOC Regional Office in Perth, with its main objective of promoting GOOS activities in the Indian Ocean, was also very much welcomed by Member States.

The Regional Committee decided to establish an ad hoc working group on capacity building chaired by Dr Partovian of I.R. of Iran with the task of developing a capacity-building strategy for the IOCINDIO region in consultation

An agreement of cooperation was signed at IOCINDIO meeting (Tehran) by Iranian Minister of Science, Research and Technology and by Executive Secretary/ADG of UNESCO for IOC

with TEMA. The Committee considered the idea of establishing a sub-regional data and information centre for the Persian Gulf in Oman and recommended that the IOC Executive Secretary, jointly with the Executive Secretary of ROPME and the Director of UNESCO Regional Office in the Arab States of the Gulf, organize consultations with Oman to discuss the proposal and make an assess ment of data management facilities of the Sultan Qaboos University of Oman.

Finally, following the IOCINDIO-III meeting, the Regional Organization for the Protection of the Marine Environment (ROPME) and IOC decided to establish a Memorandum of Understanding in order to strengthen their co-operation and implement joint activities.

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

The project office for the Intergovernmental Oceanographic Commission of UNESCO's Regional Committee for the Cooperative Investigations in the North and Central Western Indian Ocean (IOCINCWIO) was officially inaugurated on 8th February 2000 at the Kenya Marine & Fisheries Research Institute (KMFRI) Headquarters in Mombasa, Kenya.

The office was established following the endorsement of the 20th session of the IOC Assembly in 1999 through Resolution XX-15 and will be hosted for an initial period of two years by KMFRI. The Assembly took into consideration substantive growth both in terms of scientific manpower and research activities, and the strong need for an effective and Africa-based coordination mechanism to assist the Regional Committee in planning and implementing regional research, monitoring and management programmes.

The first phase of the project for the development of the Ocean Data and Information Network for Africa (ODINAFRICA-I) in the IOCINCWIO region was completed in December 2000. A review workshop was held prior to the IODE-XVI in Lisbon (Portugal) in November 2000. Starting with just two National Oceanographic Data Centres (NODCs) in Kenya and South Africa in 1997, additional NODCs/DNAs have been established in Madagascar, Mauritius, Seychelles, Tanzania, and a subsidiary national oceanographic data centre in South Africa. The capacity of the data centres to collect, process, archive and interpret various categories of data sets was strengthened through the provision of up-to-date computer equipment and software as well as training for data centre personnel. This capacity has been used effectively in developing national meta databases and data archives, thus contributing to the preservation of information and enabling users to access available datasets, including those from regional and international data centres.

E-mail and Internet connections provided through the project have improved communication between the institutions, with others outside the region, and also improved access to international data and information sources. The connections enabled the centres to publicize their activities, services and products to a wider audience by developing web sites.

A regional input centre for the Aquatic Sciences and Fisheries Abstracts (ASFA) database was established at the Kenya Marine and Fisheries Research Institute in Mombasa. This has substantially increased the number of articles published by scientists from the region that are now included in the ASFA database.

In order to further strengthen the centres to be able to effectively discharge their responsibilities, and on the basis of the experiences in the first phase of the ODINEA/ODINAFRICA project, the participants made several recommendations which have been incorporated in the implementation of ODINAFRICA-II (see IOC Workshop Report No.172).

The expertise and experience acquired in the first phase of the project will be used by closely involving the IOCINCWIO data centre managers in the ODINAFRICA data management training programme in the IOCEA region (South-South cooperation).

The ODINAFRICA Information Services Centre, located at the Kenya Marine and Fisheries Research Institute (Mombasa) is providing information services for all ODINAFRICA partner countries and has developed a web site to act as an 'African Ocean Portal' through which news, data and information on marine sciences in Africa can be accessed (http://odinafrica.org). This website, hosted on the IOC server has proved very popular with many people visiting the site and downloading information from it. Other activities implemented in the IOCINCWIO region include:

- Baseline monitoring of potentially toxic micro algae and preparation of a regional guide book for the Western Indian Ocean water;
- Publication of guidelines for assessment, monitoring and management of physical shoreline changes of the western Indian Ocean. Pilot studies using these guidelines will commence in Kenya, Mozambique and Tanzania in 2001;
- Nutrient, sediments and turbidity monitoring in Kenya, Mauritius, Seychelles and Tanzania;
- Evaluation of the status of sea-level observations and analysis of available data;
- Training courses have been organized for monitoring of marine micro-algae, sea-level data analysis, and remote sensing for inventory of seagrass beds;
- Fellowships were provided to enable scientists from the region to attend short-term training courses and to participate in scientific conferences;

IOC has collaborated closely with other organizations regarding activities in the region, including ACOPS, COI, IOI, UNEP and WIOMSA to ensure optimal use of available resources.

The rate of implementation of activities has slowed down significantly since the end of the IOC co-operation agreement with Sweden in 2000.

Since 1998, IOC has assisted, through a Swedish associate expert, in establishing SEACAM (Secretariat for Eastern African Coastal Area Management, Maputo, Mozambique) to organize training courses and seminars, and develop guidelines for local NGO capacity building, environmental assessment and sustainable financing. It has the largest database in Eastern Africa on ICAM-related projects and programmes (www.seacam.mz).

5.5 IOC Regional Committee for the Central Eastern Atlantic (IOCEA)

A major event in the year 2000 was the Fifth Session of the IOC regional Committee for the Central Eastern Atlantic (IOCEA-V), held 5-11 May 2000 in Dakar, Senegal.

This Session was particularly well attended, with more than 60 participants. The participation of high-ranking decision makers from Africa as well as from United Nations Organizations and overseas partners was well noted. Include were the: (i) Minister of Fisheries of Senegal, (ii) Chairperson of the Preparatory Committee of the African Process on Cooperation for Development and Protection of Coastal and Marine Environments in Africa, (iii) Deputy Minister of Environmental Affairs & Tourism of South Africa, (iv) Executive Director of the Scientific and Technical Committee of the Organization of African Unity, (v) West African Monetary Union (UEMOA), (vi) West African Development Bank, (vii) United Nations Industrial Development Organization, (viii) Chairman of the GOOS-AFRICA Committee, (ix) United Nations Environment Programme (UNEP) and (x) Representatives from France, Norway, Portugal, United Kingdom and United States of America. The Director of the UNESCO regional Office of Education in Africa represented the Director-General. The ADG/IOC attended the Session as well. The Secretariat expressed its gratitude to Canada and France, which provided financial assistance in support of the participation of the African Delegates.

Photo taken at IOCEA meeting, UNESCO Dakar

The Session reviewed the IOCEA-IV work programme dated 1995, and adopted a new approach towards identifying the priority projects to be implemented in the region not only on a short-, but also on a medium-term basis. The adopted IOCEA-V work programme includes the following: (i) sustainable management of marine resources and protection of biodiversity; (ii) ocean dynamics and impacts on coastal processes in the region; and (iii) marine and coastal pollution in the IOCEA region.

The 33rd Session of the IOC Executive Council adopted Resolution EC-XXXIII-12 with emphasis on the following recommendations:

(i) co-ordination and strengthening of IOC activities in the IOCEA region,
(ii) follow-up of the PACSICOM/AFRICAN PROCESS,
(iii) strengthening and development of the Large Marine Ecosystems projects in the region, and
(iv) partnership between IOC and African regional institutions for the long-term development of oceanography and marine science in the IOCEA region.

The IOCEA-V Session noted that the limited level of implementation of the activities planned under the IOCEA-IV work pro-

gramme was due, on the one hand, to the lack of sufficient funds and, on the other, the absence of co-ordinating mechanisms within the Secretariat to ensure communication among the Member States. Furthermore, Resolution XX-17 of the IOC Assembly, among other things, urged the Executive Secretary to 'assist in establishing a regional office in consultation with the Members States of that region'. The Session accepted with much appreciation the offer by Nigeria to host the regional office. Organized back-to-back with the IOCEA-V Session, the First Planning Workshop of the ODINAFRICA-II project took place 2–4 May 2000 in Dakar. This workshop decided, among other things, to establish the ODINAFRICA project management structure for IOCEA in CERESCOR, Conakry-Rogbanè, Guinea.

The IOCEA Member States have been contributing to the PACSICOM/AFRICAN PROCESS through mechanisms for the revitalization of the Abidjan Convention:
(i) the Joint IMO/UNEP meeting of national experts on the Emergency Protocol to the Conventionfor Co-operation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region, 20-22 March 2000, Accra, Ghana. The Meeting adopted an Emergency Action Plan for West and Central African countries, that was appended to the Convention;
(ii) the Fifth Conference of the Parties (COP-V) to the Abidjan Convention (Accra, 22-24 March 2000), that adopted a new work programme with emphasis on the key themes such as assessment, management and co-ordination related to the marine and coastal environment activities in the Region. As a member of the Technical and Legal Working Group, the IOC participated in these meetings and contributed to the drafting of the biennial work programme.

Other activities implemented in the framework of the RECOSCIX-CEA programme are:
(i) updating of CEADIR regional directory and
(ii) document delivery service for IOCEA countries.

IOC Black Sea Regional Committee (BSRG) 5.6

IOC activities in the Black Sea were coordinated by the Black Sea Regional Committee (BSRC). The main results were summarized at the Second Session of the Black Sea Regional Committee which took place in Istanbul from 5 to 6 May 1999.The National Coordinators from Bulgaria, Georgia, Romania, Russia, Turkey and Ukraine reported on their national activities towards the implementation of approved IOC Pilot-Projects, 'Black Sea GOOS' and 'Black Sea Fluxes' (PP 1 & 2) respectively.
The very important issue concerning the procedures for the international oceanographic data exchange in the Black Sea region was also discussed. The work plan for 2000-2001 has been approved. It was recognized that the existing IODE mechanism could be used for this purpose. It was decided that scientific results of the three international expeditions which took place within the framework of Pilot-Project n° 1 (PP-1) would be discussed during the seminar 'Sediment fluxes and radionuclides in the Black Sea' to be organized in cooperation with the International Atomic Energy Agency, in Istanbul, Turkey, in September 2000. However, due to UNESCO's financial restrictions, the above-mentioned Workshop was postponed to November 2001.

The summary report of the workshop 'Black Sea GOOS' which took place from 11 to 15 September 1999, in Albena resort was published in the year 2000 by the Bulgarian Academy of Science.

The BSRC established co-operative links with other regional programmes and their coordination units such as: PCU of GEF, Piri Reis Foundation, BSEC, IAEA, WMO (HYCOS) and NATO.

5.7 IOC activities in the Mediterranean

IOC continued its efforts towards establishing an integrated approach to the development of research, operational oceanography and services across the Mediterranean, including MedGOOS, MedGLOSS, ICAM and data exchange under IODE. These efforts encompass a strong component in training, education and mutual assistance. IOC organized, in partnership with the University of Nice-Sophia Antipolis, an advanced course on Mediterranean Integrated Coastal Area Management in Nice (France), from 4 to 15 September 2000. This bilingual French/English course was supported by the European Commission (DG-XII), UNESCO and the Provence-Alpes/Côte d'Azur Region, and also received the patronage of IGU (Oceans 21 Programme). It was oriented toward the 51 participants from 20 countries, mainly from Europe and countries of the Mediterranean Basin. These participants consisted of graduates from universities and engineering schools, and professionals from the public and private sectors already or potentially involved in coastal management.

Participants at MICAM 2000 in 'Parc Valrose', Faculty of Sciences, University of Nice-Sophia Antipolis. On the right: course leaders Dr Jacques Morelli (IOC/UNESCO) and Prof. Michel Popoff (UNSA)

Twenty-seven lecturers, mostly from the Mediterranean countries, acted as instructors.

Preparations of a proposal to the European Commission (EC) for developing a 'Mediterranean Network to Access and Upgrade Monitoring and Forecasting Activity in the Region' were initiated. The EC-funded Mediterranean Forecasting System Pilot Project (MFSPP) successfully came to the end of its first phase and funds for phase II are being sought. MedGLOSS constitutes a contribution to MedGOOS; it met in Haifa (Israel,15-17 May 2000) to agree on future developments to strengthen sea-level observations in the region.

At its Twentieth Session, the Assembly instructed the IOC Executive Secretary to take appropriate actions for the development of a Science Plan for the Unified Mediterranean Programme, in association with MedGOOS, GLOSS (MedGLOSS) and the Mediterranean ICAM (IOC-XX/3, Para.337). The process for the formulation of a science plan for a unified Mediterranean Programme was initiated in the fall of 2000.

IOC 2000

International co-operation

6

6.1 Co-operation with other organizations of the UN System and other bodies

The United Nations Open-Ended Informal Consultative Process on Oceans and the Law Of the Sea (UNICPOLOS, or ICP)

The United Nations General Assembly reviews annually all important developments in oceans and the law of the sea. The review is based on a comprehensive annual report prepared by the Secretary-General. It takes place in a constrained time frame and the need for an extended and expanded substantial discussion has been emphasized, especially in relation to further enhancement of intergovernmental and inter-agency co-operation and co-ordination. The Commission on Sustainable Development (CSD), at it seventh session in 1999, re-emphasized this need to the General Assembly, which decided, at its 54th session in November 1999, to establish an annual open-ended informal consultative process (ICP) in order to facilitate, in an effective and constructive manner, its own review of developments in ocean affairs (resolution A54/33). In its decision, the General Assembly underlined, in particular, the importance of the participation of ACC-SOCA in the consultative process and of its inputs to the report of the Secretary-General on Oceans and the Law of the Sea.

The ICP is expected to: (i) discuss the Secretary-General's annual report on oceans and the law of the sea; (ii) suggest particular issues to be considered by the General Assembly; (iii) identify areas where coordination and co-operation at the intergovernmental and inter-agency levels should be enhanced; and (iv) follow up overall developments in ocean affairs, in a manner consistent with the legal framework provided by UNCLOS and the goals of chapter 17 of Agenda 21. In its work ICP is expected to apply an integrated approach to ocean issues. Such an approach involves an overview of various sectors related to the oceans and seas, consideration of trans-sectoral issues, and most importantly, an integration of various relevant aspects of oceans and seas, including political, legal, economic, social, environmental, scientific and technical aspects. The UNICPOLOS meetings are planned to take place annually for an initial period of three years.

Symbolic Globe – by Eric Reitzel (Denmark), evoking UNESCO 'ideals of a peaceful, interdependent and diversified world…' – commemorated the Organization's 50th birthday in 1996

The first meeting of the ICP was held at United Nations Headquarters from 30 May to 2 June 2000 and was attended by the Chairperson and the Executive Secretary of IOC. The co-chairpersons of the ICP were Ambassador Tuiloma Neroni Slade (Samoa) and Mr Alan Simcock (United Kingdom). The first meeting worked through plenary sessions and two discussions panels: (i) 'responsible fisheries and illegal, unregulated and unreported fisheries – moving from principles to implementation'; and (ii) 'economic and social impacts of marine pollution and degradation, especially in coastal areas – international aspects of combating them'.

At this meeting IOC received universal recognition as the focal point for Ocean Sciences in the UN system. ICP also expressed its support for broadening the focus of work of the Intergovernmental Oceanographic Commission of UNESCO from the traditional focus on oceanography to cover all issues related to marine science and technology, and for steps to make it even more of a global centre for the promotion and dissemination of research into marine science and technology.

The Resolutions A/55/7 and A/55/8, adopted at the 55th Session of the General Assembly on October 2000, incorporate many of the issues discussed at the first Meeting of the ICP, including: the need for capacity building for the implementation of UNCLOS; those relating to illegal, unreported and unregulated fishing; and the degradation of the marine environment.

Resolution 55/7 recommended that the second meeting of the ICP, be held in New York, from 7–11 May 2001 with two areas of focus for discussions: (a) 'marine science and the development and transfer of marine technology as mutually agreed, including capacity-building in this regard'; and (b) 'co-ordination and co-operation in combating piracy and armed robbery at sea'. IOC and IMO have been asked by the co-chairpersons to lead the discussions on the Areas of Focus (a) and (b), respectively.

UNESCO/I.Forbes

Inter-secretariat Committee on Scientific Programmes Relating to Oceanography (ICSPRO)

The IOC Officers, at their meeting in January 2000, invited the Executive Secretary to investigate with the Director-General of UNESCO the revitalization of ICSPRO and the possibility of using this agreement as part of the process identified for discussion at the forthcoming meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the

'Pareja sentada', gift of sculptor Elena Laverón to UN Pavillion at Seville World Fair (1992)

Sea. ICSPRO is made up of the heads of the co-operating agencies while the ACC-SOCA is made up of senior sector specialists from the agencies of the UN system with activities in ocean and coastal areas. As a result, co-ordinated executive action for SOCA can only ensue following the due process of endorsement and financing within each Agency's governing structure. In spite of this fact, the offer made by the IOC Chairperson to consider ICSPRO as an executive high-level coordination mechanism for Oceans and Coastal Zones was not received enthusiastically at the 1st meeting of ICP.

At its thirty-third session the Executive Council noted that, with a limited number of Agencies represented at high level, ICSPRO merits special attention, while ACC-SOCA constitutes an effective mechanism for exchanging information requiring co-ordination among the Agencies. The Executive Council encouraged the revitalization of ICSPRO as a high-level executive mechanism to complement ACC-SOCA in order to respond more effectively to the new needs in ocean management.

Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)

IOC continued in 2000 to contribute to the activities of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), particularly to the activities of the GESAMP Working Group on Marine Environmental Assessments (MEA). Two reports prepared by the MEA Working Group were adopted by GESAMP at its XXXth Session, held in May 2000 in Monaco. One of these reports is entitled *A Sea of Troubles; Issues in Focus* and deals with the state of the marine environment and addresses current major issues and emerging problems. The second report is entitled *Land-based sources and activities affecting the quality and uses of the marine, coastal and associated freshwater environment*. In particular it addresses the assessment needs of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA). These reports have been peer-reviewed by more than 70 experts worldwide. They are expected to be published early 2001 and planned to be disseminated widely to the governments, international organizations and the marine environmental management community.

At its seventh session, the UN Commission on Sustainable Development called upon the Sponsoring Organizations of GESAMP to review its methods of work with a view to improving its effectiveness and inclusiveness, whilst maintaining its status as a source of agreed independent advice. GESAMP is a joint interagency advisory group sponsored by IMO, FAO, UNESCO/IOC, WMO, WHO, IAEA, UNEP and the Division for Ocean Affairs and the Law of the Sea of the United Nations Secretariat. It was established in 1969 in response to a request by the United Nations Administrative Committee on Co-ordination (ACC). ACC noted that organizations within the United Nations System should, in order to avoid duplication of efforts, together develop a mechanism for interdisciplinary consideration of marine pollution problems.

Since its foundation over 30 years ago, GESAMP has provided about fifty scientific

studies, including a wide range of hazard and risk assessments, monitoring programmes and marine environmental quality reviews and guidelines. Starting 1992 the Sponsoring Organizations have reviewed the memorandum on GESAMP including its functions and operational procedures several times; the last comprehensive review took place in August 1999.

In March 2000, UNEP recommended that an evaluation of the productivity and efficiency of GESAMP, together with its operational procedures, be carried out by at least two experts, one representing governments and one representing the scientific community. On May 2000 the Intersecretariat co-ordinating group for GESAMP, comprising the Administrative Secretary and the Technical Secretaries from the Sponsoring Organizations, as well as its Chairman and Vice-Chairman, met on 21 and 22 May 2000 to consider in detail the UNEP proposal, taking into account a further note from UNEP, and agreed in principle that an independent and thorough evaluation was necessary. An evaluation team of five experts was proposed by the GESAMP Intersecretariat, consisting of: two scientists (one from a developed country and one from a developing county) to be identified by the Scientific Committee on Oceanic Research (SCOR); two governmental experts (also one from a developed country and one from a developing county); and an additional expert who has been an ex-member or ex-chairman of GESAMP. The estimated cost of US$ 80,000 of the evaluation will be shared among the Sponsoring Organizations of GESAMP. After completion of the evaluation of GESAMP, its Sponsoring Agencies will decide whether there is still a need for GESAMP and how it fits in with other international science organizations such as ICES, PICES, IGBP, SCOPE, ICSU, etc. It will also determine whether the *modus operandi* of GESAMP, as reviewed in 1999, is appropriate to fulfil the needs of its Sponsoring Organizations for future years.

Co-operation with the International Council for Science and the Scientific Committee on Oceanic Research (ICSU and SCOR)

A strong co-operation exists between ICSU and IOC in several global research programmes such as WCRP (involving CLIVAR, GOOS and GCOS), SCOPE and IGBP (involving GLOBEC and LOICZ). IOC and the Scientific Committee for Oceanic Research (SCOR) are co-sponsors of GLOBEC and GEOHAB. IOC and ICSU also co-operate in the WDCs Panel and the projects implemented jointly include GODAR, GOSIC, and data policy. The co-operation with ICSU/SCOR and IOC was strengthened in 2000 through the co-sponsorship of the SCOR/IOC CO_2 Panel, the COASTS Conference and the new SCOR/IOC Working Group 119 on Quantitative Ecosystem Indicators for Fisheries Management as well as the involvement of IOC in JGOFS/LOICZ/IOC Continental Margins Task Team, the establishment of GLOBEC/IOC ad hoc Study Group on the Use of Environmental Indices in the Management of Pelagic Fish Populations and the planning for a GLOBEC/IOC/SPACC Synthesis and Training Office at IOC. IOC, SCOR and SCOPE continued their collaboration on the production of a book ('Oceans 2020: Science for Future Needs') summarizing the results of the Potsdam Workshop of 2-8 October 1999.

IOC participated in a SCOR/IGBP Workshop on the Future of Global Ocean

Biogeochemistry (Plymouth UK, 23-26 September 2000). The workshop was intended to define key scientific questions concerning ocean biogeochemistry that are central to the goals of the existing and planned global change research programmes, and that are likely to remain unanswered after the completion of existing projects. The ultimate goal of the activity was to begin to set the boundary conditions for a new project or projects on ocean biogeochemistry, recommending to the sponsors what scientific questions, pertaining to the marine environment, must be answered to meet the programme goals of IGBP and SCOR.

The meeting discussed progress and uncertainties regarding key processes in the ocean biogeochemical cycles and identified research priorities for the next decade of global biogeochemical cycle research, building on the expected outcomes of the existing national and international marine research activities, including, but not limited to, the World Ocean Circulation Experiment (WOCE), the Land-Ocean Interactions in the Coastal Zone (LOICZ) programme, the Past Global Changes (PAGES) programme, JGOFS, and GLOBEC. The group also took account of the ongoing activities for SOLAS. The results of the workshop form a preliminary basis for developing a framework for linking existing and future elements of international marine global change research in the context of Earth System Science, the unifying concept underpinning the restructuring of the IGBP that includes three components – representing marine, terrestrial, and atmospheric environments – with three additional elements linking these: air-sea, air-land, and land-sea. The framework is not limited to the global carbon cycle, but includes all important biogeochemical cycles in which the ocean plays a role. IOC has been invited to contribute to this development.

6.2 Follow-up to UNCED and UNCLOS

Follow-up to the United Nations Conference on Environment and Development (UNCED)

The ACC Sub-committee on Oceans and Coastal Areas (ACC-SOCA)

This Sub-committee is the Task Manager of Chapter 17 of UNCED's Agenda 21. IOC presently chairs the ACC-SOCA and has been the secretariat of the Sub-committee since its establishment in 1993. SOCA held its eighth session at the GPA Headquarters at The Hague, from 19 to 21 January 2000 and its ninth session at the IMO Headquarters in London, from 26-28 July 2000. Participants included 13 representatives from 8 UN organizations and a representative from the secretariat of the Convention on Biological Diversity. The matters considered at the meetings included:
(i) progress in the development of United Nations Atlas of the Oceans; (ii) establishment and results of the first meeting of the United Nations Open-Ended Informal Consultative Process on Oceans and the Law of the Sea (ICP); (iii) reporting and participation for Rio +10; (iv) measures for making the Sub-committee more transparent, effective and responsive, as recommended by the Commission on Sustainable Development in its decision CSD 7/1 and (v) review of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP). The newly developed prototype

of the ACC-SOCA website was demonstrated and areas of further development were agreed upon by the Sub-committee. Concerning the GPA, SOCA agreed that its main role was to provide a platform for enhanced interaction/co-ordination and co-operation in matters related to GPA implementation. It also addressed the development of the GPA clearinghouse, the action plan for a global conference on sewage and the process leading to a 2001 global GPA review.

SOCA at its eighth session concluded that co-ordinated executive action could only ensue following the due process of endorsement and financing within each agency's governing structure. SOCA identified its ongoing and planned activities as: (i) proactive production of contributions to the system-wide reporting task to international bodies such as the Commission on Sustainable Development (as the task manager for chapter 17 of Agenda 21), the General Assembly (contributing to the Secretary-General's annual report on oceans and the law of the sea), the GPA and the new ICP; (ii) joint production of the United Nations Atlas of the Oceans; (iii) forward implementation of the GPA; (iv) assistance to GIWA in the production of a policy-oriented global water assessment; (v) development of regional applications of joint activities as necessary; and (vi) provision of co-ordinated input to Rio + 10 and its preparatory process, ensuring that due attention is given to the oceans and coastal areas.

As a side event during its eighth session, SOCA hosted a briefing to 37 diplomatic missions at The Hague on its activities as the task manager for chapter 17 of Agenda 21. Four topics were presented: (i) status of implementation of the GPA; (ii) ICP as recently established by the General Assembly; (iii) United Nations Atlas of the Oceans; and (iv) addressing critical uncertainties for marine environmental management and climate change.

The newly established ICP was discussed extensively by the Sub-committee which expressed the collective willingness of the SOCA agencies to participate actively in this very comprehensive consultative process, and agreed to provide a joint written report to the first meeting of ICP on its activities and to invite all agencies and organizations to participate actively. A brochure on SOCA was subsequently produced and distributed at the 1st meeting of the ICP and a side event was held to provide a brief to the delegations on SOCA activities.

At its ninth session SOCA expressed its willingness to contribute to an official report requested by the United Nations Division for Sustainable Development, Department of Economic and Social Affairs (DESA) on the 10-year review of the implementation of Agenda 21, which will take place in 2002, although the very short (3-5 pages) Secretary General's report on oceans, which has been proposed, was considered inadequate to give a useful picture, even as a snapshot, of the whole oceans arena. In addition, SOCA felt it was essential that its own input to Rio +10, as well as the review process itself, take into consideration a number of planned and possible new initiatives on oceans (e.g. FAO/Iceland Conference on Fisheries in the Ecosystems and an NGO-organized global Conference on Oceans and Coasts at Rio +10, both planned for late 2001).
The reports of the eight and ninth sessions of SOCA are available at the website: htpp://ioc.unesco.org/soca.

Follow-up to the United Nations Convention on the Law of the Sea (UNCLOS)

In the framework of its UNCLOS activities, IOC developed the following actions:

List of Experts in Marine Scientific Research for Use in Special Arbitration
Further to the IOC Circular Letter N°1643 dated 8 March 2000, the IOC list of Experts in the field of marine scientific research, in accordance with Article 2 of Annex VIII of UNCLOS, was updated as of 12 July 2000 and sent to the UN/DOALOS for the preparation of the UN Secretary-General's annual Report. This list comprises 64 experts from 38 Member States.

UNCLOS and IODE
A contribution on 'UNCLOS and the Ocean Data Policy Exchange' will be made during the First Meeting of the ad hoc Working Group on Oceanography Data Exchange Policy, to be held in Paris from 15 to 17 May 2001. This Group was established by Resolution XX-11 (Oceanographic Data Exchange Policy) of the 20th Session of the IOC Assembly (Paris, 29 June- 9 July 1999).

First Meeting of the IOC Advisory Body of Experts on the Law of the Sea (ABE-LOS)
In response to the decision of the 33rd Session of the IOC Executive Council (Paris, 20-30 June 2000) for the preparation of the First Meeting of the IOC Advisory Body of Experts on the Law of the Sea (ABE-LOS), the Secretariat drafted and sent a questionnaire to canvass the Member States regarding suggestions for the agenda with a view to identifying the priority issues to be discussed by the Meeting. Twenty-four countries responded to the questionnaire. Co-operation between IOC and institutions established by UNCLOS and access to data, results and conclusions of MSR projects were selected as the first priorities by the Member States. However, in their comments on the questionnaire, they stressed the issues of transfer of marine technology (UNCLOS Part XIV), development of guidelines for ascertaining the nature and implications for MSR (UNCLOS Article 251) as well as MSR projects undertaken by or under the auspices of an international organization (UNCLOS Article 247).

The IHO/IAG/IOC Advisory Board on the Law of the Sea (ABLOS)
ABLOS held its 7th Meeting from 24 to 25 August 2000 in New York. The IOC representative provided information on ABE-LOS. It was agreed that the acronym was unfortunate but that the stated terms of reference of ABE-LOS did not conflict with ABLOS. The Oxford University Press announced the publication of the IOC/IHO book: *Continental Shelf Limits: the Scientific and Legal Interface (See next page)*. The Meeting provided guidance for the preparation of the next ABLOS conference to be held in Monaco in October 2001, where IOC will accede to the Chairmanship of ABLOS.

Co-operation with Institutions established by UNCLOS
IOC was represented to the Open Meeting of the Commission on the Limits of the Continental Shelf, held on 1 May 2000, which gave a good opportunity for Member States to be familiar with the CLCS procedure and designated members. IOC provided information on its programme dealing with the CLCS activities to meet a request

of the CLCS Chairperson in accordance with Article 3 of Annex 2 to UNCLOS.

IOC and the International Seabed Authority (ISA) signed, on July 2000, an MOU on the provisions of oceanographic information and data from IOC/IODE World Data Centres. Discussions are underway with the International Tribunal for the Law of the Sea (ITLOS) for the conclusion of an MOU between IOC and ITLOS.

IOC/IHO-sponsored book on continental shelf and LOS

The IOC and IHO jointly sponsored the publication of *Continental Shelf Limits – The Scientific and Legal Interface*, edited by P. J. Cook and C. M. Carleton and published in 2000 by Oxford University Press (ISBN 0-19-511782-4, 363 pages).

It was judged fitting that IHO and IOC should collaborate in the production of this book so as to more effectively address the many complex scientific and technical issues related to the continental shelf, as the criteria used to determine the outer limits of a continental shelf require information and data that fall within the specific interest and competency of the two organizations.

This unique, very comprehensive and interdisciplinary book thoroughly discusses UNCLOS, the legal aspects of the continental shelf, characteristics and resources of the continental margin, related international law, geodetic techniques and a series of other related topics. Amongst the annexes is a very useful glossary of technical terms, the key provisions of UNCLOS relating to the continental shelf, the 1958 Geneva Convention on the Continental Shelf, and a 13-page index.

How to obtain: This book is available from the publisher or from authorized distributing agents. For more details, specific to your country – including purchasing procedure, price, mailing costs etc. – contact: Mary Beth Jarrad (mbj@oup-usa.org), Oxford University Press, NYC, USA; Fax: 1-212 726 6453. Their website: www.oup-usa.org

IOC 2000

IOC within UNESCO

7

7.1 Development of IOC within UNESCO

Codification of the 'functional autonomy' of IOC

Beginning in 1990 the UNESCO administration, after extensive consultations with the elected officers of the Commission, proceeded to implement the functional autonomy status granted to the IOC in 1987 by the Organization's General Conference (24 C/Resolution 10.4), through the establishment of a special account, the corresponding financial regulations and a series of administrative prerogatives delegated to the IOC Executive Secretary*.

* One of the leitmotivs for the 'functional autonomy' status of IOC within UNESCO was to realize an increased 'operational flexibility' for the implementation of the IOC's programmes. All administrative prerogatives delegated to the IOC Executive Secretary are enumerated in Annex II to document 156 EX/9, citing the source. Since Article 8 of the new IOC Statutes establishes the level of the Executive Secretary of IOC as an Assistant Director-General (ADG), many of the special authorizations entrusted formerly through delegation to the Executive Secretary have been superseded, since they fall within the regular authority of any ADG of UNESCO.

In the Annex to document DG/Note/90/30, entitled 'Structure of the Secretariat and staffing table for 1990-1991' dated 31 August 1990, the Director-General defined functional autonomy as: 'Corresponding authority … in respect of programme implementation, management, staff questions and financial matters, within the framework of the Organization's regulations'. (Source: 156 EX/9, Paris, 4 May 1999).

Between 1998 and 2000 the Executive Board of UNESCO invited the Director-General to report on the measures adopted to implement the functional autonomy of IOC. In response, the administration, in close interaction with the Executive Board of UNESCO, especially through the work of the Financial and Administrative Commission and its Group of Experts, completed the process of codification of the functional autonomy status.

The Executive Board revised a total of three reports: 154 EX/11, 154 EX/51 and 156 EX/9. As a final step in this process, through Decision 3.3.2, the 156th Executive Board invited 'the Director-General to present to it, at its 157th session, the modified Statutes and Financial Regulations of the Commission, taking into account the standard model text for such regulations'.

Through documents 157 EX/7 and 157 EX/52, and in close co-ordination with the IOC governing bodies, the Director-General answered the request. Accordingly the revised IOC Statutes, after unanimous approval by the 20th session of the IOC Assembly (July 1999), were endorsed by the 157th session of the Executive Board together with the revised Financial Regulations and were finally approved by the 30th General Conference (30 C/Resolution 22) in November 1999.

UNESCO Headquarters, main building

External Evaluation of IOC

Following the request by the 29th UNESCO General Conference to conduct an independent evaluation of the IOC, the Director-General, after consultation with the National Commissions of the Organization, nominated a team of external experts in March 1999.

The Terms of Reference of the Evaluation asked for a detailed review of the capacities and capabilities of IOC in carrying out its mission, an assessment of the current programmes and of its administrative effectiveness and efficiency. The report, released in February 2000, recognized that the IOC is performing a vitally important role in international Earth system science and has an enviable record of achievements over many years.

However, the external panel recommended improvements in regional co-ordination arrangements, management of the Secretariat, and co-operation with other international organizations. Also, the need for a more focused programme with fewer elements was clearly recognized.

In summary, the External Evaluation reached conclusions that were translated into differentiated sets of recommendations addressed to:

(i) UNESCO – to provide resources within the Organization and preserve the Statutes and the principles of IOC's functional autonomy as approved by the UNESCO Governing Bodies;

(ii) IOC Governing Bodies and Secretariat – to conduct strategic planning and prioritization; and to implement modern financial and staff management practices; and

33rd session of the IOC Executive Council (June 2000). Membership: 36 of the Commission's 128 Member States

(iii) Member States – to establish and co-ordinate national committees for IOC, and to invest funds and human resources.

The implementation of several of the recommendations of the External Evaluation has already begun. Most notable among the recommendations are the approval of the modified Statutes by Resolution 22 of the 30th General Conference and the new management tools that are already operational in the Secretariat and field offices of IOC. Thus IOC, with regard to the improvement of its status and efficiency within UNESCO, is developing along the lines of the provisions approved by the General Conference.

UNESCO's 'Bonvin Building', which houses IOC main offices

IOC finances

8

SUPPORT TO THE IOC PROGRAMMES

A wide spectrum of activities is described within the body of this report, which highlights the relevant implementation phases of the IOC programmes for 2000. In concert with national and non-governmental initiatives, the implementation of IOC programmes and related staff costs during 2000 was financed through income from UNESCO as part of its regular programme allocation, as approved by the UNESCO General Conference, and from extra-budgetary resources, notably those provided by IOC Member States through their contributions to the IOC Trust Fund (Special Account). This report does not consider other contributions (either direct or in-kind) provided by Member States in support of the Commission's programme execution, which contributions do not enter the budgetary flow of IOC.

With regard to the regular programme allocation, the approved 30 C/5 (UNESCO Programme and Budget for 2000-2001) shows funding for the Intergovernmental Oceanographic Commission at a total of $6,244,200 ($2,577,900 for programme costs and $3,666,300 for staff costs) for the biennium 2000-2001.

The initial projection in funding, approved by the Twentieth Session of the IOC Assembly as a basis for future planning, was based on a total of $2,960,000 from the UNESCO Regular Programme and upon an estimate of extra-budgetary resources of $4,000,000.

The allocation of $2,577,900 for programme costs represented a decrease of 16% ($487,000 less) compared to the previous biennium. Furthermore the $3,666,300 allocated for staff costs includes a P-4 post ($230,000) serving the Secretariat for WESTPAC, entailing the abolition of a P-5 post at headquarters.

	Extrabudgetary resources		UNESCO Regular Programme	Total
	Earmarked	General		
Programme	1 061 218*	832 155	1 191 900***	3 085 273
Staff	442 800**		1 833 150	2 275 950
Total	2 336 173		3 025 050	5 391 223

TABLE 1.
Income 2000

* Including contributions from Governments of Flanders and Japan
** Does not include funding provided for associate experts from Denmark and Japan
*** see chart 1 below

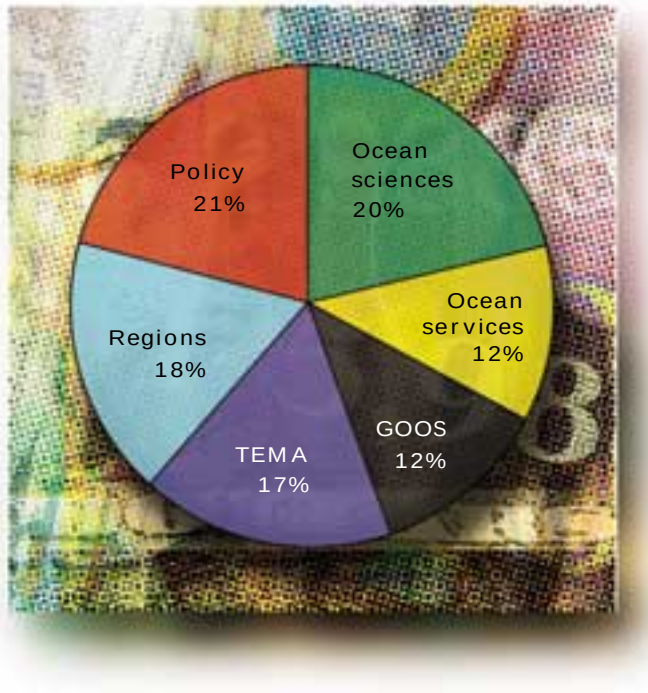


CHART 1.
Distribution of the UNESCO Regular Programme allocation (programme part) by activity

The amounts in these tables and charts are in US dollars

TABLE 2.
2000 contributions to the IOC Trust Fund

Contributor	Total	Component	Purpose
ACOPS	35 980		Regions/Africa
Australia	2 862	2862	Pacific GOOS Mtg
Chile	3 000		Tsunamis
China	40 000	20 000	Westpac activities/OM
	20 000		Westpac activities
CPPS	4 862		El Niño book (Spanish version)
Denmark	219 400		OSLR/HAB
European Union	38 355		IODE/GODAR
Finland	25 355		PACSICOM Follow-up
France	42 542	3 751	Med/GOOS
	9 854		IOCEA V
France IRD		3 070	OceanObs 99
France/IRD		2 815	Pirata/GOOS, Maroc
	11 806		Seconded personnel
France/CNRS		1 383	GOOS
	9 863		GOOS/Pacific GOOS
ICSU	20 000		GOOS
Italie Osservatorio	9 993		Med/GOOS
Netherlands	21 470	20 240	GOOS
LOICZ/Netherlands		1 230	C-GOOS-V Mtg (May 00)
Spain	23 681		OSLR/HAB
Spain	24 060		OSLR/HAB
Sweden (SIDA SAREC)	54 764		General
UK	258 814		
UK (NERC)		18 000	GOOS
UK (NERC)		10 000	GLOSS
UK/DFID		51 990	General
UK/DFID		171 454	OSLR/GCRMN
UK Met Office		7 370	Argo Coordinator
UNEP	168 000		
UNEP		18 000	Coastal GOOS
UNEP		150 000	OSLR/GCRMN
USA	880 600		
USA		600 000	General
USA/NOAA		140 000	OSLR/seconded personnel
	66 000		GOOS seconded personnel
USA/Columbia Univ		5 000	El Nino Publication
USA/Columbia Univ		5 000	El Nino Publication
US NOAA		5 000	C-GOOS-V Mtg (May 00)
US ONR		10 000	C-GOOS-V Mtg (May 00)
US NOAA		24 600	Argo Co-ordinator
US NOAA		25 000	GODAE
WMO	148 292		
WMO		20 000	GOOS
WMO		128 292	GOOS/DBCP
Sub-Total	2 022 030		
Interests	125 401		
TOTAL IOC Trust Fund*	**2 147 431**		
Belgium/Flanders Fund in Trust	122 370		ODINAFRICA
Japan Fund in Trust	66 372	43 000	WESTPAC – GOOS-related area
	23 372		Other WESTPAC-related areas, incl. HAB
New Total	**2 336 173**		

***** Earmarked contributions to the IOC Trust Fund: $1 315 276
Non-earmarked contributions: $832 155

	Ocean Sciences	Ocean Services	GOOS	TEMA/ Regions	Policy	Total Exp.'00
UNESCO Regular Programme	148 870	187 868	114 529	318 074	244 771	1 014 112
Extrabudgetary	913 787	336 752	480 610	249 531	400 903	2 381 583
Total	1 062 657	524 620	595 139	567 605	645 674	3 395 695

TABLE 3.
Programme expenditure by activity (without staff costs)

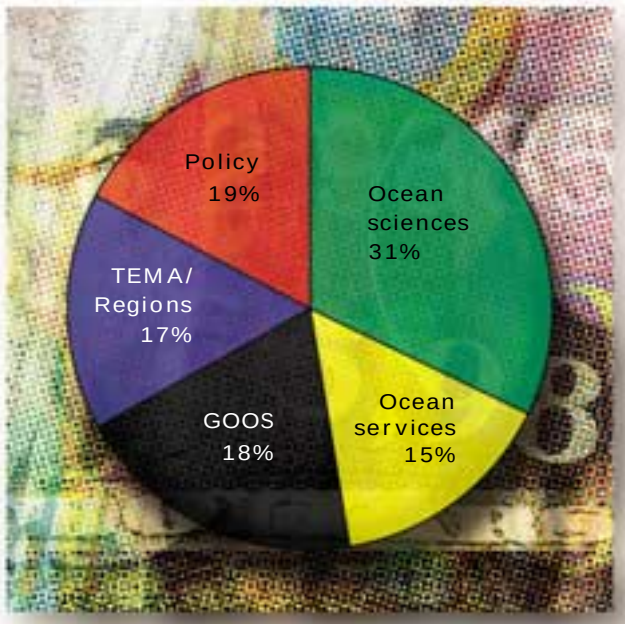


Chart 3A.
Programme expenditure by activity (without staff costs)

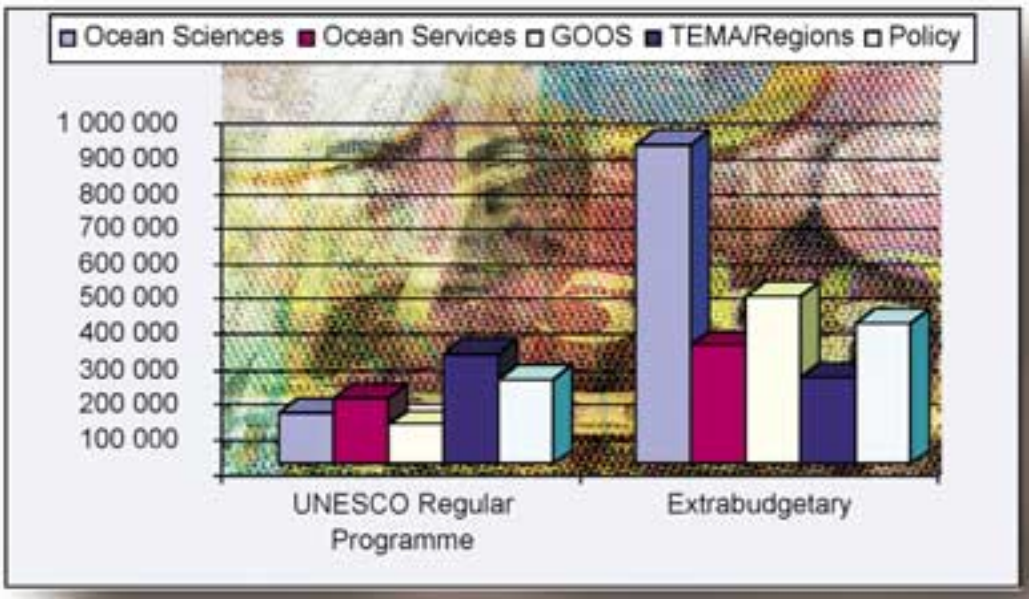


Chart 3B.
Programme expenditure 2000 – UNESCO Regular Programme versus Extrabudgetary Funds

IOC 2000

Dissemination of information/ public awareness

9

In 2000 the IOC continued its extensive programme designed to disseminate scientific information to its Member States and to promote public awareness to the world community in general, concerning the importance of the oceans and coastal marine areas and concerning the scientific research pertaining to them and to their resources. This was carried out notably in the following general avenues: (i) production and distribution of documents containing or reporting on the results of IOC (and IOC co-sponsored) activities; (ii) maintenance of a website on the various IOC programmes and on related events, products and other relevant information; (iii) co-sponsoring the publication of works designed to discuss and explain issues and phenomena related to the ocean; and (iv) co-sponsoring activities of a nature to appeal to the general public and promote awareness of ocean themes, including marine environmental conservation.

9.1 Documents

In 2000 the Commission published (via UNESCO) documents in the following five series: IOC Workshop Reports, IOC Technical Series, IOC Manuals and Guides and IOC Information Documents, plus the IOC Annual Report for 1999. (See the list of titles distributed in 2000 at the end of this section.)

As well, the Commission produced and distributed issues of the following newsletters: *GOOS News*, *Window* and *Harmful Algae News*.

Website 9.2

To meet the increasing challenges of the Internet medium, IOC had already developed one of UNESCO's first websites, which started up in 1995 and was given a boost by the IOC's public awareness activities in support of the International Year of the Ocean (1998). By extrapolating from the available figures one can estimate the number of total 'hits' (website visits or requests) at well over 2 million for the year. Of the total number of hits, about 30% visited the main site, 26% the IODE sites, 14% the GOOS site and 30% the Ocean Sciences sites.

The IOC Secretariat has experienced some difficulty in maintaining its website at a high level of comprehensiveness, given that its originator – the Ocean Services section – has been reduced in staff size. The solution, which was adopted by default, was to decentralize the web-based information and development work to the individual sections, programmes and projects. This has resulted in a total of 23 IOC subsites. The call for Member States' to support the site's reinforcement (by providing increased staffing or funding) was made at the Nineteenth Session of the IOC Assembly. The IOC website can be visited at: http://ioc.unesco.org/iocweb

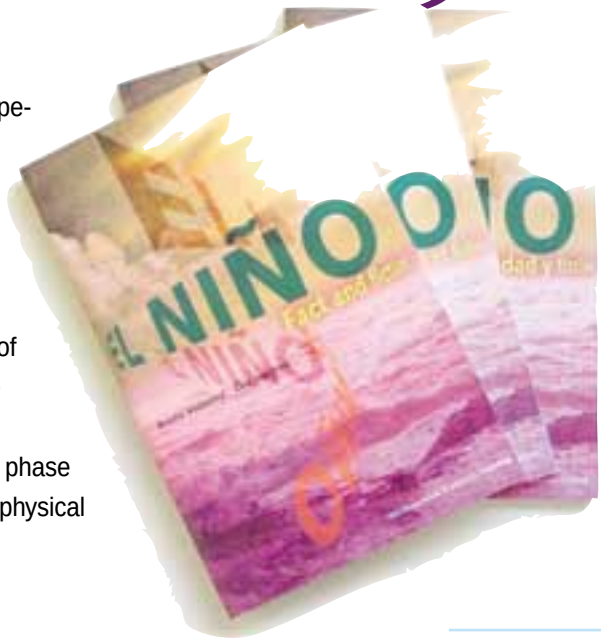
As from 2000, IOC co-operated with six other UN agencies (UN, FAO, IMO, WMO, UNEP, and IAEA), and other partners (e.g. USA's NOAA and Russia's HDNO), in a project financed by UNFIP to develop the 'UN Atlas of the Oceans'. (This project is also mentioned in the Ocean Services part of this report.) The Atlas will be essentially an information system on the oceans and coastal areas, designed for use by: (i) policy makers who need to become familiar with ocean issues, (ii) scientists, students and resource managers who need access to the underlying databases and approaches to sustainability, and (iii) the general public interested in these topics.

Publications 9.3

'Easy-to-carry' book helps understand El Niño

Ocean Forum volume is UNESCO 2000 science best-seller.

As the third volume in the IOC Ocean Forum Series, in 2000 UNESCO completed its publication of *El Niño – Fact and Fiction* in English, French and Spanish editions. The objective of the manuscript, authored by French scientists Bruno Voituriez (IRD) and Guy Jacques (University of Perpignan), was to help make scientific knowledge on and understanding of the ocean-climate interface more accessible to the general public.



Written with the non-specialist readership in mind, the authors conduct a tour of the Earth's climate machine for a better understanding of one of its normal but extreme components – El Niño (and of its succeeding phase – La Niña). Voituriez (physical

oceanographer) and Jacques (marine ecologist) relate stories of floods, droughts and forest fires. In a lively account and without sacrificing rigour, they set about to untangle the events directly attributable to El Niño and La Niña from those for which it is, to say the least, premature to make them responsible.

This title was the No. 1 best-seller in 2000, in the category of science books released by UNESCO Publishing. Besides the printed edition, a digital edition is available online (PDF format) in the three languages.

The publication was sponsored by: IOC; Fugro Global Environmental and Ocean Sciences (GEOS) Ltd. (home office in the UK); the International Institute for Climate Prediction (IRI), of the Lamont-Doherty Earth Observatory (Columbia University, USA); and the Permanent Commission for the South Pacific (CPPS, HQ currently in Quito, Ecuador). In addition to sales, UNESCO, its IOC and other co-sponsors carried out a liberal free distribution of this book, especially to institutions in developing countries.

It can be purchased from:
UNESCO Publishing, 7 place de Fontenoy,
75352 Paris 07 SP, France
Fax: 33-1-45 68 57 37
Online (printed and digital versions):
http://www.unesco.org/publishing
All inquiries at:
E-mail: publishing.promotion@unesco.org

Ordering details:

English:
El Niño – Fact and Fiction, ISBN 92-3-103649-1, printed edition: 128 pages, 24 x 15.5 cm; colour illustrations, maps and graphs; UNESCO Publishing, price: 110 French francs/16,77 euros; digital edition (PDF), price: 55 FF / 8,38 euros.

French:
El Niño – Réalité et Fiction, ISBN 92-3-203649-5, printed edition: 116 pages, 24 x 15.5 cm; colour illustrations, maps and graphs; UNESCO Publishing, price: 110 French francs/16,77 euros; digital edition (PDF): 55 FF / 8,38 euros. This (original) edition was published in 1999.

Spanish:
El Niño – Realidad y Ficción, ISBN 92-3-303649-5, printed edition: 142 pages, 24 x 15.5 cm; colour illustrations, maps and graphs; UNESCO Publishing, price: 110 French francs/16,77 euros; digital edition (PDF): 55 FF/8,38 euros.

Public awareness activities 9.4

'One Planet ... One Ocean' IOC poster

As a symbolic activity marking its 40th anniversary, the IOC produced a poster 'One Planet…One Ocean', which was distributed widely at meetings and to Member States' institutions, agencies, other organizations etc. The Commission's activities during this year were placed under this motto. The poster is reproduced on page 9 of this report. Copies are available at IOC (p.boned@unesco.org).

27th World Festival of Underwater Pictures

During the year 2000, the IOC joined other partners* in supporting the 27th World Festival of Underwater Pictures, held 1-5 November in Antibes Juan-les-Pins, France. This year's entries in the traditional event, known in French as the 'Festival Mondial de l'Image Sous-Marine', totaled over 25,000, with representation from forty-one countries, and over 120 stands demonstrating undersea films as well as advertising diving clubs and centres, specialized magazines and journals, French and other tourist offices, video and photo materiel, diving equipment etc. One hundred-fifteen films were shown in the three projection rooms of the host city's 'Palais des Congrès'. Festival records indicated registrations by over 800 people from a wide variety of disciplines. The event received considerable coverage in French and foreign press.

Sixty-one prizes were awarded, bringing the ensemble of winners a total of 120,000 French francs. One of the notable prizes bestowed at this event was donated by the IOC, offered in recognition of an undersea film selected for its outstanding quality in the promotion of research and protection of the oceans. The winner received an award of $2,500. The winners of the IOC Prize for the Year 2000 were: Yves Pellissier, J. P. Heckmann and René Heuzey, for their film entitled *Blanc Corail* (white coral), which was produced for the *Thalassa* (France 3) television programme.

Poster of the 27th World Festival of Underwater Pictures, Antibes 2000

Also held was a symposium under the theme: '20,000 leagues under the sea in the Year 2000'. Attending the festival were numerous internationally known personalities** in the world of diving and other undersea domains.

Daniel Mercier, Founding President of the Festival

In connection with the festival, a poster contest was organized, with support from IOC. Each year, children from all over the world, under 19 years of age, are invited to enter this drawing contest for the Festival's poster. The winner of the contest is invited to the Festival with his parents or teacher. In 2000, the winner was a Ukrainian girl, Tamila Zaboltniaia, aged 16. Tamila's poster is reproduced in the illustration on the preceeding page.

The Festival was initiated in 1974 by Daniel Mercier and the Spondyle Club – at that time one of the largest diving clubs in France. The Festival's main objectives have been preserved throughout the years: promoting relevant cultural and sporting activities, and providing a meeting ground for 'les amoureux de la mer' (those with a passion for the sea) and for image-creators.

The address of the Festival:
World Festival of Underwater Pictures
62, avenue des Pins du Cap
06160 Antibes Juan les Pins
FRANCE
Tel: +33–4 93 61 45 45
Fax: +33–4 93 67 34 93
E-mail: spondyle@wanadoo.fr
Website: www.underwater-festival.com

The above article was written by Gary Wright with the collaboration of Daniel Mercier.

IOC AND NAUSICAA CO-OPERATE ON PUBLIC AWARENESS

On 20 June 2000, IOC and NAUSICAA (France's 'Centre National de la Mer') reiterated their agreement on co-operation, for the years 2000-2001, in efforts to promote public awareness concerning the World Ocean's sustainable development and management. The two parties agreed to work together, each within its own mandate and sphere of activities, outlined as follows. In fact, the two partners had already begun co-operation in 1998, the International Year of the Ocean, when they signed a first agreement.

IOC, in accordance with its new Statutes, has the responsibility 'to promote international co-operation and co-ordinate programmes in research, services and capacity building, in order to learn more about the nature and resources of the ocean and coastal areas and to apply that knowledge for the improvement of management, sustainable development, the protection of the marine environment and the decision-making processes of its Member States.' As well, IOC is involved in activities promoting programmes in education, training and assistance in marine science and other ocean-related domains.

* Other partners were: City of Antibes – Juan les Pins, France's Centre National de la Mer – NAUSICAA, and the Institut Océanographique Paul Ricard. The high patronage and patronage were shared by IOC with various eminent individuals and bodies, including French ministers, regional and department governments, city officials as well as cinematographic and sports bodies. Dr Patricio Bernal, UNESCO Assistant Director-General for IOC, was a member of the 'Comité d'Honneur', an honorary committee made up of thirteen high-ranking officials.

** Illustrious participants included such personalities as Jean-Michel Cousteau (well-known environmental spokesman), Philippe Rousseau (enthusiastic deep-sea diving equipment collector), Leslie Leaney (President of Historical Diving Society, USA) and Luigi Ferraro (pioneer of scuba diving in Italy). Exhibits covered the work of such well-known French ground-breakers in this field as Jacques-Yves Cousteau, Philippe Tailliez, Frédéric Dumas and Thomé de Gamond. Exhibits demonstrated the history of diving, various techniques and especially a rich collection of diving suits.

The NAUSICAA Centre is located in Boulogne-sur-Mer and is dedicated to the general public. Its goal is to introduce the sea to visitors and increase their awareness of the need to ensure a sustainable use of ocean resources. In order to acquaint people with the ocean environment, its richness and sustainable use, the Centre disposes of large tanks, models, 'dioramas', multi-media and theatrical presentations plus other facilities.

Dedicated to educational and cultural activities – among them the development of programmes and kits for school children -– in 1999 NAUSICAA was awarded the title of 'Centre of Excellency' by IOC in recognition of its contribution to ocean protection and increasing public awareness.

In 2000, the results were distributed of the 1st International Meeting of Aquariums, Museums and Sciences Centres, held in 1999 under the theme: 'Let's act in unison to influence our public towards a better management of the ocean's resources'. Also the 1st meeting of the steering committee for the 2nd International Meeting of Aquariums, Museums and Sciences Centres, planned for 2002, was held with the support of IOC.

Guy Lengagne, NAUSICAA's President, is France's former Minister of the Sea, and currently Member of the French Parliament as well as Mayor of Boulogne-sur-Mer. Their address is: NAUSICAA, Boulevard Sainte Beuve, 62200 Boulogne-sur-Mer, France.
Tel: +33-3 21 30 98 98
(general information)
or: +33-3 21 30 99 99 (administration)
or: +33-3 21 30 99 89 (reservations)
Fax : +33-3 21 30 93 94.
Website: www.nausicaa.fr

By Gary Wright, in collaboration with Manuel Cira (NAUSICAA)

Guy Lengagne (President of NAUSICAA) and Patricio Bernal (ADG of UNESCO for IOC), in the act of signing the agreement for continued co-operation

9.5 List of titles distributed in 2000*

IOC TECHNICAL SERIES

Woods, John. Bruun Memorial Lectures: Ocean Predictability, 1999. 2000 40 pp. (Technical Series, 55). (English)

Multidisciplinary Study of Geological Processes on the North East Atlantic and Western Mediterranean Margins, 1999. 2000. (Technical Series, 56) (English)

Ad Hoc Benthic Indicator Group Results of Initial Planning Meeting. 1999. 65 pp. (Technical Series, 57). (English)

IOC MANUALS AND GUIDE

Guidelines for Vulnerability Mapping of Coastal Zones in the Indian Ocean. 2000. 40 pp. (Manuals and Guides, 38). (English, French)

Guidelines for the Study of Shoreline Change in the Western Indian Ocean Region. 2000. (Manuals and Guides, 40). (English)

Des outils et des hommes pour une gestion intégrée des zones côtières (Guide méthodologique, volume II). 2001. 64 pp. (Manuals and Guides, 42). (French. English to come)

IOC WORKSHOP REPORTS

IOC-LUC-KMFRI Workshop on RECOSCIX-WIO in the Year 2000 and Beyond (and Training Course for Librarians), Mombasa, Kenya, 1999. 2000. 61 pp. (Workshop Reports, 156). (English)

'98 IOC-KMI International Workshop on Integrated Coastal Management (ICM), Seoul, Republic of Korea, 1998. 2000. 47 pp. (Workshop Reports, 157). (English)

The IOCARIBE Users and the Global Ocean Observing System (GOOS) Capacity Building Workshop, San José, Costa Rica, 1999. 2000. 46 pp. (Workshop Reports, 158). (English)

Oceanic Fronts and Related Phenomena; Konstantin Fedorov International Memorial Symposium, Saint Petersburg, Russian Federation, 1998. 2000. 655 pp. (Workshop Reports, 159). (English)

IOC-SIDA-Flanders-MCM Third Workshop on Ocean Data Management in the IOCIN-WIO Region (ODINEA Project), Cape Town, South Africa, 1999. 2000. 29 pp. (Workshop Reports, 164). (English)

Proceedings of Workshops, An Integrated Approach, PACSICOM, Maputo, Mozambique, 1998. 2000. 349 pp. (Workshop Reports, 165). (English, French)

IOC-SOA International Workshop on Coastal Megacities: Challenges of Growing Urbanization of the World's Coastal Areas, Hangzhou, People's Republic of China, 1999. 2000.47 pp. (Workshop Reports, 166). (English)

Geological Processes on European Continental Margins, Granada, Spain, 2000. 2000. 44 pp. (Workshop Reports, 168). (English)

Ocean Circulation Science Derived from the Atlantic, Indian and Arctic Sea Level Networks, Toulouse, France, 1999. 2000. 143 pp. (Workshop Reports, 171). (English)

IOC-SOPAC Regional Workshop on Coastal Global Ocean Observing System (GOOS) for the Pacific Region, Samoa, 2000. 26 pp. (Workshop Reports, 174). (English)

* All IOC documents are available from the IOC documentation centre (p.boned@unesco.org)

IOC TRAINING COURSE REPORTS

IOC/GLOSS-GOOS Training Workshop on Sea-level Measurements, Tidal Analysis, GPS and Gravity Measurements, Satellite Altimetry and Numerical Modelling, São Paulo, Brazil, 1999 2000. 31 pp. (Training Course Reports, 54). (English)

IODE Training on Oceanographic Data and Information Management for the Spanish-Speaking Countries of Central and South America/Curso de Formación del IODE sobre la Gestión de Datos e Información Oceanográficos para los Países de habla hispana de América Central y del Sur, Rio Grande, RS, Brazil, 1999. 2000. 37 pp. (Training Course Reports, 57). (English/Spanish)

Third IOC/WESTPAC Training Course on NEAR-GOOS Data Management. Tokyo, Japan, 2000. 2000. 31 pp. (Training Course Reports, 58). (English)

IOC ANNUAL REPORT

IOC Annual Report 1999. 2000. 77 pp. (Annual Report Series, 6). (English)

INFORMATION DOCUMENTS

IOC/INF-1134 IGOS Ocean Theme Paper. May 2000. (English)

IOC/INF-1135 Report (FCCC/SBSTA/1999/10) on Research and Systematic Observations: Issues Related to the Global Climate Observing System. January 2000. (English)

IOC/INF-1136 Terms of Reference for the SCOR-IOC on Ocean CO2 Advisory Panel. April 2000. (English)

IOC/INF-1137 OceanObs 99 Conference Statement. April 2000. (English)

IOC/INF-1138 Summary Report on a JCOMM/GOOS Polar Region Strategy, Geneva, December 1999. January 2000. (English)

IOC/INF-1139 Partnership for Observation of the Global Ocean Summary Report of the POGO Inaugural Meeting, La Jolla, CA, USA, December 1999. February 2000. (English)

IOC/INF-1140 Programme on Assessment and Management Implications of Submarine Groundwater Discharge into the Coastal Zone. June 2000. (English)

IOC/INF-1141 Report of the International Seminar on the Organization of the IOC-UNESCO 'Floating University' Project in the Caspian Sea, Astrakhan, Russian Federation, November 1999. April 2000. (English)

IOC/INF-1142 GOOS Status Report 1999. April 2000. (English)

IOC/INF-1143 Continuity of High Accuracy Satellite Altimetry through Jason 1 and Jason-2. April 2000. (English)

IOC/INF-1144 Meeting of the Ad Hoc Working Group on Oceanographic Data Exchange Policy, Paris, France, May 2000. June 2000. (English)

IOC/INF-1145 First Consultative Meeting of the IOC/IODE Strategy Group of Experts, Paris, France, December, 1998. July 2000. (English)

IOC/INF-1146 Strategic Design Plan for the Coastal Component of the Global Observing System (GOOS). October 2000. (English)

IOC/INF-1147 Artic Tide Gauges: A Status Report. October 2000. (English)

IOC/INF-1148 Statutes/Statuts/Estatutos/Yctab. July 2000. (English/French/Spanish/Russian)

IOC/INF-1149 Intra-Americas Sea Tsunami Warning System meeting. Puerto Rico, Dec. 2000. 2001. (English)

IOC/INF-1150 Strategic Design Plan for the IOC-WMO-UNEP-ICSU-FAO Living

Marine Resources Panel of the Global Ocean Observing System (GOOS) – Tracking change in Marine Ecosystems. March 2001. (English)

IOC/INF-1152 Meeting of the Officers of the International Coordination Group for the Tsunami Warning System in the Pacific. Hawaii, Feb. 2001. (English)

IOC/INF-1153 Report of the IOC Consultative Group on Ocean Mapping to the 21st Session of the IOC Assembly. June 2001. (English)

IOC/INF-1154 Publications from the GIPME Open Ocean Baseline Study. April 2001. (English)

IOC/INF-1155 IOC Ocean Science Section: A Basis for Restructuring. April 2001. (English)

IOC/INF-1156 Meeting of the IOC Intersessional Intergovernmental Working Group on the Second Session of the UN Open-ended Informal Consultative Process on Oceans and the Law of the Sea. April 2001. (English)

IOC/INF-1158 Principles of the Global Ocean Observing System (GOOS) Capacity Building. March 2001. (English)

IOC/INF-1159 The Global Ocean Observing System (GOOS) Regional Groups: A Discussion Paper. April 2001. (English)

IOC/INF-1161 The Joint Communication of the Chairpersons of the five Scientific Programmes of the UNESCO and the views of the Executive Board at its 161st Session. June 2001. (English/French)

IOC/INF-1163 First Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy. Belgium, May 2001. (English)

IOC OCEAN MAPPING PRODUCTS*

How to obtain:

Note: The following are discussed on pp. 69-70 of this report.

The various versions of the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical series are obtainable, at £5 per sheet, from:
Desmond P.D. Scott, IBCM Sales Agent
Cumbers, Mill Lane,
Sidlesham, Chichester,
West Sussex PO20 7LX, UK.
Tel/fax: 44-1243 67 12 22,
E-mail: desmond.scott@messages.co.uk

The International Geological-Geophysical Atlas of the Atlantic Ocean (GAPA) is available at US$ 200 per copy (volume). Contact:
Dmitri Travin,
IOC Ocean Mapping Programme, UNESCO,
1 rue Miollis, 75015 Paris cedex 15, France;
tel: 33-1-45 68 40 44; fax: 33-1-45 68 58 12;
E-mail: d.travin@unesco.org

The International Bathymetric Chart of the Caribbean Sea and Gulf of Mexico (IBCCA) is available at US$10 per sheet through:
Mr José Luis Friar, IBCCA Chief Editor,
INEGI, avenida Patriotismo N711,
Torre A, 8° Piso, Col. San Juan Mixoas,
C.P. 03910, México D.F, Mexico;
Tel: 52-598 9946, Fax: 52-563 9932;
E-mail: jfrias@mdf.inegi.gob.mx

The International Bathymetric Chart of the Central Eastern Atlantic (IBCEA)
is available at US$ 10 per sheet through the:
Service Hydrographique et Océanographique de la Marine (SHOM)
BP-5, 00307 Armées, 75007 Paris, France;
Tel: 33-1-44 38 41 53; Fax: 33-1-40 65 99 98
http: www.shom.fr

* Not available from IOC documentation centre

The International Bathymetric Chart of the Arctic Ocean (IBCAO), under development in 2000 (see pp. 69-70), will be available in 2002. Sponsored by the International Arctic Science Committee (IASC), IOC and IHO, it is being constructed at Stockholm University. Upon publication, further details will be announced in the IOC website.

Compiled by:

Martin Jakobsson*, Stockholm University (Sweden);
Norman Cherkis*, Neptune Sciences Inc. (USA);
John Woodward*, Royal Danish Administration of Navigation and Hydrography; and
Jennifer Harding, Geological Survey of Canada.

Editorial Board:

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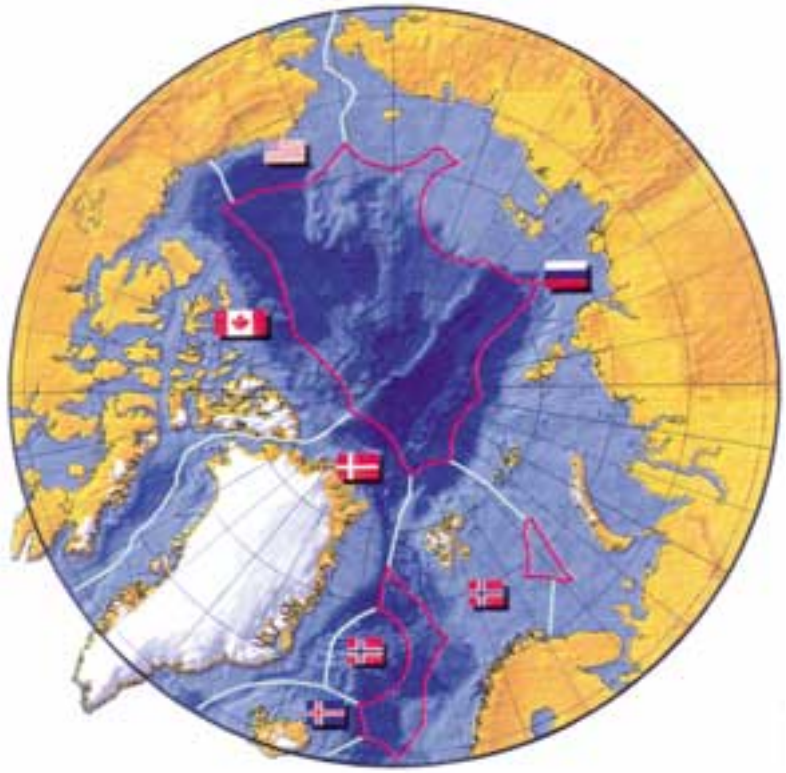
* Also members of the IBCAO Editorial Board.

International Bathymetric Chart of the Artic Ocean



Computer-drawn version of Sheet 5.17 of the General Bathymetric Chart of the Ocean (GEBCO), portraying shaded relief of the land and seabed north of 64° N and corresponding roughly to the area covered by the IBCAO. Shown are the approximate limits of the Exclusive Economic Zones (EEZs) of the six Arctic coastal States (Canada, Denmark, Iceland, Norway, Russia and the USA) participating in the project. Also indicated is the proposed scheme for partitioning responsibilities for IBCAO's compilation. Bilateral limits are shown in light green, High Seas limits are in red.

Source: 1999 report by Ron Mcnab and Arne Nielsen, Open File 3713, Geological Survey of Canada. Related to an ONR (US Navy) Grant.

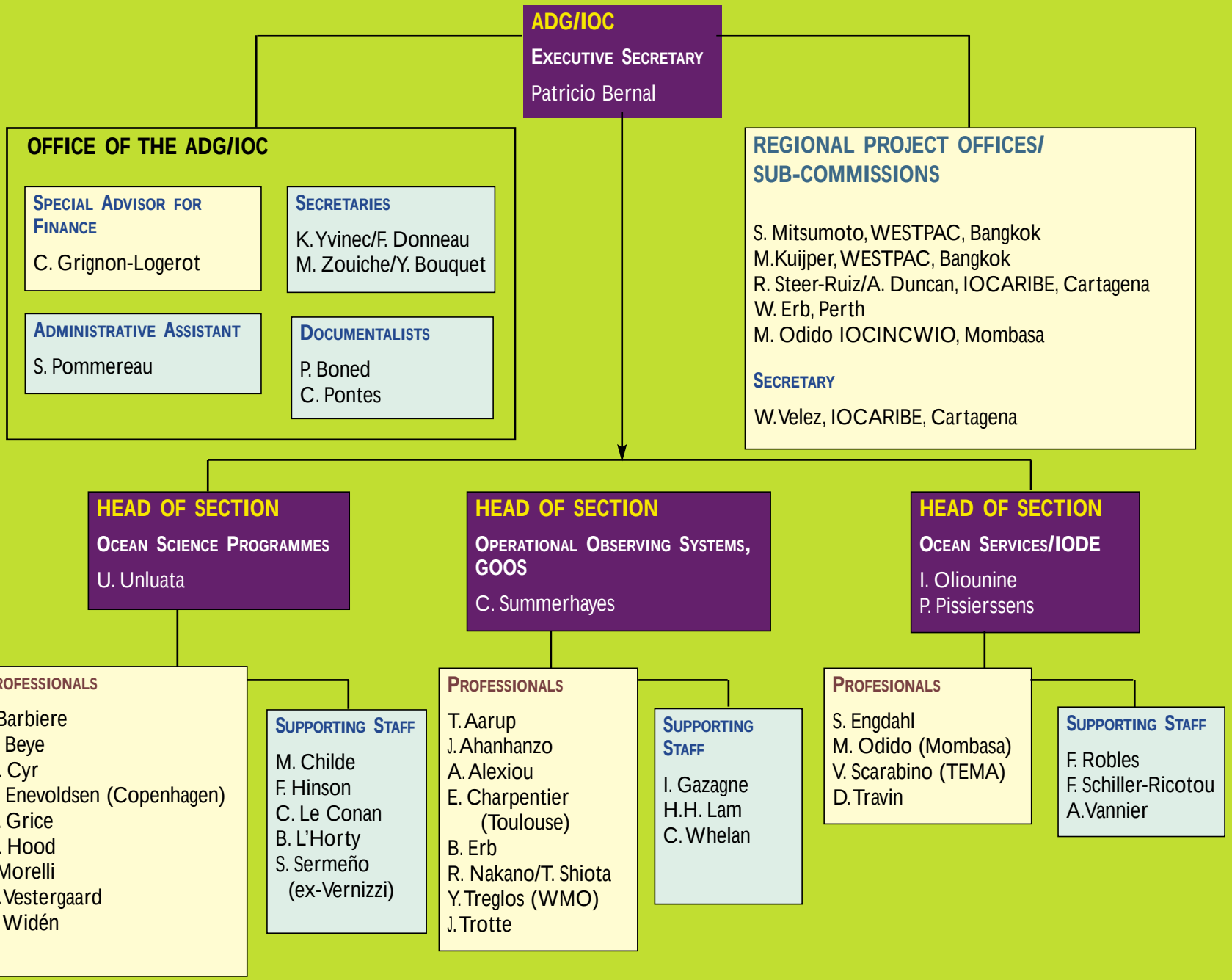
IOC staff

10

THE SUPPORTING CAST

It is true that the Commission depends largely on the international community to provide the resources and the road map for its activities. However, a vital factor in the successful execution of IOC activities is the staff of the Secretariat, both in Paris and in the regional offices. These are our colleagues who are responsible on a daily basis for overseeing and supporting the execution of the programmes. This is not always easy, since responding to the IOC's global commitments often stretches the staff's capacity.

This section presents the Secretariat's 'organigramme' (management structure) and recognizes the people in their respective areas of endeavour.


ADG/IOC
EXECUTIVE SECRETARY
Patricio Bernal
OFFICE OF THE ADG/IOC
SPECIAL ADVISOR FOR FINANCE
C. Grignon-Logerot
SECRETARIES
K. Yvinec/F. Donneau
M. Zouiche/Y. Bouquet
ADMINISTRATIVE ASSISTANT
S. Pommereau
DOCUMENTALISTS
P. Boned
C. Pontes
REGIONAL PROJECT OFFICES/ SUB-COMMISSIONS
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M.Kuijper, WESTPAC, Bangkok
R. Steer-Ruiz/A. Duncan, IOCARIBE, Cartagena
W. Erb, Perth
M. Odido IOCINCWIO, Mombasa
SECRETARY
W. Velez, IOCARIBE, Cartagena
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M. Hood
J. Morelli
O. Vestergaard
A. Widén
SUPPORTING STAFF
M. Childe
F. Hinson
C. Le Conan
B. L'Horty
S. Sermeño (ex-Vernizzi)
PROFESSIONALS
T. Aarup
J. Ahanhanzo
A. Alexiou
E. Charpentier (Toulouse)
B. Erb
R. Nakano/T. Shiota
Y. Treglos (WMO)
J. Trotte
SUPPORTING STAFF
I. Gazagne
H.H. Lam
C. Whelan
PROFESIONALS
S. Engdahl
M. Odido (Mombasa)
V. Scarabino (TEMA)
D. Travin
SUPPORTING STAFF
F. Robles
F. Schiller-Ricotou
A. Vannier

PEOPLE BEHIND THE PROGRAMMES

FRONT OFFICE STAFF

Patricio Bernal, born in Valparaiso, Chile, was the first IOC Executive Secretary 'hailing from south of the Equator'. Patricio succeeded Gunnar Kullenberg in April 1998 and was the first Assistant Director-General of UNESCO for the IOC. He got his Ph.D. in Oceanography in 1980 from Scripps Institution of Oceanography, (U. of California). At Scripps his work on large-scale physical/biological interactions and El Niño in the California Current received the Carl Eckart prize to 'the most outstanding dissertation' in 1980. Professor of Ecology and Oceanography at the University of Chile, the Catholic University of Chile and former Dean of the School of Fisheries and Oceanography at the Universidad Austral (Chile), he is author of more than 40 scientific articles and has trained many graduate students in his native Chile. Having been active for many years in international research in global change and its effects on oceans and with the return to democracy in Chile in 1990, Dr Bernal was called by the government to serve first as Director of the National Fisheries Research Institute (IFOP 1990-94) and as Under-Secretary of State for Fisheries (1994-96).

Patrice Boned left his mountains in the French Alps to study journalism in Paris and now sails on an ocean of paper and documents as IOC's dedicated documentalist. Besides having skill in organizing the documental front, Patrice is fluent in English and is learning Spanish. As a member of Le Choeur Symphonique de Paris, Patrice is rehearsing *A Sea Symphony* by Vaughn Williams, a work that Le Choeur will premiere next year.

Yvonne Bouquet left the United Kingdom in 1960 to marry a Frenchman with whom she shares a love of sailing. As an experienced and competent secretary, she proved to be quite adept at keeping several professionals in line simultaneously. She has even returned occasionally from her retirement helping to keep tabs on the situation.

Françoise Donneau, who has a historical knowledge of the Secretariat's inner workings for a number of years, spent much of her spare time painting. Among other things, she looked after the IOC's general filing and assisted in the Ocean Mapping Programme. She retired before the year was out – to enjoy life 'on the outside'.

Cécile Grignon-Logerot, seconded to IOC as a consultant from the French Ministère de l'Equipment, contributed her personal knowledge of and experience with the inner financial workings of large agencies towards keeping the IOC budget on track.

Cigié Pinto Pontes, a librarian by training, spent most of her life in Brazil at the University of Rio Grande. Afterwards she worked as chief of a metallurgy information centre in Rio, before finding her way to the 'city of light'. Besides Portuguese, she is fluent in Spanish, French and English.

Sylvie Pommereau began the year as clerk, assisting Cécile Grignon-Logerot in the tasks of keeping up with the Commission's various budget and financing lines. But in the middle of 2000, Sylvie also decided to retire early and enjoy the summer weather and generally pursuing a life of increased leisure and various cultural activities.

Ksenia Yvinec started the year as Dr Bernal's secretary and in August took over the job of Sylvie Pommereau as clerk responsible for following the Commission's Regular Programme budget. Besides understanding the complicated language of administration and finances, she is also fluent in English, French and understands Spanish (in addition to her native Russian).

Michelle Zouiche came to France from England several years ago and succeeded in her long-standing ambition to become well integrated into French life, in spite of her lingering taste for Coca Cola. (She is also known for her 'petit faible pour le chocolat'.) She joined the IOC in August 2000, helping out in the 'Front Office' with her various skills, including bilingual English-French capability, and finished the year as Dr Bernal's secretary and IOC special assistant for party organizing.

OCEAN SCIENCES STAFF

Umit Unluata, from Turkey, got his Ph.D. in Hydrodynamics from MIT (USA). After being recruited by UNESCO/IOC in June 1998, Umit became the Head of the Ocean Sciences Section in the re-structured secretariat. In Turkey, Umit was the Director of the Graduate School of Marine Sciences of the Middle East Technical University (Erdemli). In addition to his overall responsibilities in the Ocean Sciences Section, Umit is the Secretary of the UN-ACC Subcommittee on Oceans and Coastal Areas and the IOC/UNESCO Technical Secretary for GESAMP. He has also been assigned to co-ordinate the IOC Marine Science activities in the Mediterranean. His most recent research papers concern physical oceanography and ecosystems dynamics of the Black Sea.

Julian Barbière, from Anglo-French roots, originally joined the IOC in 1995, after obtaining his second Master in Environmental Management in Glasgow. He worked first as a consultant in the implementation of the IOCINCWIO work plan and other coastal activities in the Indian Ocean region. In 1998, as a programme specialist, he took on the responsibility of running the Marine Science for ICAM Programme as well the IOC liaison for the IOCINDIO Regional Committee. During the year 2000, he also assisted Patricio Bernal in co-ordinating internal matters at IOC.

Dienaba Beye, from Senegal, has been with IOC since April 1997, responsible for UNCLOS-related matters. Dienaba participates in the ad hoc Technical and Legal Working Groups for the Abidjan and Nairobi Conventions on the Protection, Management and Development of the Marine and Coastal Environment, for Western and Eastern African Regions. She also contributes to the implementation of the IOC programmes in the IOCEA Region.

Maggie Childe, who holds a B.A. (with honours) in Environment and Society, joined IOC for a three-month period from September to December. She assisted the IOC/ICAM and GIPME Programmes until she decided to return to her homeland of Canada to continue her studies.

Ned Cyr, prior to Umit's arrival, served as Head of the Ocean Science and Living Resources Programme, on secondment from the US National Oceanic and Atmospheric Administration's National Marine Fisheries Service. Ned has extensive experience with fisheries oceanography and fish life history studies, as well as ecosystem approaches to living marine resource management. In addition to his responsibilities with the OSLR Programme, he was Technical Secretary for the LMR GOOS panel.

Henrik Enevoldsen joined IOC in 1991 as an Associate Expert from Denmark, a specialist in Aquatic Biology. Previously he taught at Aarhus and Copenhagen Universities and worked as a consultant with environmental monitoring programmes including those on phytoplankton and harmful algae. In IOC he is Project Co-ordinator for the IOC Harmful Algal Bloom Programme, since 1995 posted at the IOC Science and Communication Centre on Harmful Algae at the University of Copenhagen. He also is the Technical Secretary for the IOC Intergovernmental Panel on Harmful Algae, and co-ordinates the production of the IOC newsletter *Harmful Algae News*.

George Grice, from the USA, served several years at the Woods Hole Oceanographic Institution as Chair of the Biology Department and Associate Director of the Institution. Around 1990 he joined the National Marine Fisheries Service of NOAA as Director of Research Planning and of Co-ordination for the Northeast Fisheries Science Center; later he became the Center's Deputy Director. Afterwards George moved to Paris to join the Secretariat of the IOC as Senior Assistant Secretary, first as the Head of the OSLR Programme and later as the science advisor to the Commission's Executive Secretary.

Fanny Hinson, from Accra, Ghana, came in Paris in 1985. In 1988 she entered UNESCO as a secretary for two years in the (former) Division of Marine Science. She was transferred to IOC in 1992 and worked with Stefan Anderson, on programmes concerning pollution and marine debris in West Africa. She also worked for Umit Unluata as administrative assistant. Fanny passed away in July 2000 in Accra at the age of 42, leaving a son of 11. She left an indelible memory with her colleagues for her personality and smiling face.

Maria Hood joined IOC in 1999 from the USA. She holds a Ph.D. in Marine Chemistry and Geochemistry from the MIT/Woods Hole Oceanographic Institution Joint Programme and carried out post-doctoral fellowship studies on pCO_2 variability at the Laboratoire d'Océanographie Dynamique et de Climatologie in Paris. She works principally in the Oceans and Climate Programme, and serves as the Technical Secretary for the SCOR-IOC Ocean CO_2 Advisory Panel. See p. 177 for additional programme activites.

Christiane Le Conan, from France, has been working in IOC for 14 years. Amongst other tasks, she has helped organize conferences, especially those dealing with marine pollution. She is presently working as a secretary for Umit Unluata. She is an avid 'cavalière', and spends some of her spare time qualifying in first-aid techniques. (Shouldn't IOC exploit these skills, e.g. for seahorses and wounded experts?)

Brigitte L'Horty, from France, a teacher by training. She has been working in IOC for a year, assisting especially in administrative matters related to the ICAM, HAB and other Ocean Science programmes. Although a debutante in UNESCO, Brigitte is one of our quadrilingual ladies, and came to us with a wealth of experience 'on the outside' (private industry, teaching…)

Jacques Morelli, seconded by France, joined IOC in 1999. He holds a permanent position with the Centre National de la Recherche Scientifique (CNRS) as a marine scientific researcher. At IOC he was involved in capacity-building efforts in integrated coastal area management for the Mediterranean Basin.

Silvia Sermeño, ex-Vernizzi, from El Salvador, has been working at IOC for 13 years. She works as an administrative assistant in matters related to the Mediterranean, UNCLOS and TEMA. Silvia ('chica trilingue') is very active in Union-related activities, especially cultural events, and is well known as Latin singer of 'boleros' among the Spanish-speaking community in UNESCO.

Ole Vestergaard, a biologist, joined IOC in April 2000 as an Associate Expert from Denmark. Previously he worked at the University of Copenhagen doing research in aquatic ecology and environmental assessments of aquatic ecosystems. In the IOC assisted in the development and implementation of the HAB programme, in close contact with the HAB Science and Communication Centres in Copenhagen and Vigo, and of the Global Coral Reef Monitoring Network (GCRMN), including the South Asia component. He is also the Technical Secretary for the Study Group on Benthic Indicators and the newly launched Study Group on Coral Bleaching Indicators.

Anna Widén is a marine biologist with a Master's from Gothenburg University in her native country of Sweden. She joined IOC as a consultant in February 1999, after a previous internship and smaller contracts in the Secretariat. She worked in the Ocean Sciences section, assisting in the Integrated Coastal Area Management and Marine Pollution programmes. She left IOC in September 2000 to continue her Ph.D. studies in Marine Policy in the UK.

OPERATIONAL OBSERVING SYSTEMS

STAFF

Colin Summerhayes, from the UK, is the Director of the GOOS Project Office (GPO). His international career began when he graduated from London University and joined the New Zealand Oceanographic Institute as a marine geologist after a brief sojourn at Oxford. After acquiring a Master's Degree he left New Zealand to do a Ph.D. in Applied Geochemistry at Imperial College, promptly leaving for a post-doc at the University of Cape Town, followed by spells on the staff of the Woods Hole Oceanographic Institution, Exxon Production Research Company (Houston), BP Research Company (UK), and the UK's Institute of Oceanographic Sciences, Wormley (as Director). He joined IOC in May 1997 from the Southampton Oceanography Centre, where he was Deputy Director. His most recent research papers are on the paleoceanographic and paleoclimatic history of the Benguela Current and on the paleoceanographic history of the Portuguese continental margin during glacial to interglacial transitions. Colin is Technical Secretary for the GOOS Steering Committee and the Intergovernmental Committee for GOOS.

Thorkild Aarup, originally from Denmark, joined us from the USA in January 1999, to become Technical Secretary for GLOSS and for the Coastal GOOS Panel. In his previous life, Thorkild was head of the computer group at the Danish Institute for Fisheries Research. Afterwards he obtained a Ph.D. in remote sensing and marine optics from Copenhagen University and held positions at Bigelow Laboratory for Ocean Sciences (USA), the University of Massachusetts (USA), and the Niels Bohr Institute for Astronomy, Physics and Geophysics (Denmark). His most recent research work was on ocean transparency of the seas of northwestern Europe.

Justin Ahanhanzo, (Benin) joined IOC in 1994, consulting on pollution issues and capacity building, including the LME approach. After helping develop GOOS-AFRICA, he joined the GOOS Project Office in 1998, coordinating the GOOS-AFRICA and MedGOOS programmes and editing the *GOOS Newsletter*. Justin helped implement other IOC programmes in Africa, helped coordinate the UNESCO contribution to the PACSICOM/AFRICAN PROCESS. He is Technical Secretary for IOCEA and Project Manager for the new UNESCO Cross-Cutting Project on Remote Sensing for Integrated Management of Ecosystems and Water Resources in Africa.

Arthur Alexiou, from the USA, has been with the IOC for 16 years, having previously completed a career in NOAA, culminating as Director for Sea Grant Institutional Programs. Art is responsible for IOC's ocean climate activities – including operational issues as well as climate research, working as Technical Secretary for the Ocean

Observations Panel for Climate. He represents IOC on the Joint Scientific Committee for the World Climate Research Programme and on the Scientific Steering Groups for CLIVAR and WOCE.

Etienne Charpentier, from France, has been working for the IOC since 1993. He is the Technical Coordinator for the Data Buoy Cooperation Panel (DBCP) and the Ship of Opportunity Programme Implementation Panel (SOOPIP). He runs the JCOMM-OPS centre in Toulouse with the Argo Coordinator. He worked for the DBCP in Washington (DC, USA) from 1989 to 1993 and has been involved in the development of a dedicated sub-system for processing and distributing buoy data on the GTS. He also helped set up quality-control guidelines for buoy data and operates the DBCP, SOOP and JCOMM-OPS websites.

Ned Cyr, profiled on p.172, was responsible for the Living Marine Resources Panel of GOOS and for the Global Coral Reef Monitoring Network, a component of the GOOS Initial Observing System.

William Erb, USA, obtained a B.S. in Oceanography and Meteorology from Maritime College, New York, and a Merchant Marine Third Mate's License in 1965. After assignments in other US agencies, Bill joined the State Department, serving finally as Director, Office of Marine Science and Technology Affairs. He was a senior member on several US delegations to IOC and seconded to the Commission for 1996-1998 as Senior Advisor. He was active in GOOS and capacity building. In 2000 he became Head of the new IOC Perth Regional Programme Office in Australia, working on GOOS development in the Indian Ocean, South Pacific and Australia. He was instrumental in launching MedGOOS, PacificGOOS, Indian Ocean GOOS and SEAGOOS.

Maria Hood (profiled on p. 173) provides GOOS with expertise on ocean carbon observations through the SCOR-IOC Advisory Panel on Ocean CO_2, and maintains the GOOS Products and Services Bulletin on the GOOS Web site.

Rimi Nakano, left us in June 2000, having been seconded from Japan as Associate Expert in June 1998. Rimi was our main liaison for NEAR-GOOS (North-East Asian Regional GOOS), and was in charge of the Japanese Fund-in-Trust. She also served as the IOC liaison for WESTPAC, the IOC regional Sub-commission for the Western Pacific. She was replaced by Tsuyoshi Shiota.

Tsuyoshi Shiota, from Japan, joined us for two years in June 2000 as the replacement for Rimi Nakano. Tsuyoshi graduated from Tokyo University as a Bachelor of Law, and worked for the Ministry of Education, Science, Sports and Culture, as well as Japan's Science and Technology Agency.

Yves Tréglos, from France, was seconded to IOC by WMO in 1980 to coordinate the joint IOC-WMO Integrated Global Ocean Services System (IGOSS), which has now been subsumed within JCOMM. Yves provides the GPO link to such bodies as the Data Buoy Cooperation Panel, and CLS (Collecte-Localisation-Satellite) Service Argos, the French-USA firm through which information from buoys is relayed back to base by satellite. He is also the GOOS webmaster.

Janice Trotte, from Brazil, was on secondment from the Brazilian Directorate of Hydrography and Navigation until May 2000. She was the Technical Secretary for the TAO (Tropical Atmosphere-Ocean) Implementation Panel, and was very involved in developing the PIRATA (Pilot Research Array of moored buoys in the Tropical Atlantic) programme. She also helped develop IOCARIBE-GOOS.

Umit Unluata, from Turkey, and Head of Science Programmes, was the Technical Secretary of the GOOS Health of the Oceans Panel. (He is profiled in the Ocean Science section, which he heads.)

Cherie Whelan is from Birmingham, UK, and keeps us all smiling. She took over the British secretarial tradition, upon Yvonne Bouquet's retirement, of keeping several professionals on their toes. Her multi-coloured background includes work as a croupier, law court clerk etc. She also likes to dabble in poetry.

Irene Gazagne, one of the rare true Parisians, born on an island in the centre of Paris. She helps keep us *au courant* with computing developments and produces the *GOOS News*.

Ho Hien Lam hails from Vietnam, where she taught French. Eventually she embarked on a boat ride that brought her to the centre of the French-speaking world. Her pedagogic experience and her Asian way (taking things philosophically) help her to carry out smoothly the diverse and demanding tasks of the Office of the Director of GPO and its professional staff, and to meet the challenge of making sure that the GPO Director's written French is up to scratch!

OCEAN SERVICES

STAFF

Yuri Oliounine, from Russia, became a member of the IOC Secretariat in 1979. Among his responsibilities over the years were those of Head of the Ocean Services Section, and staff member responsible for the Commission's programmes on data collection and observing systems, natural hazards related programmes. Finally, in 1996, he was appointed IOC Deputy Executive Secretary. Since his retirement in 2000, he has helped the Secretariat as a part-time consultant.

Peter Pissierssens was born in Belgium. 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 Governments of Belgium and Kenya as well as for UNEP and IOC. In 1992 he joined the IOC Secretariat and worked on the IODE's Marine Information Management activities, IOCINCWIO and the IOC website. Following the retirement of Yuri Oliounine in July 2000, he took over as Head of IOC's Ocean Services Section. He is also responsible for the co-ordination of the IOC's Africa programmes and IOC's web-based public awareness activities.

Dmitri Travin is Russian, with a background in engineering, hydrography, navigation and oceanography. He joined IOC in 1989 as a seconded staff member until 1992, in charge of the International Bathymetric Chart of the Mediterranean Sea (IBCM) and its Geological/Geophysical Series in the IOCXCSEM Operational Unit in Monaco. In 1994 he was again seconded to IOC by the Russian Government as Senior Assistant to the IOC Executive Secretary for Ocean Mapping. He is responsible also for implementation of the Black Sea Regional Committee Action Plan and for the IOC relations with IHO.

Mika Odido, from Kenya, did research at Kenya's Marine and Fisheries Research Institute from 1981. He was in charge of the Information and Data Management Programme at the institute and in this capacity played a key role in the implementation of several IOC programmes in the IOCINCWIO region, including RECOSCIX-WIO and GLOSS, for which he was the Regional Coordinator. Currently he is Head of the recently established IOCINCWIO Project Office as well as Co-ordinator for ODINAFRICA for IOCINCWIO region.

Françoise Ricotou (née Schiller) was born in Madagascar and has been working at UNESCO for 21 years, 15 of them at IOC. She first worked for the GLOSS and GOOS programmes then joined Ocean Services in 1993. She assists Peter (with IODE, ODINAFRICA, GLODIR and *WINDOW Newsletter*) and takes care of IOC's mailing lists.

Adrien Vannier (né Wanigesekera) was born in Ceylon (Sri Lanka), now a French citizen. Arriving in Paris in 1973, he joined UNESCO/IOC in January 1982 and worked with the MEDI Programme, afterwards with Yuri Oliounine and Peter Pissierssens in the IODE, ITSU and GODAR programmes. Besides duly investing energy in his work, Adrien is a founding member of the IOC's morning coffee club and, at lunchtime, keeps fit at the local Gymnase Club.

Sten Engdahl, Swedish associate expert, joined IOC in 1998 on secondment to SEACAM (Maputo, Mozambique). He applies his background knowledge (Master's in international business, economics and resource economics plus Ph.D. research in international management), to related IOC-ICAM matters. Sten previously worked for the Swedish Ministry for Foreign Affairs and in the private sector in Vietnam.

TEMA

Victor Scarabino, a biologist from Uruguay, is an IOC consultant. He has contributed to TEMA-related work related in Latin America and the Caribbean since 1995, helping to set up a series of networks on marine science in the region. He assists the IOC-TEMA Management Committee in co-ordinating all IOC activities involving capacity building.

Françoise Robles, from France, retired in August 2000, after completing thirty years with UNESCO (nearly a record!). After two years in another Division, she joined the IOC staff in 1972, and served in a number of different programmes during her career with the Commission. Her final months were divided between TEMA and Ocean Mapping. She shone in linguistic exploits (French, Spanish, English and she had a go at Russian).

WESTPAC

Maarten Kuijper, from the Netherlands, has been a member of the staff in the WESTPAC Office, Bangkok, since 1997. He assumed the responsibility of Technical Secretary for NEAR-GOOS in early 2000 and has since assisted the NEAR-GOOS community through an on-going strategic planning exercise.

Shigeki Mitsumoto, from Japan, is Head of the IOC WESPAC Secretariat. He supervises regional components of HAB, paleo-geographical mapping and remote sensing for ICAM. In Japan, he did research on climate change until joining IOC in April 1997. Prior international activities included a summer seminar at WHOI (June–Aug. 1978), and research at Princeton University (1989-1991).

The IOC photo album

A brief chronology...

Secretaries

1961	Dr W.S. Wooster (USA)
1963	Prof. K.N. Fedorov (USSR)
1970	Dr S. Holt (UK)
1972	CDr D.P.D. Scott (UK)
1980	Dr M. Ruivo (Portugal)
1989	Dr G. Kullenberg (Denmark)
1998	Dr P. Bernal (Chile)

Chairpersons

1961	Dr A. Bruun (Denmark)
1962	Dr W.M. Cameron (Canada)
1964	Dr N.K. Panikkar (India)
1965	Prof. H. Lacombe (France)
1967	Rear Adm. W. Langeraar (The Netherlands)
1973	Dr G.F. Humphrey (Australia)
1977	Dr A. Ayala-Castañares (Mexico)
1982	Prof. I.A. Ronquillo (Philippines)
1987	Prof. U. Lie (Norway)
1991	Prof. M.M. Murillo (Costa-Rica)
1995	Mr G.L. Holland (Canada)
1999	Prof. Su Jilan (China)

Silver anniversary photo

Left to right
Seated: I. Ronquillo, M. Ruivo
Middle: W. Wooster, W. Cameron, W. Langeraar, S. Holt
Rear: G. Humphrey, A. Ayala-Castañares,D.Scott, K. Fedorov, H. Lacombe

2000 officers...

Left to right: T. Olatunde Ajayi (4th Vice-Chair), S. Khodkin (3rd Vice-Chair), Su Jilan (Chair), G. Holland (past Chair), P. Bernal (Executive Secretary), D. Pugh (1st Vice-Chair), M. Leal de Azevedo (2nd Vice-Chair)

Passing the gavel...

G. Holland receives it from M. Murillo with G. Kullenberg watching

Having fun...

U. Lie; G. Holland; G. Kullenberg; Su Jilan

Source: IMS Newsletter No. 41-42; 1985 UNESCO

the IOC photo album

IOC staff in 1988...

12 years later...: Same spot, same time,
different angle and season...

IOC 2000

Annexes

Member States of the Commission (128) as of December 2000

AFGHANISTAN	(11 March	1991)
ALBANIA	(26 January	1993)
ALGERIA	(Jul. 1964/Nov.	1965)
ANGOLA	(26 October	1982)
* ARGENTINA	(Before November	1961)
* AUSTRALIA	(Before November	1961)
AUSTRIA	(Oct. 1962/Jun.	1964)
AZERBAIJAN	527 January	1998)
BAHAMAS	(29 January	1979)
BANGLADESH	(29 October	1982)
BARBADOS	(18 December	1985)
* BELGIUM	(Before November	1961)
BELIZE	(22 September	1995)
BENIN	(23 October	1986)
* BRAZIL	(Before November	1961)
BULGARIA	(Oct. 1967/Dec.	1969)
CAMEROON	(Nov. 1971/Nov.	1973)
* CANADA	(Before November	1961)
CAPE VERDE	(20 August	1984)
* CHILE	(Before November	1961)
* CHINA	(Before November	1961)
* COLOMBIA	(Oct. 1967/Dec.	1969)
COMOROS**	(08 February	2000)
CONGO	(Nov. 1961/Sep.	1962)
* COSTA RICA	(28 February	1975)
CÔTE D'IVOIRE	(Before November	1961)
CROATIA	(24 December	1992)
* CUBA	(Before November	1961)
CYPRUS	(05 December	1977)
DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA	(31 October	1978)
DENMARK	(Before November	1961)
DOMINICA	(21 September	1999)
DOMINICAN REPUBLIC	(Before November	1961)
ECUADOR	(Before November	1961)
* EGYPT	(Oct. 1969/Nov.	1971)
EL SALVADOR	(16 February	1993)
ERITREA	(12 November	1993)
ESTONIA	(10 March	1992)
ETHIOPIA	(05 March	1976)
FIJI	(09 July	1974)
* FINLAND	(Before November	1961)
* FRANCE	(Before November	1961)
GABON	(26 October	1977)
GAMBIA	(30 August	1985)
GEORGIA	(09 July	1993)
* GERMANY	(Before November	1961)
* GHANA	(Before November	1961)
GREECE	(Oct. 1962/Jun.	1964)
GUATEMALA	(Dec. 1965/Oct.	1967)
GUINEA	(01 May	1982)
GUINEA-BISSAU	(26 January	1984)
GUYANA	(20 July	1977)
HAITI	(23 March	1976)
ICELAND	(Oct. 1962/Jun.	1964)
* INDIA	(Before November	1961)
* INDONESIA	(Oct. 1962/Jun.	1964)
* IRAN, Islamic Republic of	(03 June	1975)
IRAQ	(Oct. 1969/Nov.	1971)
IRELAND	(07 November	1978)
ISRAEL	(Before November	1961)
* ITALY	(Before November	1961)
* JAMAICA	(Oct. 1967/Dec.	1969)
* JAPAN	(Before November	1961)
JORDAN	(06 April	1975)
* KENYA	(Nov. 1971/Nov.	1973)
KUWAIT	(13 November	1974)
LEBANON	(Oct. 1962/Jun.	1964)
LIBYAN ARAB JAMAHIRIYA	(11 March	1974)
MADAGASCAR	(Dec. 1965/Oct.	1967)
MALAYSIA	(Jul. 1964/Nov.	1965)
MALDIVES	(20 May	1987)
MALTA	(Oct. 1969/Nov.	1971)
MAURITANIA	(Before November	1961)
MAURITIUS	(Oct. 1969/Nov.	1971)
* MEXICO	(Before November	1961)
MONACO	(Before November	1961)
* MOROCCO	(Before November	1961)
* MOZAMBIQUE	(08 April	1981)
MYANMAR	(07 June	1988)
NETHERLANDS	(Before November	1961)
NEW ZEALAND	(Nov. 1961/Sep.	1962)
NICARAGUA	(17 November	1977)
* NIGERIA	(Nov. 1971/Nov.	1973)
NORWAY	(Before November	1961)
OMAN	(16 November	1982)
PAKISTAN	(Before November	1961)
PANAMA	(Oct. 1967/Sep.	1969)
* PERU	(Dec. 1965/Oct.	1967)
* PHILIPPINES	(Oct. 62/Jun.	1964)
POLAND	(Before November	1961)
* PORTUGAL	(Oct. 1969/Nov.	1971)
QATAR	(20 July	1976)
* REPUBLIC OF KOREA	(Before November	1961)
ROMANIA	(Before November	1961)
* RUSSIAN FEDERATION	(Before Nov.	1961)
SAINT LUCIA	(14 September	1992)
SAMOA	(10 April	1978)
SAUDI ARABIA	(14 June	1978)
* SENEGAL	(Oct. 1967/Sep.	1969)
SEYCHELLES	(27 February	1979)
SIERRA LEONE	(19 April	1974)
SINGAPORE	(Dec. 1965/Oct.	1967)
SLOVENIA	(16 June	1994)
SOLOMON ISLANDS	(11 May	1982)
SOMALIA	(10 July	1974)
* SOUTH AFRICA	(Oct. 1967/Sep.	1969)
* SPAIN	(Before Nov.	1961)
SRI LANKA	(Jun. 76/Jan.	1977)
SUDAN	(26 August	1974)
SURINAM	(21 January	1977)
SWEDEN	(Jul. 1964/Nov.	1965)
SWITZERLAND	(Before Nov.	1961)
SYRIAN ARAB REPUBLIC	(Oct.1969/Nov.	1971)
THAILAND	(Before Nov.	1961)
TOGO	(22 October	1975)
TONGA	(03 January	1974)
TRINIDAD & TOBAGO	(Oct. 1967/Sep.	1969)
TUNISIA	(Before Nov.	1961)
* TURKEY	(Nov. 1961/Sep.	1962)
* UKRAINE	(Nov. 1961/Sep.	1962)
UNITED ARAB EMIRATES	(02 June	1976)
* UNITED KINGDOM OF GREAT BRITAIN & NORTHERN IRELAND	(Before Nov.	1961)
* UNITED REPUBLIC OF TANZANIA	(Oct. 1967/Sep.	1969)
* UNITED STATES OF AMERICA	(Before Nov.	1961)
URUGUAY	(Before Nov.	1961)
VENEZUELA	(Oct. 1962/Jun.	1964)
* VIET NAM	(Before Nov.	1961)
YEMEN	(22 May	1960)

* Members of the Executive Council

** On 8 Feb. 2000, Comoros became the 128th Member State

ASSEMBLY
EXECUTIVE COUNCIL
EXECUTIVE SECRETARY
SECRETARIAT

Ocean Sciences

- **Oceans and Climate**
  (WCRP, JGOFS, CLIVAR, El Niño)
- **Ocean Science in Relation to Living Marine Resources, OSLR**
  (HAB, GCRMN, GLOBEC, LME, SAHFOS)
- **Marine Pollution Research and Monitoring**
  (GIPME, MEL)
- **Science for Integrated Coastal Area Management**
  (ICAM, COASTS, OCEANS 21)
- **Ocean Science in Relation to Non-Living Resources, OSNLR**
- **United Nations Convention on the Law of the Sea**

Operational Observing Systems

- **Global Ocean Observing System, GOOS**
- **GOOS Modules, Regional Bodies and Pilot Projects**
  (Argo, COOP, EuroGOOS, GODAE, GOOS-Africa, IOCARIBE-GOOS, MedGOOS, NEAR-GOOS, OOPC, PacificGOOS)
- **Integrated Global Observing Strategy, IGOS**
- **Joint Technical Commission for Oceanography and Marine Meteorology, JCOMM**
  (DBCP, SOOP, TIP, GLOSS)
- **Global Climate Observing System, GCOS**
- **Satellite Remote Sensing**

Ocean Services

- **International Oceanographic Data and Information Exchange, IODE**
  (GODAR, GLODIR, GTSPP, MEDI, ASFA, GETADE, GE-BCDMEP, GEMIM, Ocean Teacher, OceanPortal, marineXML…)
- **IODE regional projects**
  (ODINAFRICA, ODINCAR-SA, Regional Ocean Portals, MEDAR/MEDATLAS,…)
- **IDNDR-Related Activities**
  International Tsunami Warning System (ITSU)
  Storm Surges Disaster Reduction
- **Ocean Mapping**
  (GEBCO, GAPA, IBCM)
- **Public Information**
  (IOC website, Newsletters)

Training, education and mutual assistance

REGIONS
2 Regional Sub-Commissions, 5 Committees, 2 project offices and other specific programmes

IOCARIBE
IOCINDIO
Black Sea
GOOS Office, Perth, Australia
Caspian Sea
WESTPAC
IOCEA
IOCSOC
IOCINCWIO Project Office, Mombasa, Kenya
Persian Gulf, Red Sea and Gulf of Aden
Mediterranean
IOCINCWIO

List of acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea
ABLOS	Advisory Board on the Law of the Sea
ACC	Administrative Committee on Coordination (UN)
ACMRR	Advisory Committee on Marine Resource Research
ACOPS	Advisory Committee on the Protection of the Sea
ADRIMED	Scientific Cooperation to Support Responsible Fisheries in the Adriatic Sea (FAO)
AFRIBAS	African Basins
AIMS	Analysis, Interpretation, Modelling and Synthesis (WOCE)
ANCA	Grupo de Trabajo para las Algas Nocivas en el Caribe (COI) (IOC HAB working group for the Caribbean)
AOPC	Atmospheric Observation Panel for Climate
Argo	GODAE global profiling float project (not an acronym)
ASAP	Automated Shipboard Aerological Programme
ASFA	Aquatic Sciences and Fisheries Abstracts
BCDMEP	Biological and Chemical Data Management and Exchange Practices
Black SeaGOOS	Black Sea regional GOOS
BODC	British Oceanographic Data Centre
BSEC	Black Sea Economic Cooperation (Organization for, Istanbul)
BSRC	Black Sea Regional Committee (IOC)
CalCOFI	California Cooperative Oceanic Fisheries Investigations
CCCO	Committee on Climatic Changes and the Ocean (SCOR-IOC, no longer functioning)
CEA	Central Eastern Africa
CEADIR	Central Eastern Africa Regional Directory
CEOS	Committee on Earth Observation Satellites
CEP	Caspian Environmental Programme
CERESCOR	Centre de Recherche Scientifique de Conakry-Rogbanè (Guinea) (Centre for Scientific Research, Conakry-Rogbanè)
CIESM	Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée (International Commission for the Scientific Exploration of the Mediterranean Sea)
CLIVAR	Climate Variability and Predictability Project (WCRP)
CLCS	Commission on the Limits of the Continental Shelf
CMM	Commission for Marine Meteorology (WMO, see JCOMM)
CMS	Centre for Marine Studies (University of Queensland, Australia)
CMSLT	Commission on Mean Sea Level and Tides (IAPSO)
CNRS	Centre National de la Recherche Scientifique (France)
COASTS	Coastal Ocean Advanced Science and Technology Studies
COOP	Coastal Ocean Observations Panel (GOOS)
COP	Conference of the Parties (of UNFCCC)
CORM	Cooperation between IODE and Research and Monitoring Programmes
CPC	Coordination and Planning Committee
CPPS	Comisión Permanente del Pacífico Sur (Permanent Commission for the South Pacific)
CSA	Cambridge Scientific Abstracts (publisher)
CSD	Commission on Sustainable Development
CSIRO	Commonwealth Scientific and Industrial Research Organization
DANIDA	Danish International Development Assistance

DBCP	Data Buoy Cooperation Panel
DCDB	Data Centre for Digital Bathymetry (IHO)
DEOS	Dynamics of Earth and Ocean Systems
DESA	Department of Economic and Social Affairs (UN)
DFID	Department for International Development (UK)
DNA	Designated National Agency
DOALOS	Division for Ocean Affairs and the Law of the Sea (UN)
DSDP	Deep Sea Drilling Programme
E2EDM	End-to-End Data Management Systems
EC	European Commission
ECMWF	European Centre for Medium-range Weather Forecasting
EDIOS	European Directory of Initial Observing Systems
EEZ	Exclusive Economic Zone
EGOS	European Group for Ocean Stations
EMWIN	Emergency Managers Weather Information Network
ENSO	El Niño-Southern Oscillation (An Ocean/Atmosphere Interaction Study)
ESCAP	Economic and Social Commission for Asia and the Pacific (UN)
EUMETSAT	European Organization for the Exploitation of Meteorological Satellites
EURASLIC	European Aquatic Sciences and Libraries and Information Centres
EuroGOOS	European GOOS
FANSA	Groupo de Trabajo de la COI sobre Floraciones Algales Nocivas en Sudamérica (IOC working group on HABs in South America)
FAO	Food and Agriculture Organization of the United Nations
FOCI	Fisheries-Oceanography Coordinated Investigations (NOAA)
GAPA	International Geological/Geophysical Atlases of the Atlantic and Pacific Oceans (IOC)
GARP	Global Atmospheric Research Programme (WMO-ICSU)
GCMD	Global Change Master Directory (NASA)
GCN	GLOSS Core Network
GCOS	Global Climate Observing System (WMO-ICSU-IOC-UNEP)
GCRMN	Global Coral Reef Monitoring Network
GDA	GEBCO Digital Atlas
GDP	Global Drifter Programme
GE-BCDMEP	Group of Experts on Biological and Chemical Data Management and Exchange Practices (IODE)
GEBCO	General Bathymetric Chart of the Oceans
GEEP	Group of Experts on Biological Effects of Pollutants (GIPME)
GEF	Global Environment Facility
GEMIM	Group of Experts on Marine Information Management (IODE)
GEMSI	Group of Experts on Methods, Standards and Intercalibration (GIPME)
GEOHAB	Global Ecology and Oceanography of Harmful Algal Blooms (IOC-SCOR)
GEOS	Geodynamics Experimental Ocean Satellite
GEOSEC	Geochemical Ocean Sections Studies (USA)
GEOSIC	Global Observing Systems Information Centre
GESAMP	Group of Experts on the Scientific Aspects of Marine Pollution
GESREM	Group of Experts on Standards and Reference Materials (GIPME)
GETADE	Group of Experts on Technical Aspects of Data Exchange
GGE	GLOSS Group of Experts

GIPME	Global Investigation of Pollution in the Marine Environment
GIWA	Global International Water Assessment
GLOBEC	Global Ocean Ecosystems Dynamics
GLODIR	Global Directory of Marine and Freshwater Professionals
GLOSS	Global Sea-Level Observing System
GODAE	Global Ocean Data Assimilation Experiment
GODAR	Global Oceanographic Data Archaeology and Rescue Project (IODE)
GOOS	Global Ocean Observing System (IOC-WMO-UNEP-ICSU)
GOOS-AFRICA	African Global Ocean Observing System
GOSIC	Global Observing Systems Information Center (USA)
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (See LBA)
GPO	GOOS Project Office
GSC	GOOS Steering Committee
GTS	Global Telecommunication System
GTSPP	Global Temperature/Salinity Profile Programme
GWS	Global Web Service (ICM)
HAB	Harmful Algal Blooms
HAE-DAT	Harmful Algal Events Database
HDNO	Head Department of Navigation and Oceanography (Russian Federation)
HELCOM	Baltic Marine Environment Protection Commission/Helsinki Commission
HOTO	Health of the Ocean
HYCOS	Hydrological Cycle Observing System (WMO)
IABP	International Arctic Buoy Programme
IAEA	International Atomic Energy Agency
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centres
IAPSO	International Association for the Physical Sciences of the Ocean (IUGG)
IAS	Intra-Americas Sea
IASI	Intra-Americas Sea Initiative
IBCAO	International Bathymetric Chart of Arctic Ocean
IBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IOC)
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic (IOC)
IBCM	International Bathymetric Chart of the Mediterranean (IOC)
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	international Bathymetric Chart of the Western Pacific
IBPIO	International Buoy Programme for the Indian Ocean
ICAM	Integrated Coastal Area Management
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of the Sea
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific (IOC)
ICLARM	International Centre for Living Aquatic Resources Management
ICP	Informal Consultative Process (see UNICPOLOS)
ICRI	International Coral Reef Initiative
ICSPRO	Inter-secretariat Committee on Scientific Programmes Relating to Oceanography (UN-FAO-UNESCO-WMO-IMO)
ICSU	International Council for Science; (formerly: International Council of Scientific Unions)
IFREMER	Institut français de recherche pour l'exploitation de la mer
IGBP	International Geosphere-Biosphere Programme (ICSU)

I-GOOS	Intergovernmental Committee for GOOS
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System
IGY	International Geophysical Year (ICSU, 1957-1958)
IHDP	International Human Dimensions Programme (on Global Environmental Change)
IHO	International Hydrographic Organization
IHP	International Hydrological Programme (UNESCO)
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Sub-commission for the Caribbean and Adjacent Regions
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCINCWIO	IOC Regional Committee for the Cooperative Investigations in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IOCSOC	IOC Regional Committee for the Southern Oceans
IODE	International Oceanographic Data and Information Exchange (IOC)
IOI	International Ocean Institute
IOMAC	Indian Ocean Marine Affairs Cooperation
IPAB	International Programme for Antarctic Buoys
IPCC	Intergovernmental Panel on Climate Change
IPHAB	IOC Intergovernmental Panel on Harmful Agal Blooms
IPIMAR	Instituto de Investigação das Pescas e do Mar (Institute for Fisheries and Sea Research, Portugal)
IPO	International Programme Office (GEOHAB)
IRD	Research Institute for Development (France) (Institut de Recherche pour le Développement) Formerly: French Scientific Research Institute for Development through Cooperation (ORSTOM)
IREX	International Recruitment Experiment
IRI	International Research Institute for Climate Prediction (Columbia University, USA)
ISABP	International South Atlantic Buoys Programme
ITA	IGOSS Telecommunication Arrangements
ITIC	International Tsunami Information Centre
ITSU	Tsunami Warning System in the Pacific (IOC and partners)
IUCN	World Conservation Union (formerly: International Union for the Conservation of Nature)
IYO	International Year of the Ocean (1998)
JAFOOS	Joint Australian Facility for Ocean Observing System
JAMSTEC	Japan Marine Science and Technology Centre
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology (WMO/IOC)
JGOFS	Joint Global Ocean Flux Study
J-GOOS	Joint Scientific and Technical Committee for GOOS
JMA	Japan Meteorological Agency
JSC	Joint Scientific Committee (WCRP)
JTA	Joint Tariff Agreement (Argos)
KMFRI	Kenya Marine & Fisheries Research Institute
LBA	Land-Based Activities (See GPA)
LDEO	Lamont-Doherty Earth Observatory (Columbia University, N.Y., USA)
LME	Large marine ecosystem
LOICZ	Land-Ocean Interaction in the Coastal Zone (ICSU/IGBP)

LUC	Limburg University Centre (Belgium)
MAMCOMP	Training Programme on Modelling and Monitoring of Coastal Marine Processes
MAOA	Meteorological Aspects of Ocean Affairs
MAPMOPP	Marine Pollution (Petroleum) Monitoring Pilot Project (IOC)
MCM	Marine and Coastal Management (South Africa)
MEA	Marine Environment Assessment
MEDAR	Mediterranean Data Archaeology and Rescue
MEDATLAS	Mediterranean Hydrographic Atlas (EC)
Med-GLOSS	Mediterranean GLOSS
MedGOOS	Mediterranean Regional GOOS
MEDI	Marine Environmental Data Information Referral System
MEDS	Marine Environmental Data Service (Canada)
MEL	Marine Environment Laboratory (IAEA)
MFSPP	Mediterranean Forecasting System Pilot Project
MSP	Medium-Sized Project
MSR	marine scientific research
NASA	National Aeronautics and Space Administration (USA)
NATO	North Atlantic Treaty Organisation
NEAR-GOOS	North-East Asian Regional GOOS
NERC	Natural Environment Research Council (UK)
NGDC	National Geophysical Data Centre (NOAA)
NGO	Non-governmental organization
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre (IODE-affiliated)
NOWPAP	North-West Pacific Action Plan (UNEP)
OBIS	Ocean Bio-geographical Information System
OCEANS 21	Science for Sustainable Use of Ocean and Coastal Zones (IOC/IGU)
ODINAFRICA	Ocean Data and Information Network for Africa (IOC-Flanders)
ODINCARSA	Ocean Data and Information Network for the IOCARIBE and South America regions
ODINEA	Ocean Data and Information Network for Eastern Africa
ODP	Ocean Drilling Programme
OMP	Ocean Mapping Programme
ONR	Office of Naval Research (USA Navy)
OOP	Ocean Observation Panel (CLIVAR)
OOPC	Ocean Observations Panel for Climate (GOOS, GCOS, WCRP)
OOSDP	Ocean Observing System Development Panel (CCCO-JSC)
OPC	Ocean Processes and Climate (IOC)
OSLR	Ocean Science in Relation to Living Resources
OSNLR	Ocean Science in Relation to Non-Living Resources
OSPAR	Oslo-Paris Commission – Convention for the Protection of the Marine Environment of the North-East Atlantic (1992)
PacificGOOS	Pacific Regional GOOS
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management (Maputo, Mozambique, 18-25 July 1998)
PCU	Programme Coordination Unit (GEF)
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea & Gulf of Aden
PICES	North Pacific Marine Science Organization (Pacific counterpart of ICES)

PIMRIS	Pacific Islands Marine Resources Information System
PIRATA	Pilot Research Moored Array (of buoys) in the Tropical Atlantic
PMEL	Pacific Marine Environmental Laboratory (NOAA)
PMOCs	Principal Meteorological or Oceanography Centres
POGO	Partnership for Observation of the Global Ocean
POL	Proudman Oceanographic Laboratory (UK)
POMS	Pilot Ocean Monitoring Study (IOC-SCOR)
PPM	Pre-project manager
PRE-COI	Programme Régional Environnement – Commission de l'Océan Indien
	(Regional Environment Programme – Indian Ocean Commission)
PREP	Penaeid Prawns Recruitment Project (OSLR)
PSMSL	Permanent Service for Mean Sea-Level
RECOSCIX	Regional Co-operation in Scientific Information Exchange in the Western Indian Ocean
ResKit	Resource Kit (IODE)
RMS	Root Mean Square
RNODC	Responsible National Oceanographic Data Centre
ROPME	Regional Organization for the Protection of the Marine Environment
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SAMBAS	South American Basins
SAREC	Swedish Agency for Research Cooperation with Developing Countries
SARP	Sardine and Anchovy Recruitment Project
SBSTA	Subsidiary Body for Scientific and Technological Advice (see UNFCCC)
SCAR	Scientific Committee on Antarctic Research (ICSU)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (ICSU)
SCUFN	Sub-Committee on Undersea Feature Names
SEACAM	Secretariat for Eastern African Coastal Area Management (Maputo, Mozambique)
SEACAMP	South-East Asia Center for Atmospheric and Marine Prediction
SEA-GOOS	South-East Asia GOOS
SGD	Submarine Groundwater Discharges
SHOM	Service Hydrographique et Océanographique de la Marine (France)
	(French Naval Hydrographic and Oceanographic Service)
SIDA	Swedish International Development Cooperation Agency
SOC	Specialized Oceanographic Centre (IGOSS)
SOC	(also) Southampton Oceanography Centre (UK)
SOCA	Sub-Committee on Oceans and Coastal Areas (UN ACC)
SOCIO	Sustained Observations for Climate in the Indian Ocean
SOLAS	International Convention for the Safety of Life at Sea (IMO 1974)
SOOP	Ship-of-Opportunity Programme
SOPAC	South Pacific Applied Geoscience Commission
SPACC	Small Pelagic Fishes and Climate Change (GLOBEC)
SPREP	South Pacific Regional Environment Programme
SSC	Scientific Steering Committee
SSG	Scientific Steering Group
SST	Sea Surface Temperature
SURFA	Surface Flux Analyses Project (OOPC)

TAO	Tropical Atmosphere Ocean Array
TAR	Third Assessment Report (IPCC)
TEMA	Training, Education and Mutual Assistance in the Marine Sciences (IOC cross-cutting facility for Capacity Building in Marine Sciences, Services and Observations)
TIP	Tropical Moored Buoy Implementation Panel
TOC	Total Organic Carbon
TOGA	Tropical Ocean and Global Atmosphere (programme/study)
TRITON	Triangle Trans-Ocean buoy Network (Japan)
TRODERP	Tropical Demersal Coastal Fishery Recruitment Project
TTR	Training-Through-Research Programme (also 'Floating University')
TWS	Tsunami Warning System
UE	Union Européene (European Union)
UEMOA	West African Monetary Union (l'Union Économique et Monétaire Ouest-Africaine: Bénin, Burkina Faso, Côte d'Ivoire, Guinée Bissau, Mali, Niger...)
UHSLC	University of Hawaii Sea Level Center (USA)
UK	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDOALOAS	(See DOALOS)
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNICPOLOS	United Nations open-ended Informal Consultative Process on Oceans and the Law of the Sea
UNIDO	United Nations Industrial Development Organization
UOT	Upper Ocean Thermal
UOP	Upper Ocean Panel (CLIVAR)
USA	United States of America
USSSDAP	Underway Sea Surface Salinity Data Achieving Pilot Project
VOS	Vessel of Opportunity; also Voluntary Observing Ship
WB	World Bank
WCRP	World Climate Research Programme (WMO-ICSU-IOC)
WDC	World Data Centre
WESTPAC	IOC Sub-commission for the Western Pacific
WG	Working Group
WGNE	Working Group on Numerical Experimentation
WHO	World Health Organization
WIOMAP	West Indian Ocean Marine Applications Project
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment
WVS	World Vector Shoreline (USA)
WWW	World Wide Web (Internet)
XBT	Expendable Bathythermograph
XML	Extensible Markup Language

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION

ANNUAL REPORT 2000

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