Intergovernmental Oceanographic Commission

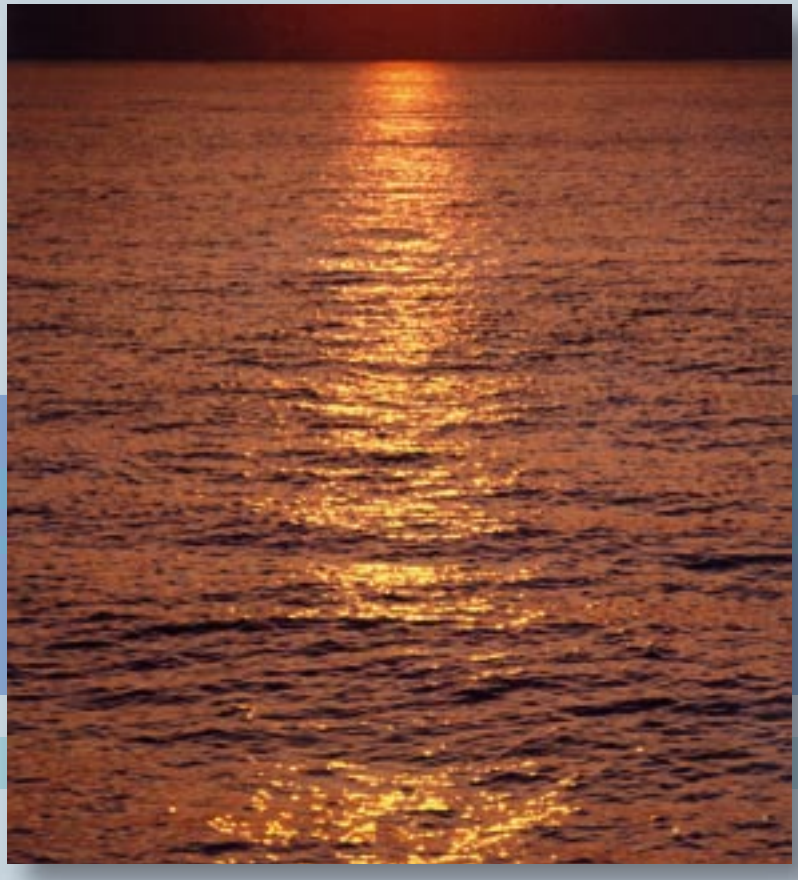
Annual Report 2002

UNESCO

Intergovernmental Oceanographic Commission

Annual Report Series 9

Annual Report 2002



Courtesy Luc Cuyvers, MN Films

UNESCO

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Purpose and Role of the Intergovernmental Oceanographic Commission of UNESCO

The purpose of the Commission is to promote international cooperation and to coordinate programmes in research, services, and capacity building, in order to learn 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.

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

FROM THE CHAIRMAN

The year 2002 was marked by several important events for the Intergovernmental Oceanographic Commission of UNESCO, but certainly the most important one was the World Summit on Sustainable Development in Johannesburg. Both the Global Conference hosted by IOC here in Paris in December 2001 and the Extraordinary Executive Council of the IOC, convened immediately afterwards, were instrumental in gaining momentum for the ocean agenda in the preparatory process. The Commission not only prepared the IOC Declaration to WSSD, but also played an important role in activating and promoting the consideration by the Summit of a full agenda of ocean issues.

There were three outcomes from the WSSD: The Heads of State Declaration, the Plan of Implementation, and the Series of Type-II Partnerships recognized by the process. It is a remarkable fact that the Plan of Implementation includes a specific reference to IOC in Paragraph 34. That Paragraph addresses the importance of a science-based approach to sustainable development, and identifies several important actions and commitments that are crucial for the future work of IOC, one of which is the participation of IOC in the Global Marine Assessment, a regular process to be established by 2004.

The Informal Consultative Process (ICP) on Oceans and the Law of the Sea, established in 1999 by the United Nations General Assembly, has been a very useful exercise. The IOC has participated in all ICP meetings, assuming an important role in the fields of its competence and being clearly recognized as the focal point in Ocean Sciences and Ocean Services for the UN system. Through ICP a broad recognition has emerged on the part of governments that, to improve governance of the ocean, there is an urgent need to improve coordination on ocean affairs within the UN system. The role that IOC played in the past through the Inter-Secretariat Committee on Scientific Programmes Relating to Oceanography (ICSPRO) and later on in the Sub-Committee of Oceans and Coastal Areas (SOCA), as pointed out by the Director-General of UNESCO, Mr. Matsuura, will need to continue in the future mechanism to be established in the UN. I wish to thank the Director-General for his encouragement and support in this matter.

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

FROM THE EXECUTIVE SECRETARY

"A wonderfully simple concept to understand"

Welcome to the Intergovernmental Oceanographic Commission of UNESCO's 2002 Annual Report. Looking back, this year seems to have been a year of delivering messages, and you'll be reading about one in particular, sustainable development, many times. While it's exceptionally challenging to implement, I'm happy to say it's a wonderfully simple concept to understand. It's about finding a critical balance: Improving the lives of people living in poverty whilst reversing the continuing degradation of our global environment. Fortunately, it's quite possible.

This was made very clear last summer at the World Summit on Sustainable Development (WSSD). For ten days in Johannesburg, South Africa, over 60,000 government delegates, NGOs, business leaders, and media representatives gathered at the Summit to come up with an implementation plan. IOC joined them and delivered its message: Sustainable development is highly dependent on the wise management of the oceans and coasts based on scientific knowledge.

Public policy decisions depend on our understanding of how the oceans work. In order to promote better knowledge and an improved application of ocean science, IOC is dedicated to making its Member States able to gather and use essential information accessible for the development, negotiation, and adoption of international agreements.

Particularly significant policy results in 2002 included the successful endorsement of the African Process for the Development and Protection of the Coastal and Marine Environment in Sub-Saharan Africa, to which IOC, as a Partner, provides expertise in developing projects and mobilizing resources. During the Partnership Conference at WSSD, participating governments effectively approved and launched the African Process' Programme of Interventions, representing the culmination of project proposals developed over the past four years. African governments came together, demonstrated a unified political awareness, and delivered a powerful, informed message. Now the potential is great indeed.

When IOC was originally created in 1960, one of its initial goals was to "survey the oceans." We are fulfilling that goal—but in a very different way to what was envisioned at that time. Currently, a vast global network of sustained ocean observations is operating as the Global Ocean Observing System (GOOS), a programme that was proposed for the first time in IOC in 1987, and which today is part of the fast developing, new field of operational oceanography. In the international effort towards achieving sustainable development, GOOS and the ocean services that IOC is advancing will one day form the ocean component of an immense integrated Earth observation system designed, as U.S. Secretary of State Colin Powell recently described, to "better the lives of ordinary people in every land." By continuously monitoring the conditions of our planet, the messages we hope to deliver in the not too distant future will help effectively forecast long-range weather conditions, natural disasters, and climate change.

You are about to explore a range of unique scientific and development programmes in this Annual Report. They operate through observing systems, data and information management, improved science, high quality research, and capacity building, and are developed in response to the issues you hear about daily: public-health and safety, ecosystem decline, depletion of resources, natural hazards, and climate change. We hope that the following pages will reveal the questions and answers that shape the messages we deliver. On behalf of all those involved in our endeavors, I warmly invite you to discover more about the Intergovernmental Oceanographic Commission.

Patricio A. Bernal
Assistant Director-General, UNESCO
Executive Secretary, IOC

Earth is the Blue Planet

Earth is the Blue Planet - the Water Planet. The ocean connects us through trade. We live beside it, and use it as an amenity. We swim in it, sail on it, dive in it, and catch fish from it. We love to gaze upon it, and write poems about it. We dump our wastes in it. Our sewage, fertilisers, and industrial chemicals are borne to it by rivers. Our gases and dusts blow into it through the air. Its health affects our own and that of the creatures who depend on it. Navies use it for battle space. We dig minerals, oil, and gas from underneath it.

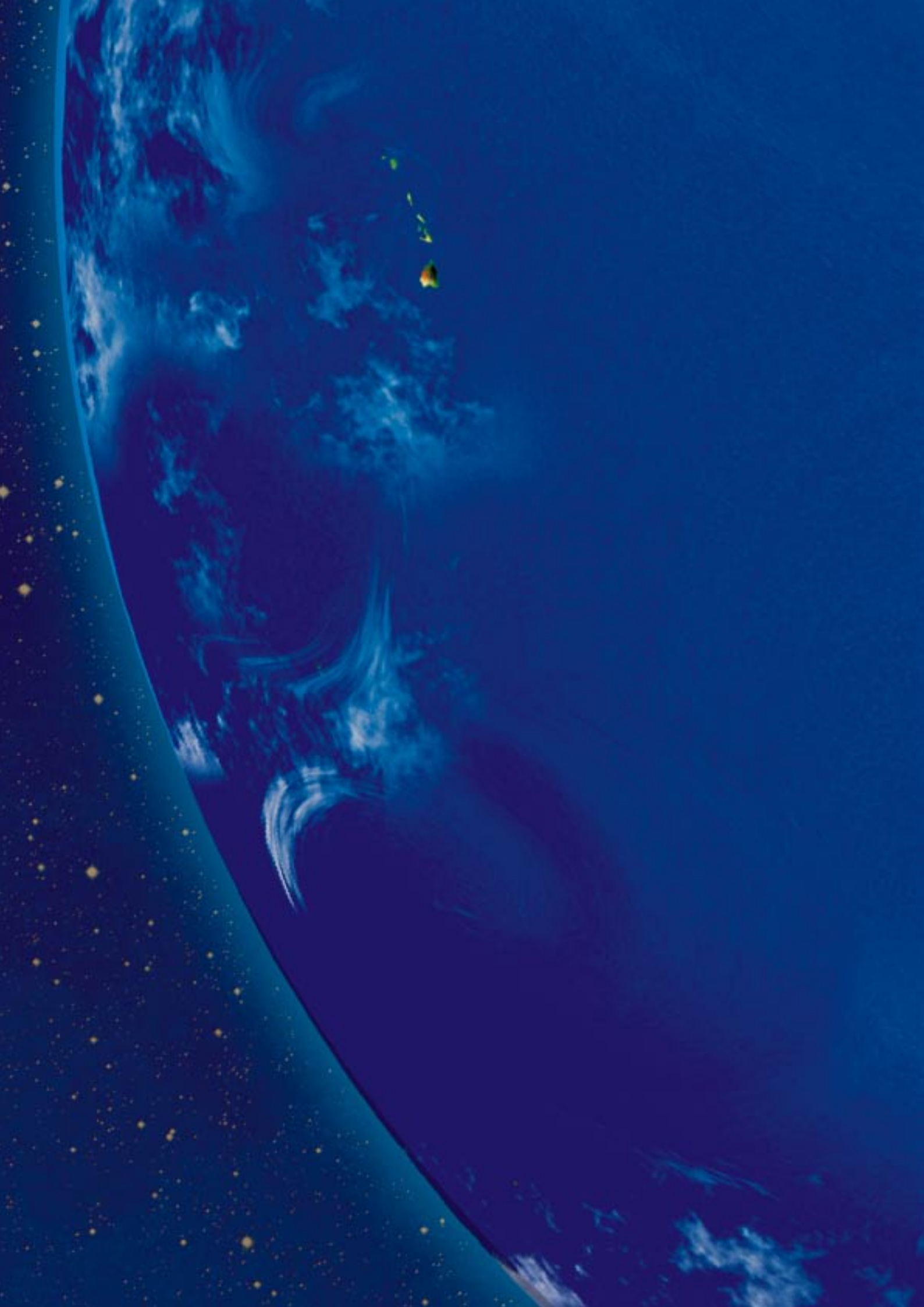
Even so, the ocean affects man in more ways than most people imagine. The ocean controls weather and climate, and through them our water supplies, hydroelectric power, growing seasons, the lengths and extremes of winters, energy supplies, wave heights, the strength and incidence of hurricanes, storm surges, coastal erosion, and toxic algal blooms, just to name a few.

Knowledge, understanding, and the ability to predict change are what mankind needs to ensure the use of marine resources and environments in such a way that future generations will continue to benefit from the ocean. Knowledge about the ocean comes from observing its behaviour. Understanding comes from examining the processes that make the ocean work and sustain its ecosystems in a healthy manner, and from appreciating how the ocean and its contents respond to changes caused by external forces driven by nature or by man. Prediction comes from the ability to combine knowledge and understanding in conceptual and numerical models that will enable us to forecast the timing, magnitude, and extent of ocean change, whatever may cause it. Knowledge, understanding and prediction of the ocean are the province of the Intergovernmental Oceanographic Commission of UNESCO, in the cause of sustainable development for the betterment of humankind. The challenge is enormous, and can only be met through partnerships with experts from other specialised agencies with ocean interests.

As the United Nations' focal point for ocean science, the Intergovernmental Oceanographic Commission is a catalyst for the advancement of knowledge, understanding, and prediction in the ocean science arena.

Colin Summerhayes

Head of Operational Observing Systems, IOC



Mandate of the Intergovernmental Oceanographic Commission of UNESCO

At the 31st General Conference of UNESCO, held in Paris, November 2001, Koïchiro Matsuura, the Director-General, was authorized to apply the following action plans, in order to pursue four main objectives:

I. Improve scientific knowledge and the understanding of ocean and coastal processes. By organizing and coordinating major scientific programmes, UNESCO Member States should be assisted to design and implement sustainable policies for ocean and coastal zones. The capacity of developing countries should be reinforced, particularly by targeting sub-Saharan Africa in the framework of the African Process, and programmes in the development of scientific mechanisms for an ecosystem approach (responding to the mandate of UNCLOS, UNCED/Agenda 21, and the Global Conventions of Climate Change and Biodiversity, and regional conventions.)

II. Organize the collection of ocean and coastal observations, the modelling and the production of forecasts needed for the management and sustainable development of the open and coastal ocean. To be achieved by implementing the Global Ocean Observing System (GOOS) and its related pilot projects and regional components, and by increasing the capacities, participation, and full involvement of developing countries.

III. Further develop the International Oceanographic Data and Information Exchange (IODE) system. New national oceanographic data and information exchange facilities should be established, along with the creation of needed capacities, particularly in developing countries. Current ocean data and information should be made accessible to a wide community of users (in accordance with the existing UN Conventions and UNESCO's approach on data and information.)

IV. Intensify the follow-up to the Pan African Conference on Sustainable Integrated Coastal Management (PACSICOM). PACSICOM (Mozambique, July 1998) was a major conference addressing several environmental and development problems facing Africa's coastal regions, organized jointly by UNESCO, the governments of Mozambique and Finland, and the United Nations Environment Programme (UNEP).

Global Results and Achievements in 2002

The promotion of international cooperation and coordination of programmes in research, services, and capacity-building in order to learn more about the nature and resources of the ocean and coastal areas.

IOC achieved two important results in 2002 due to the sustained work of the IOC network of national institutions and scientific working groups, coordinated by the Operational Observing Systems and the Ocean Services Programmes:

1. The follow-up to the 1998 Pan-African Conference on Sustainable Integrated Coastal Management (PACSICOM) resulted in a series of regional coastal management projects, contributing to the operational phase of the African Process in the framework of the Environment Component of the New Partnership for Africa's Development (NEPAD). This represents the achievement of long-standing work in Africa in relationship with coastal and environmental issues. The next biennium (2004-05) will see the consolidation phase of this work.

2. The Plan of Action resulting from the World Summit on Sustainable Development (WSSD) in Johannesburg, September 2002, placed ocean issues high on its agenda. In part, it called on UNESCO/IOC to support the development of permanent capacities in ocean sciences, services, and observations (particularly through WSSD Type II Partnerships on Oceans where IOC is identified as a partner.)

Applied new knowledge for the improvement of management, sustainable development, and protection of the marine environment, and the decision-making processes of Member States of IOC.

2002 was a very active year for IOC in promoting coordination of ocean agencies in the UN system, particularly concerning the UNEP Governing Council Decision 21/13. IOC played an important role at the Bremen Technical Meeting (March 2002) through its collaboration with UNEP/World Conservation Monitoring Centre (WCMC), where it proposed structuring the urgently needed Global Marine Assessment (GMA) of the state and trends of all aspects of marine ecosystems. Based on a scientific assessment of the global marine environment, the GMA could provide advice, guidance, and assistance on actions required to mitigate environmental impacts and changes. The 57th UN General Assembly subsequently requested a report on this issue at its 58th session, and proposed holding an intergovernmental meeting in 2004. The progress made by the IOC Ocean Science Programmes in 2001-02 in coordinating working groups on the relation between climate and pelagic fisheries abundance, and on ecosystem indicators for management of fisheries, will produce useful and timely products for the GMA process in 2003-04.

Policy

Courtesy Tamara Bialecka

When Science and Statecraft Combine to Keep an Eye on our Planet…

In the following extract from a recent speech to the International Panel of the U.S. Ocean Commission, Dr. Patricio A. Bernal, Executive Secretary of the Intergovernmental Oceanographic Commission of UNESCO, discusses the need for international partnerships in "operational oceanography," referring to a vast global network of sustained ocean observations. Data collected can be incorporated into an integrated Earth observation system, designed to effectively forecast long-range weather conditions, natural disasters, and climate change. U.S. Secretary of State, Colin Powell, recently spoke of the system's "dramatic benefits" and "enormous human potential" towards improving economic operations, and ultimately, promoting sustainable development.

UNITED STATES COMMISSION ON OCEAN POLICY

Mandated in 2000, the U.S. Commission finds and makes recommendations to the President and Congress for a coordinated and comprehensive national ocean policy. At a meeting in Washington, D.C., in October 2002, it heard and discussed ocean-related issues of concern pertaining to Satellite and Data Management.

Pictured (l-r) front row are: Professor Marc J. Hershman, Washington State; Dr. Thomas R. Kitsos, Executive Director; Mr. Ted A. Beattie, Illinois; and Dr. Paul A. Sandifer, South Carolina. Second row: Mr. Lawrence Dickerson, Texas; Mrs. Lillian Borrone, New Jersey; Ms. Ann D'Amato, California; and Mr. Paul L. Kelly, Texas. Back row: Mr. Christopher Koch, Virginia; Mr. Edward B. Rasmuson, Alaska; Dr. James M. Coleman, Louisiana; Admiral James D. Watkins, USN (Ret.), Chairman, Maryland; Mr. William D. Ruckelshaus, Washington, D.C.; Dr. Andrew A. Rosenberg, New Hampshire; Vice Admiral Paul G. Gaffney II, USN, Washington, D.C.; Dr. Robert Ballard, Connecticut; and Dr. Frank Muller-Karger, Florida.
Courtesy U.S. Commission on Ocean Policy

Your invitation asked me to give IOC's view on how the USA can best preserve and enhance its role as a leader in ocean and coastal activities. I will do this from the perspective that I know best: International Cooperation.

Participating in the International Panel of the Ocean Policy Commission gives me the opportunity, first of all, to thank the United States of America for its constant support of the work of the Intergovernmental Oceanographic Commission (IOC) of UNESCO. On September 12, President Bush, in his speech to the UN General Assembly, announced the return of the USA to the United Nations Educational, Scientific, and Cultural Organization (UNESCO), which the USA abandoned many years ago. We in the IOC are very happy about this decision, which gives UNESCO a significant and deserved backing for the fulfilment of its very important mission. However, it is important to point out here that the USA is returning to UNESCO, but not to the IOC—because the USA never left the IOC. The USA has provided 42 years of constant leadership in support of the development of Ocean Science and Ocean Services through international cooperation in IOC. During all its years of absence from UNESCO, the USA has been a full and very active member of the IOC, electing and being elected in the Governing Bodies, and providing much-needed additional resources and personnel to serve at the IOC Secretariat in Paris. In 1987, the delegation of the USA joined others in proposing the development of a Global Ocean Observing System. For all this, the Member States of the IOC, and the professionals that work in the Secretariat of IOC, are extremely grateful.

In 1960 the creation of the IOC was agreed and endorsed by the First Oceanographic Conference gathered in Copenhagen. During the preparatory meeting for that Conference in Paris in March 1960, the USA delegation was

headed by Dr. Roger Revelle, then Director of Scripps Institution of Oceanography in La Jolla, CA. Dr. Revelle summarized the purposes of this new UN organization:

> "In considering the needs for international co-operation in the marine sciences, it is convenient to divide the problem into three parts: research, oceanic surveys and assistance to underdeveloped countries."

Revelle's statement defined a true "programme" for the newly created IOC. This programme has been relentlessly carried out through international cooperation.

In the 60s, the International Indian Ocean Expedition gave a significant push to the oceanographic knowledge of the then less well-known ocean basin of the world.

Today, the precision of the maps of the bottom of the ocean is orders of magnitude better than what they were when Revelle spoke in Paris. Not only have they improved, but by turning new geophysical tools to survey the bottom of the sea, we have also been able to map its geological history. By drilling into the marine sediments and ocean floor, science gave us the confirmation of Plate Tectonics, the theory about the changing nature of the Earth's crust—perhaps one of the deepest scientific revolutions of the second half of the twentieth century.

Several major international ocean research programmes were undertaken in the last three decades, including:

- The comparative studies of the major coastal upwelling systems of the world
- The Coastal Upwelling Ecosystems Analysis (CUEA) project during the International Decade of Ocean Exploration
- The physical oceanography of the equatorial oceans during the Tropical Ocean Global Atmosphere (TOGA) project that created the understanding and the capabilities to forecast the El Niño and La Niña oscillation

These successful projects were followed by:

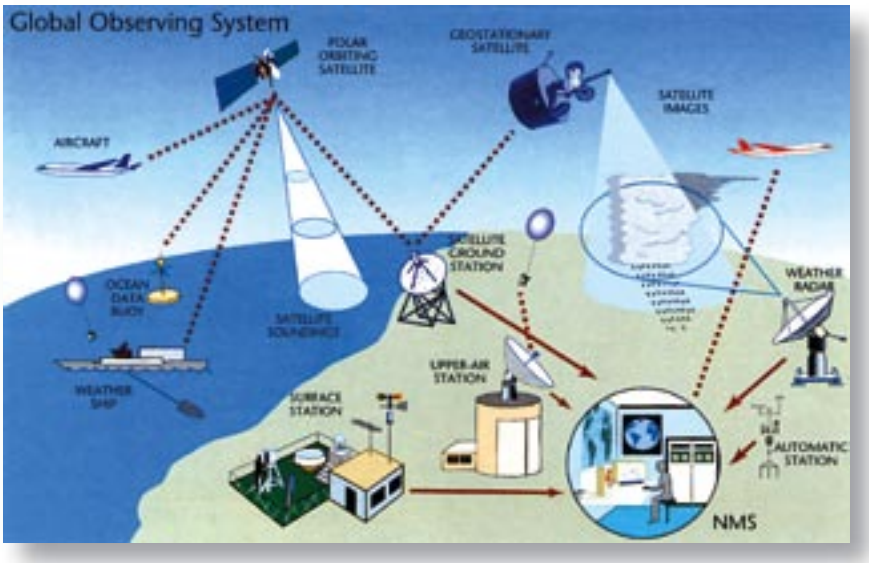
- The World Ocean Circulation Experiment (WOCE)
- The Joint Global Ocean Flux Study (JGOFS) studying the role of the ocean in the global balance of carbon
- The Global Ocean Ecosystems Dynamics Programme (GLOBEC) studying the structure and changes in marine ecosystems

Today we are actively engaged in the planning of the Climate Variability and Predictability Programme (CLIVAR) study, the newest and most wide-ranging component of the World Climate Research Programme (WCRP), jointly co-sponsored by the World Meteorological Organization (WMO), IOC, and the International Council for Science (ICSU). CLIVAR´s objective is to move the forecasting window for weather and climate from days and weeks into seasons and the interannual range.

CLIVAR would have been unthinkable without the significant progress achieved in Ocean Sciences, the development of new technologies available to collect data and information in the ocean and from space, and the constant progress of computer technology that has enabled the use of numerical models to integrate all this new information into meaningful projections and forecasts.

"CLIVAR´s objective is to move the forecasting window for weather and climate from days and weeks into seasons and the interannual range."

All these research projects have left behind a legacy of permanent Ocean Services, that is, an ensemble of automatic instruments operating over

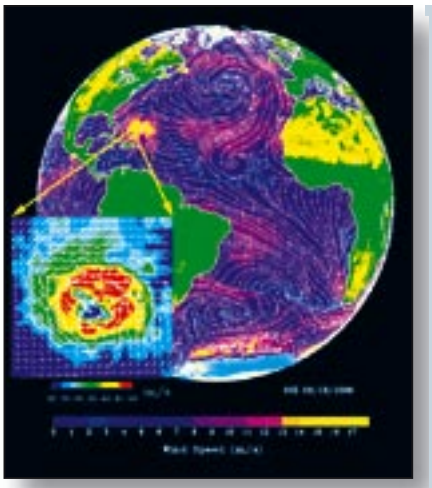


Weather and Climate: Their Variability and Change.
Courtesy of World Meteorological Organization

vast expanses of oceans, optimally deployed to acquire data and information on a specific set of properties of the World Ocean.

These Ocean Services, coordinated by the IOC in cooperation with the World Meteorological Organization, fulfil Revelle's second goal, "surveying the oceans," but with a big difference to what he had in mind in 1960. The Ocean Services that we have developed are surveying the ocean in *real-time*. If oceanographers of the 60s were restricted to the use of dedicated vessels to go out to sea to collect information, the oceanographers of today can arrive in the morning at their offices, turn on their computers, download the new information available on the Web, run their models to see the changing ocean conditions, and produce an updated forecast. Not all oceanography can be done this way, but we cannot underestimate this major change.

The integration of the data streams provided by these Ocean Services, together with those of space satellites, has enabled a new engineering—that of global observing systems. This is changing the way we do oceanography forever and creating, for the first time, a true Operational Oceanography. The change is so deep that, in order to move forward, the obstacles we face are mostly cultural.



Surface winds in the Atlantic Ocean as viewed by the QuickSCAT scatterometer, with the detailed structure of Hurricane Floyd (August 1999). *Courtesy of NASA*

"Global observing systems … changing the way we do oceanography forever and creating, for the first time, a true Operational Oceanography."

Operational Oceanography is being made possible by the development of the Global Ocean Observing System (GOOS): the integrated operation of a series of Ocean Services covering the World Ocean. GOOS was proposed for the first time in IOC in 1987 and was officially endorsed as a programme of the Commission in 1989. The IOC took the blueprint of GOOS to Rio de Janeiro in 1992, to the UN Conference on Environment and Development, where it became the Ocean Component of the Global Climate Observing System. As such, GOOS is sponsored by the World Meteorological Organization (WMO), the United Nations Environmental Programme (UNEP), the International Council of Science (ICSU), and by the IOC (which acts as the lead agency.) Since then, and thanks not in minor part to the active participation of scientists and technicians of the USA, we now have an Initial GOOS, contributing to the daily world data stream coming from the oceans.

The Ocean Services integrated into GOOS were developed during the last three decades as independent systems. The Global Sea-Level Observing System (GLOSS) for sea-level, and the Integrated Global Ocean Services System (IGOSS) for the collection of data on the vertical structure of the upper layer of the ocean, and the International Tsunami Warning System are examples of permanent Ocean Services developed by IOC, composed of tide-gauges, vertical probes launched by commercial ships, fixed and drifting buoys, bottom seismometers, and backed by orbiting and stationary satellites. Moving an engineering system from prototype and research status to operational status implies significant changes. Operations require dedicated specialists and careful plans to deploy, maintain, and constantly upgrade the systems. A system of quality control over the output is needed, for early detection of any signs of degrading elements in the system.

In an unprecedented step forward in interagency cooperation, the 13th Congress of the World Meteorological Organization (WMO) and the 20th Session of the IOC Assembly approved the fusion of several long-standing independent committees belonging to both organizations into a single body: The Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM). After two years of preparation JCOMM held its first official meeting in Akuyreri, Iceland in June 2001. JCOMM is charged with the supervision of all the technical groups in charge of the operational systems for the Global Ocean Observing System.

Although today Operational Oceanography is restricted mostly to the physical aspects of ocean dynamics, and in that sense is closely linked to the forecast of weather and climate, Operational Oceanography is evolving and will enlarge its current scope to incorporate the continuous monitoring of the chemical and biological environments of the ocean. This development, driven by the growing use of the oceans and the ever-increasing impact of land activities

on the ocean, is taking place as we speak and will come to maturity in coming years.

These efforts are financed by the Member States of the IOC and are clearly designed with a broad purpose of "public service" in mind. In this sense, IOC has a clear advantage as an intergovernmental organization because, among other things, it can guarantee the universal character of the system, facilitate the exchange of primary data and information, and help in the development of capabilities around the world. Of course, the information obtained from these systems, once in the public domain, can be used, and is being used, by specialized organizations to generate and provide a wide range of applications and services, both public and private.

There are several aspects to this challenge. The first one is institutional development. Member States, and the IOC, need to prepare themselves to absorb the needs posed by Operational Oceanography. It is here where salutary scepticism exists in the scientific community. The financing of ocean research has allowed the building of what we have. However, the financing of Operational Oceanography cannot depend on the funding for Science. Since there is no other known source to fill the gap, this is seen as a huge menace to the stability of international research efforts.

But this analysis offers a very incomplete picture. The Tropical Atmosphere Ocean project (TAO) array of 70 permanently moored buoys in the Equatorial Pacific was science 15 years ago, but today it is an operational array maintained regularly by the National Oceanic and Atmospheric Administration (NOAA). The USA delegation to the IOC has contributed this array towards the GOOS system.

The way forward is not simple and complex decisions need to be adopted at a national level. In most countries, the full scope of managing the opportunities and risks introduced by the rights and obligations agreed upon in the United Nations Convention on the Law of the Sea (UNCLOS) is not dealt with by one single branch of the administration. On the contrary, reflecting the "functional" character of many of those rights and obligations (fisheries, environment, defence, transport, etc.) they are usually delegated to a variety of departments in the administration, with weak coordination amongst them.

Highly technical and specialized departments in charge of ocean policy and ocean affairs that include ocean data collection and the support of ocean research in their mission exist in only a very few countries. Organizations like NOAA in the USA (the creation of which was recommended by the Stratton Commission) are an exception rather than the rule around the world. As the economic potential of the ocean is realized, more countries will devote increased resources to this end.

The second challenge makes reference to the use of the data and information generated by operational oceanographic services. Effective use requires the organization of sophisticated systems for processing, modelling, and distributing the information. It is not just a matter of securing access to the data, important as this aspect is. It is necessary to establish a highly technical and dedicated organization with the mission of using the data to produce and distribute final products. These organizations do exist today, both in the public and in the private sector.

There are different options here. Is this a development that each Member State of the IOC wishes to face independently, or would it be a possible "joint" effort within IOC, organized at regional scale, for example?

"Our concern has shifted to sustainable development … to improve economic operations by taking into account the limits set up by our natural boundaries"

This image of Earth's city lights was created with data from the Defense Meteorological Satellite Program (DMSP) Operational Linescan System (OLS)
Courtesy: NASA, Earth Observatory Team http://earthobservatory.nasa.gov

El Niño-Southern Oscillation Observing System
Source: NOAA

Could it be that the global observation of the ocean could be the goal of a private consortium?

The third challenge is economic in nature. Global observations constitute a very particular case of all the observations that can be collected. The main feature is the very large scale at which they are collected. In the upper limit, GOOS will be sampling properties of a single system: the Global Ocean. The sample size is one.

At each spatial and temporal scale there are specific properties of the ocean that are related to that scale and others that "spill-over" to other scales. In theory, full forecasting capabilities would be available only if all scales are properly sampled. This is a huge technical requirement. Conceptually this is not a minor detail. In GOOS, what is a local observation collected along the East Coast of North America, becomes a "remote and distant" observation for a forecast in the North Sea, and vice-versa. If we want to extend weather forecasts in the USA from six days to two weeks, not only do we have to build a USA-Coastal GOOS, we also have to collect information in and over the Pacific and Indian Oceans. We need to have a very clear picture of what is happening in and around the Indian sub-continent.

From a practical point of view, there are absolute limits (spatial scale) beyond which the collection of data from private observation networks faces diminishing returns, and a point where profitability eventually breaks down. Data originating from the local scale, where they can be considered a "rival good" start losing their "rival" character as they are collected at larger scales, becoming essentially "non-rival goods" at the global scale.

In my mind this a natural process. I cannot refrain from giving you my hypothetical vision of how Euro-GOOS was started. During the development of the offshore oil and gas exploitation in the North Sea, I imagine one day the *rendez-vous* of two vessels from two different R/D companies, deploying instruments in an area of the North Sea to provide services to oil companies operating, for example, off the British Isles and off the coast of Norway. After avoiding interference with each other out at sea, back in port, senior officers of both companies got together and asked themselves what it would take to have an agreement to share the data from a single instrument array, saving the cost of the extra array (US$500,000 for a moored array), or perhaps to jointly deploy the extra array in an area in which neither of the two had the resources to invest if working alone.

So, they sat down, wrote the specifications, precision, accuracy, dynamic range of the linear response of the transducers, frequency of sampling, etc., (exactly what we have done in IOC to build GOOS) and then they agreed to share the data in a given format. The knowledge that allows them to be specialists and provide good advice to their clients is not in the data—it is in knowing how to use the data. However, they cannot use that knowledge without having the data.

Since the potential users of these products come from a wide range of public and private activities, most of them on land, it is necessary to efficiently segment the markets between public and private agents, with the goal of maximizing total economic benefits to society. Although society might wish to recover the cost of collecting the data directly, simply by selling the data, I am firmly convinced that is the wrong approach. The benefits to society are increased by the free and open exchange of primary data and by allowing the development of a variety of specialists that can tailor their products to the specific needs of their clients. These extra layers of specialists provide jobs, generate revenues and taxes, and secure efficient servicing of final users. The specialists might also develop additional observing networks to improve their products. Think of the detailed forecasting of the atmospheric

"A Global Ocean Observing System … its very nature and large-scale of coverage requires the cooperation of all the countries of the world"

circulation for purposes of air-quality control and air-pollution mitigation.

During the origins of GOOS in the 80s, the dominant preoccupation was climate change. We wanted to ascertain the role of the ocean in climate change. We still do. However, today our concern has shifted to sustainable development in a more general and comprehensive way: to improve economic operations by taking into account the limits set up by our natural boundaries. Nations have agreed on the need to protect global ecosystems, realizing that the stability of the planet's life-support system depends on their integrity.

Until now, the building of GOOS has very much been the result of "science pushing" and that is why one of my first priorities as Executive Secretary of the IOC is to enlarge the "societal pull" for the completion of that effort. IOC has started to work directly with a variety of private users who are interested in trying the new information in their own daily management operations. Companies and agencies involved in the energy, power, tourism, building regulation, insurance, and financial sectors have all expressed interest in working with us to better specify their need for information. We are not asking private users to finance the investment directly, although some have demonstrated willingness to do so; rather, we would like them to demonstrate the utility of this information to their activities, and to show the real values involved.

Other developments are taking place very fast. In 1999 and 2000, IOC was engaged in the development of the first blueprint for a Global Carbon Observing System. The Global Terrestrial Observing System, led by the Food and Agriculture Organization of the United Nations (FAO), is actively improving the measurement of terrestrial carbon fluxes. We have published the work of several groups of experts defining the initial Carbon Observing System for the ocean. We see this development as an integral part of GOOS.

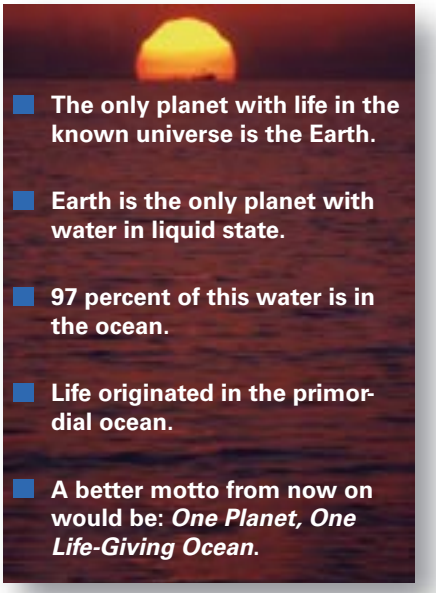
In 1998, the agencies involved in UN-sponsored Observing Systems and the Committee for Earth Observation Satellites (CEOS) agreed to unite their two strategies into a common Integrated Global Observing Strategy (IGOS). IGOS is managed by an IGOS Partners Forum, which will further the definition, development, and implementation of a unifying strategy. IGOS involves major space-based and *in situ* systems for global observations of the Earth, including climate and atmosphere, oceans, land surface, and the Earth's interior. IGOS should improve governments' understanding of global observing plans, provide a framework for decisions on the continuity of observation of key variables, reduce duplication, help to improve resource allocation, and assist the transition from research to operations.

* * *

My answer to the question of how the United States can best preserve and enhance its role as a leader in ocean and coastal activities is bluntly simple: Recognize and consistently support what the USA has been leading in the international arena to build a Global Ocean Observing System. This initiative was born international, its very nature and large-scale of coverage requires the cooperation of all the countries of the world.

I hope that the U.S. version of GOOS contains plans for deploying instruments, not only off the west and east coasts of the continental USA and in the Arctic Ocean, but also in partnership with other agencies and countries to deploy instruments and platforms around the Antarctic Continent to help to secure the future missions of the operational satellites devoted to ocean observations.

In our efforts to raise public awareness about what we do at IOC, we have been using as our motto the phrase *One Planet, One Ocean*. During this year's World Summit on Sustainable Development in Johannesburg, we presented the work of IOC in six languages under this motto. This is an abbreviation of a much more fundamental one: *One Life, One Planet, One Ocean*.



Background photo courtesy of Luc Cuyvers, MN Films

IOC 2002 Policy Activities

1. **Functioning of IOC governing bodies and the direct follow-up of their decisions and resolutions.**

2. **Coordination of Ocean Sciences, Observations, and Services within the UN System.**

3. **Improvements on the decision-making process of the Commission by its Assembly and Executive Council.**

4. **Follow-up of major international environmental conventions.**

5. **Public awareness and publications, including preparations for the World Summit on Sustainable Development (Johannesburg, September 2002).**

IOC policy is based on increasing the effectiveness of the governing bodies of the Commission, the promotion of e-publishing and e-communication, the creation and support of partnerships with UN and non-UN organizations to implement different aspects of the IOC Programme, and the development of public awareness and dissemination tools based on traditional media and new computer technology, such as specialized portals and Web sites.

Results and Achievements in 2002

1. Technical assistance provided to the International Seabed Authority (ISA), the Commission on the Limits of the Continental Shelf (CLCS) and the International Tribunal for the Law of the Sea (ITLOS).

As formally requested by the Secretary General of the UN, IOC cooperates with two institutions established by the United Nations Convention on the Law of the Sea (UNCLOS): the International Tribunal for the Law of the Sea (ITLOS), and the International Seabed Authority (ISA). A Memorandum of Understanding was signed with ISA on 7 July 2000.

Achievements in 2002

IOC participated at the Workshop on Prospects for International Collaboration in Marine Environmental Research to Enhance the Understanding of the Deep-Sea Environment (Jamaica, 29 July-2 August 2002). At this meeting, scientific experts examined the prospects for international collaboration in marine environmental research to enhance understanding of the deep sea environment. Cooperation activities were analysed with ISA officers.

The International Seabed Authority Secretariat Headquarters in Kingston, Jamaica. © ISA file photo

2. Organization of the meetings of the Advisory Body of Experts on the Law of the Sea (ABE-LOS).

Through the results of their meetings, ABE-LOS provides important advice to the governing bodies of IOC, and contributes to the implementation of UNCLOS in the area of marine scientific research, the transfer of marine technology, and capacity building.

Achievements in 2002

ABE-LOS II was convened in accordance with Resolution XXI-2 adopted by the 21st Session of the IOC Assembly (Paris, July 2001). It was held at the invitation of the Kingdom of Morocco in El Jadida, Morocco, 6-9 May 2002. The 3rd Meeting of ABE-LOS (ABE-LOS III) will take place in Lisbon, Portugal, in May 2003.

3. The outcomes of the World Summit on Sustainable Development include oceans as a high priority for sustainable development.

The WSSD outcomes will influence IOC's work in the future, inasmuch as ocean issues will be highly placed on the results of the governments' agreements at WSSD. The 21st Assembly of IOC recognized the need to provide a global forum on oceans and coasts to a wide range of organizations, in order to deliver a stronger and more coordinated message at WSSD in September 2002. This led to the co-organization of the Global Conference on Oceans and Coasts, held in Paris at the end of 2001. The Assembly also recommended that additional pathways should be explored for delivering a message from IOC to the WSSD (possibly through the IOC regional constituencies, or via UNESCO's participation as a member of the Preparatory Committee of the World Summit on Sustainable Development.)

Achievements in 2002

The role of IOC and its activities in the sustainable management of oceans and coasts was recognized at WSSD. This occurred especially through the Plan of Implementation, one of the two main political documents adopted by the Summit (the other one being the Political Declaration.) Paragraph 34(d) of the Plan of Implementation states: "Strengthen the ability of the Intergovernmental Oceanographic Commission of the UNESCO…to build national and local capacity in marine science and the sustainable management of oceans and their resources." Although oceans are not mentioned in the Political Declaration, many statements call for the reinforcement of current policies.

4. Adoption of relevant decisions and resolutions on strategic or policy issues.

Achievements in 2002

The 35th Executive Council (Paris, 4-14 June 2002) approved eight resolutions on programme and policy matters. The Report of this meeting was edited, printed, and distributed electronically to Member States in September 2002. The 22nd Assembly of IOC is scheduled for 24 June-4 July 2003.

5. Increased coordination and cooperation with UN agencies addressing ocean issues.

The coordination and cooperation with UN agencies addressing ocean issues has been enhanced according to the Initiative for the Ocean Assessment (UNEP) and the statutory meetings of IOC's governing bodies.

Acting Together for the Future of the Blue Planet.
Courtesy Nausicaa-National Sea Centre

Achievements in 2002

IOC representatives attended the Technical Workshop for Establishing a Regular Process for the Global Assessment of the Marine Environment (Bremen, 18-20 March 2002). IOC has also actively cooperated with the UNEP World Conservation Monitoring Centre (WCMC) in conducting a review of the scope, status, and timing of existing and forthcoming assessment and assessment-related activities carried out under relevant national, regional, and global organizations. Action has been undertaken to identify gaps in their coverage and ways in which they could be integrated into the Global Assessment of the State of the Marine Environment (GMA) process. The results of this work will be presented to the next UNEP Governing Council (February 2003.)

6. Increased collaboration with IOC's partners outside the UN, including IOC Advisory Bodies.

Participation in technical meetings addressed to respond to UNCLOS mandates, and in public awareness activities concerning sustainable management of ocean-related activities.

Achievements in 2002

IOC supported the 2nd International Meeting, "Acting Together for the Future of the Blue Planet," organized by NAUSICAA-National Sea Centre (Boulogne, December 2002). As a result of this meeting almost 120 organizations representing museums and aquaria, environmental and educational NGO's, made a commitment to implement a vast public awareness campaign, potentially reaching 200 million people across five continents, about the need to manage oceans and the environment in a sustainable way.

"Science under the Blue Flag"

Bernard H. Oxman is a professor of law at the University of Miami School of Law in the USA and director of the law school's Ocean and Coastal Law Program. He has published numerous books and articles on the law of the sea, is currently Co-Editor in Chief of the American Journal of International Law, and recently served as Judge *ad hoc* of the International Tribunal for the Law of the Sea. A former Assistant Legal Adviser of the U.S. Department of State, Professor Oxman was U.S. Representative and Vice-Chairman of the U.S. Delegation to the 3rd UN Conference on the Law of the Sea, where he chaired the English Language Group of the Drafting Committee.

During the 22nd Assembly of the Intergovernmental Oceanographic Commission of UNESCO, held in Paris in June 2003, Professor Oxman was invited to discuss the challenge, both of the past 20 years and the future, of achieving global acceptance and maintaining the integrity of the 1982 UN Convention on the Law of the Sea, often referred to as "a Constitution for the Oceans." Achieving and retaining a truly unified and universal law of the sea, as new fields of activity and increased uses of the oceans confront all States with important issues is, Professor Oxman argues, "not an easy project."

"It is a special pleasure to return to the place where I had my first opportunity to participate directly in the work of a global intergovernmental organization.

Not very long after I completed my naval service in late 1968 and joined the Office of the Legal Adviser of the Department of State, I was assigned to the United States delegation to an IOC meeting at UNESCO Headquarters to work on measures to facilitate scientific research in coastal areas and international cooperation with respect to such research. It was here that I formed an abiding commitment to the idea that the IOC could play a key role in such facilitation and cooperation, by becoming the mechanism through which all States, developed and developing, could participate in the realization of a research agenda reflecting all of their priorities.

To my brilliant Argentine colleague, Elsa Kelly, I described the idea as "science under the blue flag." Dr. Kelly emphasized that we must encourage States and institutions with substantial oceanographic capabilities to make developing countries and coastal States true partners in the scientific enterprise. I emphasized that we must find a way to liberate scientific research in coastal areas from the unnecessary bureaucratic and political obstacles to consent. The trick, of course, is to do both.

I brought that idea back with me to Washington in an effort to make it part of the approach of the United States during the preparations for the Third UN Conference on the Law of the Sea. It was not easy to persuade scientists and others in the United States and Europe skeptical of international bureaucracies, and it is fair to say they were never fully persuaded. My good fortune in becoming United States Representative to the Law of the Sea Conference, and vice-chairman of the U.S. delegation, afforded me additional opportunities to build a consensus on at least a modest version of the idea. The object was to include provisions in the UN Convention on the Law of the Sea that accord special privileges to international organizations like the IOC with respect to coastal State consent for scientific research projects, and that by doing so create an incentive for governments and scientific institutions with substantial research capabilities to involve the organization and its members more fully in both the planning and execution of their projects.

We almost succeeded. Unhappily my skills were not equal to the task of persuading my esteemed and influential colleague at the Law of the Sea Conference, the late Conseiller d'Etat and Judge of the International Court of Justice, Guy Ladreit de Lacharrière. He was apparently unsure of the ability of political authorities to control the scientific judgments of technical international organizations; I would imagine some in this room would be tempted to respond: *tant mieux*. Be that as it may, the result is that the challenge now falls to the IOC and its Advisory Body of Experts on the Law of the Sea in general, and to Professor Alfred Soons and his Sub-Group colleagues in particular, to try to build a practical structure under Article 247 of the Convention that responds to its *raison d'être* and advances its underlying purposes.

But some might ask: Why do that? Why not just amend the Law of the Sea Convention and fix the problem? And while we are at it, we can fix some other problems too. Moreover, why even bother with the United Nations and the UN General Assembly? Why not effectively supercede the offending provisions of the Law of the Sea Convention with a new agreement drafted here in Paris? After all, another UNESCO body drafted a treaty on underwater cultural heritage that, at least in part, purports to do just that. Who knows how widely it will be ratified? Why should we care?

It was perhaps with such questions in mind that Dr. Patricio Bernal, the distinguished Executive Secretary of the IOC, with reference to my address on such matters at the UN General Assembly Commemorative Session last December, honored me with an invitation to highlight some of the points that might be of interest to those who participate in the work of the IOC. I am pleased to do so now.

* * *

Few would quarrel with the view that the fundamental goal of the Charter of the United Nations is the promotion of a peaceful international order throughout the world. And few would quarrel with the proposition that the promotion of the rule of law in international affairs is essential to achieving that goal. This is not an easy project. Universal law requires universal commitment. The Charter embraces the legal premise of the sovereign equality of States. Promoting the rule of law depends on the willingness of States to commit themselves to particular rules.

The history of the law of the sea in the twentieth century amply demonstrates both the need for, and the difficulty of, attaining universal assent to a single body of basic rules. Once in the first half of the twentieth century, and twice in the first decade of the second half, the community of States attempted to achieve universal assent to a written articulation of these rules, and failed. Those failures may in themselves have contributed to the descent into the confusion and chaos of conflicting claims to use and control the sea.

It was therefore with more than a little trepidation, and more than the ordinary degree of political attention, that the community tried again. Preliminary work, both within and outside the United Nations, began in 1967. The 3rd UN Conference on the Law of the Sea convened in 1973, thereafter generally meeting at length two times per year, with important informal meetings between sessions. These formal sessions and informal meetings continued until the Conference finally adopted the United Nations Convention on the Law of the Sea in 1982. In time it became evident that the goal of a global consensus, namely universal ratification, could not be achieved without addressing the problems with Part XI of the Convention regarding deep seabed mining; this was done in 1994 in the Implementing Agreement, and the Convention and the Agreement finally entered into force and began to attract widespread adherence.

Why did it take so long? Among the reasons is that governments were committed to trying to get it right this time: they understood that getting it right meant uniformity of substance and universality of adherence. Diplomats and lawyers are well aware that many treaties, by permitting reservations, sacrifice uniformity of substance in order to promote universality of ratification; others may do the reverse. This Convention, despite its enormous size and complexity, prohibits reservations. And the Convention as a whole, not merely the Implementing Agreement, was generally negotiated with a view to securing universal ratification. A single body of basic rights and duties and precise allocations of jurisdiction applicable to all was the ambitious goal. We are now well on the way to achieving that goal. But we are not there yet.

"This is not an easy project. Universal law requires universal commitment. The Charter embraces the legal premise of the sovereign equality of States. Promoting the rule of law depends on the willingness of States to commit themselves to particular rules."

The good news is that there are now 145 parties to the Law of the Sea Convention, and that the governments of some other States are publicly committed to seeking parliamentary approval of the Convention. The bad news is that there are, nevertheless, still a significant number of nonparties.

Those who regard the Convention as a species of *droit acquis* that can be taken for granted as we move on to new things ought not overlook the fact that two essential objectives of the Convention could be prejudiced by new projects unless care is taken in how they are pursued. The first is the goal of universal ratification: if we want a truly universal law of the sea, governments and institutions should do more to promote universal ratification of the Convention, and should also seek to avoid actions that might frustrate it. The second is the goal of coherence and uniformity of substance: if we want to maintain the uniformity reflected in the prohibition on reservations, then

we should be cautious about actions that could fracture the Convention into a series of conflicting and competing instruments regarding basic rights and duties and precise allocations of jurisdiction at sea.

The question of changes to the Convention entails a risk/benefit calculus. While an amendment conference will soon be permissible under the Convention, even the prospect of such a conference could prejudice universal ratification of the Convention as it stands. It could also undermine the perceived legitimacy of the Convention as a source of customary law and otherwise.

These costs would be sustained without even knowing whether the conference will be able to produce amendments that would themselves be widely accepted. At best, there is likely to be a long period of uncertainty. Entry into force of amendments generally will require ratification by at least two thirds of the States Parties (two-thirds of the current 145 parties is 97); and at that point the amendments generally will enter into force only for the States that ratify or accede to them, and will not affect the rights and duties of other States Parties.

The Convention has been called a Constitution for the Oceans. One of the reasons is that, like municipal constitutions, it provides a normative and procedural framework for change and adaptation within the constitutional order. In my view, to the extent possible, change should be contemplated within, rather than to, that constitutional order. To put it differently, one ought to consider the alternatives for achieving an objective before deciding that an amendment or other formal change is necessary.

One of the more interesting aspects of the Convention is that it recognizes and reflects an underlying irony of the law, namely that stability in the law is not possible without orderly adaptation and change. The regimes established by the Convention are not static. The Convention combines norms and jurisdictional allocations with a series of frameworks for developing specific rules in the context of other arrangements and organizations. Some are global, especially where global uniformity or minimum global standards are necessary or desirable; others are regional or local. Nowhere is this more apparent than in the regimes for environmental protection, navigation safety, and management of living resources. But the provisions for cooperative measures are not limited to these fields.

"As the principal international organization specifically concerned with oceanography, the IOC has a significant role under the provisions of the Convention that expressly or implicitly refer to the work of competent international organizations with respect to marine scientific research. The governing statutes of the IOC were specifically amended to assume that role."

As the principal international organization specifically concerned with oceanography, the IOC has a significant role under the provisions of the Convention that expressly or implicitly refer to the work of competent international organizations with respect to marine scientific research. The governing statutes of the IOC were specifically amended to assume that role.

It should also be recalled that many of the provisions of the Convention are subject to arbitration or adjudication. Those processes certainly can play an important role in assisting States in their understanding of how the Convention applies to new circumstances or unforeseen problems.

With respect to most situations, therefore, the question is not whether new problems or new issues or new ideas can be addressed without formally amending the Convention, but how to do so. One response to that question is evident in the decision of IOC to create the Advisory Body of Experts on the Law of the Sea.

My analysis of this matter might be challenged on the grounds that such a decentralized system of negotiation on different issues can ultimately lead to more incoherence and lack of uniformity than an amendment process. What is to stop these different organs, for example the IOC, from producing agreements that are not really consistent with the basic rights and duties and precise allocations of jurisdiction set forth in the Convention, and that undermine the coherence of the system?

My answer is that there is something of an historic pattern of self-restraint that seems to reflect an informal, and in my view felicitous, understanding that the questions of basic rights and duties and precise allocations of jurisdiction in the law of the sea are to be addressed in negotiations organized by the United Nations itself. All three conferences on the law of the sea were convened by the UN General Assembly. The two implementing agreements to the UN Convention on the Law of the Sea were both negotiated at UN headquarters under UN auspices.

The International Maritime Organization, which has sponsored countless

treaties on navigation and marine pollution, has successfully built upon the jurisdictional structure of the Law of the Sea Convention, but has consistently endeavored to avoid addressing basic jurisdictional issues dealt with in the Convention. The International Civil Aviation Organization looks to the Law of the Sea Convention to inform the content of its constituent instrument and regulations. The UN Conference on Environment and Development, notwithstanding a very high level of representation, explicitly worked on the basis of the Convention. A similar pattern can be discerned in the work of the Food and Agriculture Organization of the United Nations (FAO) and of the IOC. There is however a recent exception to this long pattern of self-restraint and deference to the role of the United Nations General Assembly and the United Nations Convention on the Law of the Sea that may be discerned in certain provisions of the controversial convention on underwater cultural heritage negotiated under UNESCO auspices. I trust it will be the exception that proves the rule.

In conclusion, I would summarize my advice on this matter as follows:

First, most problems can and should be addressed by separate arrangements within the framework of the Convention's basic norms and jurisdictional provisions.

Second, one should not confuse unwillingness to agree with legal inability to do so. Nothing in the Convention either requires States to insist on exercising rights or to refuse to accept new duties by agreement; in many cases, quite the opposite is suggested by the Convention. If there are political obstacles to an agreement on the matter, there is little reason to believe those obstacles will disappear in the context of the negotiation or ratification of amendments or new jurisdictional treaties.

Third, there are risks involved in an amendment process. At a minimum government representatives should hesitate to contemplate such a process until it has been fully explored by all their government agencies with an interest in marine matters that have been candidly informed that there is no sure way to control the agenda or the outcome of an amendment conference once it starts, or to control *ad hoc*, uncoordinated and chaotic revision of the basic jurisdictional provisions of the Law of the Sea Convention by any of a multitude of international organizations and conferences.

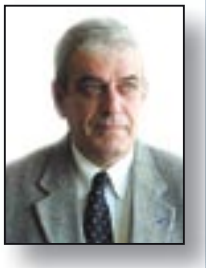
And last, if the real objective is to lay a political foundation for imposing a new restraint on the right of a State without consent and against its will, let us at least be candid and recognize that we are placing a higher priority on the particular restraint than on the furtherance of the rule of law in international affairs. Each time we do this, our appeals to law ring a little more hollow, and we promote a little more cynicism about the rule of law in international affairs. That was the lesson of the law of the sea in the twentieth century. It is not a lesson a rational world would ignore."

IOC Programme Sections

Courtesy Luc Cuyvers, MN Films

An Overview of the Year 2002 in IOC's

Ocean Science Programmes

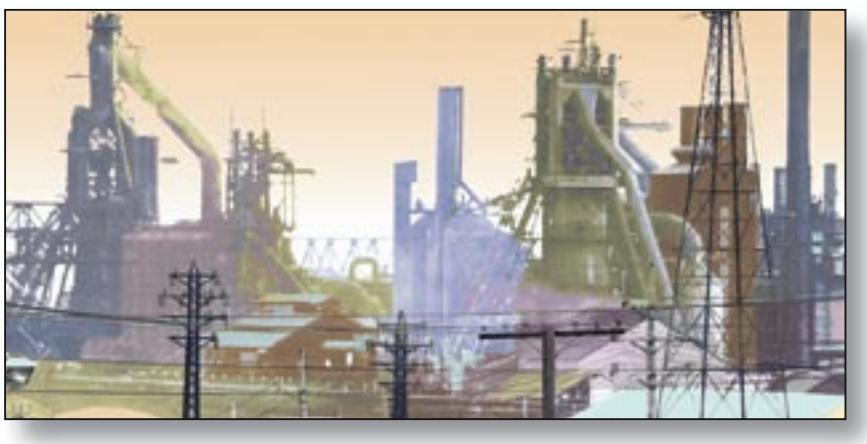


By Umit Unluata, Head of Section

The year 2002 marked the successful continuation and further development of Ocean Sciences Section (OSS) activities, in harmony with its restructuring process completed in 2001. Some selected highlights of 2002 for the OSS are outlined below:

Ocean Carbon Programmes

Human activities have profoundly altered the Earth's global carbon cycle. The study of carbon and climate is no longer strictly an academic exercise, but one that demands political consideration at an international level. The Intergovernmental Oceanographic Commission of UNESCO's ocean carbon programmes bring together scientists from many nations to make joint plans for ocean carbon observations, to compile and assess results, and to introduce these findings back into the research community and the intergovernmental decision-making processes. In 2002, the IOC published *A Global Ocean Carbon Observation System: A Background Report* as a contribution to the design of the ocean climate observing system. Also in 2002, the IOC, together with the Scientific Committee on Oceanic Research (SCOR), developed plans for a pilot project with the International Geosphere-Biosphere Programme (IGBP)-International Human Dimensions Programme on Global Environmental Change (IHDP)-World Climate Research Programme (WCRP) Global Carbon Project to create an international hub for information on ocean carbon observations and to provide a forum for international agreements on standardization of observations and data. An international workshop was planned for January 2003 to launch this new programme (for further information, see <http://ioc.unesco.org/iocweb/co2panel/>.)



Human activities have profoundly altered the Earth's global carbon cycle

Coastal Nutrients

Human activities related to food and energy production have greatly increased the amount of nutrient pollution entering the coastal environment, often with dire environmental and economic consequences. IOC established the Global Nutrient Export from Water Sheds Working Group (Global NEWS) in 2002 as an international, interdisciplinary scientific taskforce, focused on understanding and modelling the relationship between human activity and coastal nutrient over-enrichment. Global NEWS models are expected to be used to identify areas prone to nutrient over-enrichment and the watershed sources of those nutrients, and to develop mitigation strategies for those areas. In the launching of the Group's activities, supplementary funds were received from the National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation (NSF). Later, the United Nations Environment Programme (UNEP)-Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) and UNEP-MED POL agreed to co-sponsor the Group's regional activities (for further information, see <http://www.marine.rutgers.edu/globalnews/> .)

River carrying pollution from a factory in Tegucigalpa, Honduras to the coast
Courtesy Y. Nagata/UNESCO

Coral Reefs

Climate change-related thermal stress is developing as a major threat to coral reefs on a global scale. Elevated sea surface temperature, combined with other stressors, triggers the expulsion of microalgae

from corals where they sustain critical life processes under healthy conditions. The resulting coral bleaching events are increasing in both frequency and intensity, causing serious degradation of reefs. The IOC Working Group on Coral Bleaching and Ecological Factors was established in 2001 to investigate key physiological processes and ecological effects associated with bleaching, and to develop indicator tools and models to project future change and impacts on coastal populations depending on reefs. In 2002, the Bleaching Group, in collaboration with a large team of researchers and students from over the world, held two research workshops (on the Great Barrier Reef, Australia, in March, and in the Caribbean in September) to pilot future investigations through a global collaborative research and capacity building network. These two workshops were highly successful and led to a series of outcomes, including further development of the research workplan 'Understanding Coral Bleaching Across Four Oceans' expected to be sponsored by the World Bank (for further information, see <http://ioc.unesco.org/coralbleaching/>.)

Indices for Management of Pelagic Fish Populations

Through the work of the IOC/Global Ocean Ecosystems Dynamics Programme (GLOBEC) Study Group on the use of environmental indices in the management of pelagic fish populations, significant progress has been achieved. In addition to the reports of the meetings of the Group, several scientific papers have been submitted to peer review journals for publication. The results of the Group will undoubtedly provide a comprehensive review of the use of environmental indices, such as hindcasting/nowcasting/forecasting, and management tools of the fluctuations of pelagic fish in selected areas, including Western Africa and western South America (for further information, see <http://www.pml.ac.uk/globec/main.htm>.)

Harmful Algal Blooms (HABs)

The proliferation of certain marine microalgae increasingly causes harm to human health, coastal economies, fisheries, aquaculture and tourism, due to the potent toxins or the biomass they produce. In 2002, the IOC HAB Programme provided capacity enhancement opportunities, supported cooperative research projects, and maintained an international network among HAB researchers and managers. The joint IOC-SCOR science programme on the Global Ecology and Oceanography of Harmful Algal Blooms (GEOHAB) developed its Implementation Plan. The IOC Intergovernmental Panel on HAB reviewed progress and set programme priorities for 2003-05 (for further information, see <http://ioc.unesco.org/hab/default.htm> .)

Geosphere – Biosphere Interactions

As a major first step towards establishing an IOC programme on the geosphere-biosphere coupling in relation to the protection of the marine environment of the high seas, the International Conference on Geosphere/Biosphere/Hydrosphere Coupling Processes was held in Aveiro, Portugal, 30 January-2 February. A three-month "training-through-research" cruise (TTR-12) to the Mediterranean Sea, Northeast and Central Atlantic provided for capacity building in interdisciplinary research on the geosphere-biosphere interaction to over 70 students and young researchers from 13 countries of East and West Europe, North Africa, Latin America, and Southeast Asia. Results of the TTR-11 cruise (2001) and of the Aveiro Conference were published. The TTR Web site, presenting the programme's results since its establishment in 1991, was launched and can be accessed at <www.ioc.unesco.org/ttr>.

Red Tide in Seto Inland, Japan
© *WESTPAC-HAB 2002*

Integrated Coastal Area Management (ICAM)

Recognizing the need to better harmonize and understand how ICAM projects around the world are performing and, in particular, whether the environment and local communities are really benefiting from its approach, the IOC/ICAM programme launched a new initiative on the development of indicators and assessment frameworks for ICAM. This was achieved through the organization of an international workshop in Ottawa, Canada, April 29-May 1, sponsored by the Department of Fisheries and Oceans (DFO) and NOAA. As a result, a *Reference Guide on the Use of Indicators* (Manual and Guide No. 45) will be published, and an international research project launched in 2003.

2002 saw the conclusion of the African Process for the Development and Conservation of the Marine and Coastal Environment. This was a two-year project (in which IOC/ICAM played a leading role, together with UNEP and the Advisory Committee on the Protection of the Sea [ACOPS]) financed by the Global Environment Facility (GEF) that gave rise to the development of a portfolio of 20 projects addressing the main issues of degradation of the coastal and marine environment in the 11 participating countries. In order to develop and finalize the portfolio, IOC/ICAM organized five regional meetings (Accra, Abidjan, Abuja, Johannesburg, Dakar). A Partnership Conference was organized during the World Summit on Sustainable Development in order to secure the support of the donor community for these projects, and was attended by eight African Heads of State. As a result of this high political support, the African Process Portfolio has now been integrated into the New Partnership for Africa's Development (NEPAD) Environment Action Plan <www.ioc.unesco.org/icam>.

IOC's CO_2 Panel: 20 years of working on "a complex and vast puzzle"

Maria Hood, Programme Specialist for the Intergovernmental Oceanographic Commission of UNESCO's Ocean Science Programmes, discusses IOC's role in assessing the profound alteration of Earth's global carbon cycle and the oceans' increasing absorption of carbon dioxide (CO_2) caused by the burning of fossil fuels. Present levels of CO_2 are the highest in 400,000 years—a fact that poses real concerns for global climate change, weather-related disasters, and the spread of diseases. IOC, through its international and intergovernmental partnerships and the CO_2 Panel's Ocean Carbon Programme, is tackling the standardization of measurement techniques in an effort to investigate exactly how CO_2 acts in the ocean, and how much of it is actually being taken up as a direct result of human activities.

Challenges of a Changing Climate: the IOC's Ocean Carbon Programme

The Call for International Coordination of Research and the Birth of the IOC

During the International Geophysical Year (IGY) of 1957–58, Roger Revelle led an international group to coordinate oceanographic exploration under the IGY banner, and two years later, an international oceanographic expedition that would later be called "the assault on the largest unknown—the International Indian Ocean Expedition." It became clear to Revelle and many others that the enthusiasm of an international group of scientists to work together was not sufficient to tackle the scale and complexity of such expeditions, and that there was a real need for an intergovernmental mechanism to obtain formal agreements and commitments from governments. Having been a founding member of the 1955 UNESCO International Advisory Committee on Marine Sciences, Revelle returned to UNESCO for the 1960 Intergovernmental Conference on Oceanographic Research and recommended the establishment of an Intergovernmental Oceanographic Commission (IOC). In 1962, the IOC took over the lead for the coordination of the International Indian Ocean Expedition, with the Scientific Committee on Oceanic Research (SCOR) serving as the scientific advisory group.

Figure 1. Ocean carbon chemist, climatologist, and founding father of the IOC: Roger Revelle, 1909-1991, USA
Courtesy of Mandeville Special Collections Library, UCSD

Today, the IOC is still guided by this original mandate "to promote international cooperation and to coordinate programmes in research, services and capacity-building." (IOC *Statutes,* Article 2.) 40 years after its creation, the IOC continues to lead international efforts to investigate the largest unknowns—expeditions not driven solely by the spirit of discovery, but rather by the growing concerns of society about a changing climate. Human activities have profoundly altered the Earth's global carbon cycle. These alterations are linked to globally rising temperatures, increases in severe weather events, and an ever-shifting and currently unpredictable pattern of droughts, floods, famine, and disease. We are now faced with a scientific and societal challenge of daunting proportions—determining if, and how, humans can manage the global cycle of one of the Earth's key elements.

Challenges of a Changing Climate

The earliest concerns about adding excess CO_2 to the atmosphere from the burning of fossil fuels were not taken seriously because of the belief that the oceans would absorb most of the industrially produced CO_2 emitted to the

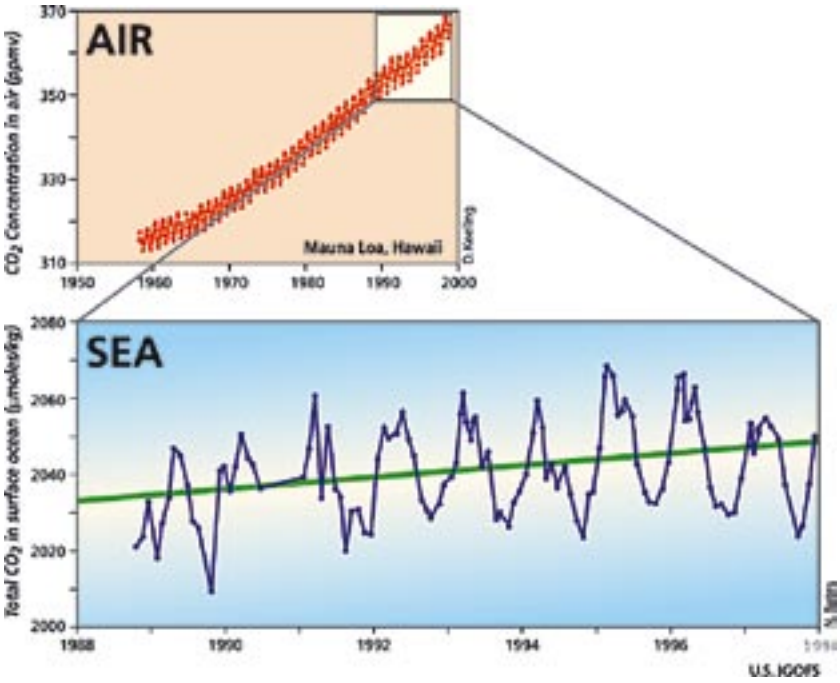


Figure 2. Atmospheric concentrations of CO_2 over time measured in the air at the Mauna Loa Observatory in Hawaii and in the sea at the Bermuda Atlantic Times Series Station. Courtesy of U.S. JGOFS.

atmosphere. A paper published in 1957 by Revelle and Hans Suess sounded the alarm. Their calculations showed that ocean uptake of CO_2 was much slower than originally thought, and that the oceans could absorb no more than 50 percent of the carbon dioxide being emitted annually by the burning of fossil fuels. The remainder would build up in the atmosphere, where it would increase the atmosphere's ability to trap heat, producing a "greenhouse effect." In 1958, Charles David Keeling began making the first high-quality measurements of atmospheric CO_2 at the Mauna Loa Observatory in Hawaii, and soon after gave the world proof that the concentration of CO_2 in the atmosphere was increasing rapidly. 25 years later, a time history of ocean carbon dioxide began at the Bermuda Atlantic Time Series Station and documented the slow penetration of this excess CO_2 into the surface oceans.

Many were convinced that this growth in CO_2 was the result of human activities. Critics argued that this was part of the natural carbon cycle, pointing out that carbon concentrations in the atmosphere vary greatly in response to the planet's natural oscillation between glacial and interglacial periods. The only way to find out where we were on this natural climate cycle was to reconstruct the past atmospheric CO_2 history by analysing the gas concentrations in bubbles trapped, year after year, in snow layers of the Arctic and Antarctic ice sheets.

"Estimates suggest that the ocean is presently taking up about 30-40 percent of fossil fuel CO_2"

In 1998, a team of French, Russian, and American scientists succeeded in recovering the deepest ice core ever drilled—3,623 meters long—from the Russian Vostok station in Antarctica. This record captures four full climate cycles spanning more than 400,000 years, and has provided numerous insights about the Earth's carbon and climate cycles. Between glacial and interglacial periods, atmospheric CO_2 concentrations have oscillated regularly between approximately 180 parts per million by volume (ppmv) during the cold periods, and 280 ppmv during warm periods. (See figure 3, next page.)

The exact causes-and-effects of events that lead to this oscillation are not yet fully understood. But one thing is clear: present atmospheric CO_2 levels (~370 ppmv) are now higher than experienced on the planet for at least the last 400,000 years. Other evidence suggests these concentrations have not been seen in the last 20 million years. Today there is little doubt about the cause of increasing atmospheric CO_2 and a real concern about the effect this will have on climate: "the balance of evidence suggests a discernible human influence on climate." (Intergovernmental Panel on Climate Change, Third Assessment Report.)

The ocean is the largest mobile reservoir of carbon on decadal to millennial time-scales, and its complex physical, chemical, and biological processes play significant roles in both absorbing and releasing carbon dioxide. Understanding its behaviour is crucial for understanding the global carbon cycle and its effect on climate. International research programmes such as the World Ocean Circulation Experiment (WOCE) and the Joint Global Ocean Flux Study (JGOFS) have provided us with the first global view of ocean carbon dynamics, and estimates suggest that the ocean is presently taking up about 30-40 percent of fossil fuel CO_2 emissions. We know that both the location and amount of this ocean uptake changes with regional climate perturbations such as El Niño events.

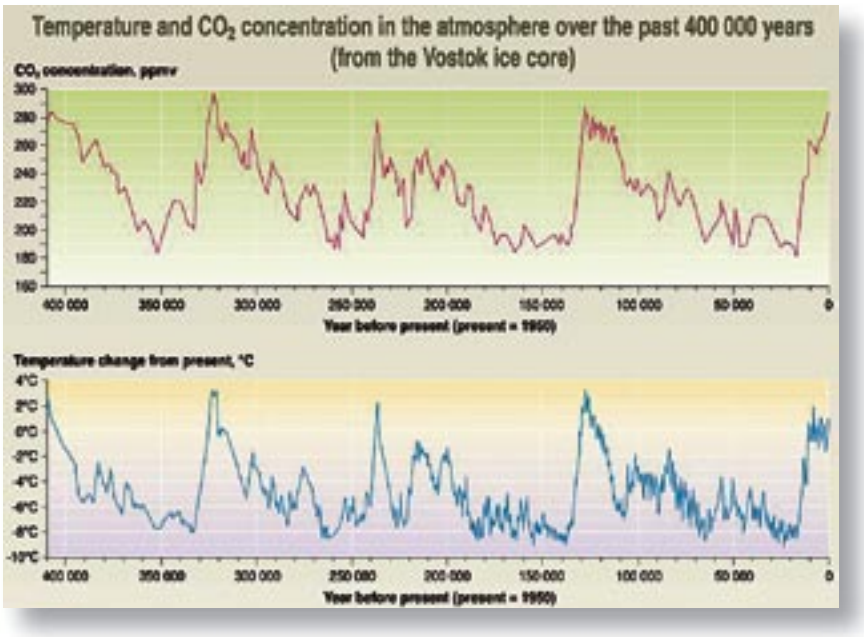


Figure 3. Historical reconstruction of atmospheric CO_2 concentrations and temperature from the Vostok Ice Core. J.R. Petit, J. Jouzel *et al.*, *Nature* 399, 429-436, 1999. *Courtesy of ClimateArk and UNEP GRID-Arendal.*

We also know that the natural, long-term storage of atmospheric CO_2 in the deep ocean acts to decrease potential climate impacts. But the future behaviour of the oceanic sink is problematic, depending upon possible changes in ocean circulation and marine biogeochemistry. After more than 20 years of investigation, we still are unable to fully answer basic questions about the ocean carbon cycle with much certainty:

- How large are present-day oceanic carbon sources and sinks, where do they operate, and what processes are controlling them?
- How will oceanic carbon sources and sinks behave in the future under higher CO_2 and a possibly altered climate and ocean circulation?
- How and where will we monitor the ocean carbon cycle, assess our forecasts of future oceanic sink behaviour, and determine the effectiveness of any deliberate attempts to store excess CO_2 in the deep ocean?

Facing the Challenge with a Unified Strategy

Faced with such a complex and vast puzzle, the need for international and intergovernmental cooperation becomes clear. The challenge isn't simply one of coordinating observations over large space and time scales, but one that is complicated by the very nature of ocean carbon itself, requiring specific international agreements on measurement techniques and standards. The annual increase in ocean carbon is very small (about 0.1 percent) compared to the natural ocean carbon concentrations and variability over an annual cycle. Using our best technology, we still have some difficulty distinguishing between this yearly accumulation and uncertainties in our measurement techniques. In the early 1980s, experiments to determine if different measurement techniques were giving different values for the same water sample showed that the differences between measurement techniques were greater than the expected accumulation of CO_2 in the ocean over a 20-year period! The differences between these techniques had to be documented and corrections applied to the data to assemble usable data sets from these early programmes. Unfortunately, with no single standard for applying corrections, the data from this period are compiled into several data sets; each corrected using a different set of standards and assumptions.

As the international ocean carbon community mounted the Global CO_2 Survey as part of the WOCE and JGOFS programmes in the early 1990s, finding ways to make comparable measurements and consistent data sets based on many individual national programmes became a priority. At that time, there was no single international group to coordinate or implement such a programme. The science was led by a team from the U.S. Department of Energy, with international scientific oversight provided by the JGOFS Scientific Steering Committee and communicated to the larger community by the IOC–JGOFS CO_2 Panel. In this programme, the international community reached initial agreements on standardized instrumentation and methods for sampling, analysis and data processing, and widely disseminated this information through the publication of a Methods Handbook. The development and use of certified reference materials enabled scientists to verify the performance of their at-sea measurement systems and provide a way to directly compare their results to those of other scientists using other analytical techniques. The framework for international coordination, established as part of the Global CO_2 Survey Programme, still guides the core activities of the CO_2 Panel today.

IOC's Call and Response

The IOC is called on both directly and indirectly by several UN conventions and intergovernmental bodies to carry out assessments and investigations of the ocean's role in the global climate and carbon cycle (see illustration.) 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 and, in 1984, the CCCO established a CO_2 Advisory Panel. For 20 years, the CO_2 Panel has been IOC's main instrument to meet the calls of intergovernmental conventions and of the international research community for the study of ocean carbon.

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As an intergovernmental organization, however, the role of the IOC in the study of the ocean is distinctly different from that of non-governmental programmes. The IOC does not conduct or sponsor research. Instead, its mission is to encourage nations to work together, to facilitate the compilation and assessment of results, and to introduce these findings back into the research community and national, regional, and intergovernmental decision-making processes. The necessary coordination for this can only be accomplished at the international level, and the IOC has been asked to play a leading role.

In 2000, the IOC's CO_2 Panel began developing a comprehensive ocean carbon programme to address these issues and to respond to intergovernmental needs for high-quality ocean carbon data for global modelling and assessment activities. Programme activities are addressing:

Observations

The CO_2 Panel has joined forces with the IGBP-IHDP-WCRP Global Carbon Project to develop a joint pilot project called the International Ocean Carbon Coordination Project (IOCCP). This pilot project and its headquarters at the IOC will serve as a central point of coordination for ocean carbon observation activities and the support services needed to create a global view of ocean carbon from many individual ocean carbon observation and research programmes (<http://ioc.unesco.org/ioccp>.) The IOCCP is working on targeted projects with the following Partners to integrate ocean carbon observation plans and strategies into the framework of international activities:

- Climate Variability and Predictability Study (CLIVAR)
- Surface Ocean–Lower Atmosphere (SOLAS) Study
- Integrated Marine Biogeochemistry and Ecosystems Research (IMBER) Programme
- The North Pacific Marine Science Organization (PICES) ocean carbon working groups
- Joint Technical Commission for Oceanography and Marine Meteorology Ship Observations Team (JCOMM SOT)
- International Ocean Colour Coordinating Group (IOCCG)
- Global Ocean Observing System (GOOS)
- Global Climate Observing System (GCOS)
- Integrated Global Observing Strategy (IGOS)

The IOCCP is also working with the IOC and the World Meteorological Organization (WMO) to facilitate the permission process for ocean carbon measurements in territorial waters.

Research

The CO_2 Panel facilitates ocean carbon research through co-sponsorship of working groups, the development of syntheses and assessments on specific topics, and providing reviews and advice for better coordination of ocean carbon research in global research programmes. The Panel has developed and maintains a Watching Brief on ocean carbon sequestration science, and is developing an international symposium to produce a peer-reviewed synthesis of science in this field. This synthesis is being developed in cooperation with the Intergovernmental Panel on Climate Change (IPCC) *Special Report on Carbon Dioxide Capture and Storage*. The Panel is a co-sponsor of the Surface Ocean–Lower Atmosphere Study (SOLAS) working group on air-sea fluxes of CO_2. In response to requests from SCOR and IGBP, the Panel will provide a forum for review and coordination of carbon research carried out as part of these programmes.

Standards

One of the most important functions of the Panel is to provide a forum for agreements on methods, data formats, standards, and intercalibration exercises. Targeted activities include an intercalibration exercise for underway pCO_2 sensors, a workshop for data and metadata formats for underway measurements, advocacy for continuing support and expansion of the certified reference materials programme, and publication and translation of an updated *Handbook of Methods for the Analysis of the Various Parameters of the Carbon Dioxide System in Sea Water.*

Regions

The CO_2 Panel and its IOCCP are working with regional groups to develop internationally consistent plans for ocean carbon research and observations and collaborative analysis of data on basin and global scales. The IOCCP serves as the international coordination mechanism for the IOC-

Estimates suggest that the ocean is presently taking up about 30–40 percent of fossil fuel CO_2 emissions

CP-appointed ocean carbon representatives on the CLIVAR basin panels for the Atlantic, Pacific, Indian, and Southern Oceans. The Panel carries out joint activities with the North Pacific Marine Science Organization (PICES) working groups in the Pacific, the CARbon IN the Atlantic (CARINA) project in the Atlantic, and several new national and regional activities currently being proposed.

Training

The IOC, through the CO_2 Panel, sponsors training workshops focusing on ocean carbon and climate. In 2003 the Panel will sponsor the SOLAS Summer School at the University of Corsica for graduate students on air-sea interactions and biogeochemical cycling, and a summer course at the Abdus Salam International Center for Theoretical Physics on Climate Variability Studies in the Ocean. Based on the new *Handbook of Methods* (October 2004) the IOCCP will organize a series of training workshops on ocean carbon measurement techniques.

Data Exchange, Products, and Publications

The Panel and IOCCP are working to develop cooperative agreements between scientists on data sharing and collaborative data syntheses, and establishing a coordinated network of regional data centers with:

- PICES PICNIC (Japan)
- CARINA (Europe)
- WDC-MARE (Europe/global)
- CDIAC Ocean CO_2 Programme (USA/global)
- Global Hydrographic Project Office (USA/global)

Initial plans for data release, data management plans, and cooperation have been developed. The IOCCP is actively involved in facilitating the development of basin-scale and global data sets and working with regional groups on issues of data sharing and collaborative analysis. Plans are evolving for a new Global CO_2 Survey that will produce a high-quality, uniformly calibrated ocean carbon data set (dissolved inorganic carbon, total alkalinity, and pCO_2) for the major ocean basins, with the IOCCP playing a central coordinating role.

Publications and Contributions of the Panel and IOCCP

CO_2 Panel Web site: <http://ioc.unesco.org/iocweb/co2panel>

IOCCP Web site: <http://ioc.unesco.org/ioccp>

IOC-SCOR *Ocean CO_2 Advisory Panel, First Session Report*. (September 2000) Available on Panel Web site or in hard copy from the IOC. Available from <http://ioc.unesco.org/iocweb/co2panel>

A Global Ocean Carbon Observation System: A Background Report, GOOS Report 118. (2002) Available from <http://ioc.unesco.org/iocweb/co2panel> or in hard copy from the IOC.

IOC-SCOR *Ocean CO_2 Advisory Panel, Second Session Report*. (February 2002) Available from <http://ioc.unesco.org/iocweb/co2panel>

Ocean Carbon Sequestration: A Watching Brief. (2002) Available from <http://ioc.unesco.org/iocweb/co2panel>

Ocean Carbon Observations from Ships of Opportunity and Repeat Hydrographic Sections: Results from the First Workshop of the International Ocean Carbon Coordination Project. (January 2003) IOCCP document 03/1, available on CD-ROM, or from <http://www.ioccp.org>

Sabine, C.L. and M. Hood, *New Levels of International Cooperation Among Ocean Carbon Scientists*. EOS Trans. AGU (June 10, 2003)

The Integrated Global Carbon Observing Strategy of the IGOS-Partners. (accepted June 2003) Draft available from the IGOS-P Web site: <http://www.igospartners.org>

The Global Carbon Project: the Scientific Framework and Implementation. In preparation. Draft available from the GCP Web site: <http://www.globalcarbonproject.org/>

The Second Report on the Adequacy of the Global Observing System for Climate. Available from the GCOS Web site: <http://www.wmo.ch/web/gcos/gcoshome.html>

International Calls for IOC's Ocean Carbon and Climate Programmes

The IOC was designated as the sub-task manager for the United Nations Conference on Environment and Development (UNCED) Action Plan for Global Sustainable Development (Agenda 21), Chapter 17, Programme Area E, "Addressing Critical Uncertainties for the Management of the Marine Environment and Climate Change." In this programme area, Section 17.102 on management-related activities states: "Recognizing the important role that oceans and all seas play in attenuating potential climate change, IOC and other relevant competent United Nations bodies, with the support of countries having the resources and expertise, should carry out analysis, assessments and systematic observation of the role of oceans as a carbon sink."

Similarly, the IOC is called upon in the United Nations Framework Convention on Climate Change (UNFCCC), Article 4 1(g), where all Parties to the Convention agree to promote and cooperate in the systematic observation and development of data archives related to the climate system. The Global Climate Observing System (GCOS) is the mechanism recognized by the Convention for facilitating this commitment, and the Global Ocean Observing System (GOOS) of the IOC is the ocean component of GCOS. In carrying out this commitment, the Parties have agreed to, *inter alia*, support and further develop, as appropriate, international and intergovernmental programmes and networks or organizations aimed at defining, conducting, assessing and financing research, data collection and systematic observation, taking into account the need to minimize duplication of effort.

In 1997, the UN-Interagency Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) issued a report on the storage of CO_2 in the deep sea, and recommended the IOC to monitor progress in research in this field and to stand ready to provide further advice on the subject should it be requested by the United Nations agencies.

The recent 2003 G8 Summit Action Plan on the Marine Environment states that, by acting in accordance with the relevant United Nations Conventions, the G8 countries will work towards sustainable fisheries and marine conservation. Specifically, the G8 countries commit to, *inter alia*, improving coordination and cooperation among national agencies and international organizations, notably the International Maritime Organisation (IMO), the FAO, the Intergovernmental Oceanographic Commission and the UN Environment Programme, including through capacity building to improve global assessment and reporting and strengthen science-based decision making.

Facing an Uncertain Future: Tracking the State of our Coral Reefs

Despite their huge importance to fisheries, coastal livelihoods, and economies, coral reef ecosystems are rapidly being degraded. To date, 27 percent of the world's reefs have already been lost, and 14 percent more are expected to decline within the next 20 years, according to a recent report published by the Global Coral Reef Monitoring Network (GCRMN). **Ole Vestergaard**, Programme Specialist with the Intergovernmental Oceanographic Commission of UNESCO's Ocean Science Programmes, looks at the stresses on coral reefs caused by human-related activities, as well as increased effects of global warming, and examines IOC's international efforts to arrest and reverse the current decline. By training researchers and managers, developing new tools and knowledge, coordinating observations, sharing information and data, and promoting a livelihoods focus in coastal management, IOC and its Partners are working towards the goals established by the World Summit on Sustainable Development for equitable and sustainable use of the world's coral reef resources.

Productive and complex, coral reef ecosystems sustain the livelihoods of millions of people living in tropical coastal areas. Some of these people are very poor and their daily survival depends on the reefs. Due to their high biodiversity, reefs support large stocks of fish, and generate food, income, and tourist revenues, while also protecting coastal settlements against wave action and rising sea levels.

Today, however, coral reefs are endangered ecosystems. Increasing stress—caused by land-based marine pollution, overfishing and destructive fishing practices, sedimentation due to mismanaged agriculture and deforestation, dredging and coastal construction—is seriously degrading coral reefs. This pressure is likely to increase in the future as a result of population growth and further coastal development.

Added to this, coral reefs are among the first ecosystems to show the impact of current trends of global warming. Elevated sea surface temperatures, combined with other factors, trigger mass coral bleaching (the loss of symbiotic microalgae from corals due to heat stress) and disease outbreaks, while climate change-related acidification of surface waters slows coral reef development and enhances erosion processes. A central question, therefore, is: Are coral ecosystems resilient enough to withstand current pressures, and/or are they able to adapt rapidly enough to the current predicted rate of change? If they are not, the results will be complex and wide-ranging negative impacts on the functioning of coral reefs and associated ecosystems.

The combination of human-caused stress and currently changing climate patterns is now seriously driving coral reefs into global decline.

Under healthy conditions, reefs are able to withstand certain amounts of environmental or human-caused stress. Coral bleaching is not a new phenomenon, although its frequency and intensity is increasing; the 1997-98 global mass bleaching event was the worst ever recorded. Due to their high biodiversity and complex functions, reef ecosystems, under healthy conditions, are resilient and have a natural ability to withstand certain levels of damage. However, when the stress accumulates beyond critical thresholds, reefs lose their ability to recover.

With current human-caused stress and trends in global climate, the world stands to lose its reefs, as we know them today, within a few decades (*Science* 301). A transition from coral reefs to algae-dominated coastal habitats is one of the outcomes that will alter the resources and goods currently generated by reefs, with severe consequences for the livelihoods of large reef-dependent coastal populations and society in general.

The third status report on the world's coral reefs, released in November 2002 by the Global Coral Reef Monitoring Network (GCRMN) of the IOC/UNESCO - World Conservation Union (IUCN) - United Nations Environment Programme (UNEP) - World Bank (WB), gave new pessimistic evidence on the declining trends for reefs, although it also reported some examples of successful management efforts reverting current trends of degradation Wilkinson, C. (ed.) (2002): *Status of Coral Reefs of the World: 2002*).

The reef-dependent coastal poor are those who suffer first when reefs decline, and therefore need urgent attention. Squeezed in their struggle for a daily livelihood, often with no other alternative than to use destructive harvesting practices, they are caught in the gaps between development and conservation objectives, marginalized by well-meaning but imbalanced conservation and management efforts, and sometimes ending up being treated as the 'enemies' of the reefs. While reefs do need protection, management interventions need to be holistic and incorporate the reef users in the planning and implementation processes. Cross-sectorial solutions are needed if we are truly serious about meeting the International Development Targets of halving world poverty by the year 2015, and fulfil the commitments made at the World Summit on Sustainable Development (WSSD) in September 2002, concerning an equitable and sustainable use of resources.

"The combination of human-caused stress and a changing climate is now seriously driving coral reefs into global decline"

The bleaching phenomenon, named for the white colour that the affected corals display (here on *Acropora* sp.,) results from stress on the coral animals. This causes corals to expel their zooxanthelle, or symbiotic algae, that give them their colour. One factor is high water temperature. Sustained bleaching will eventually kill the coral, although recovery to health and original colour can occur if the stress is removed.

What can be done?

The Intergovernmental Oceanographic Commission is very concerned about the predicted future for the world's coral reefs, and the critical situation this would cause for the many people in its Member States.

So what can be done? If we are to revert the current situation, human-caused stress on reefs must be effectively reduced. To achieve this, sound and holistic coastal management must be implemented, supported by effective intersectorial policymaking and planning, taking into account the needs of impoverished coastal populations. This, in turn, requires better knowledge, observations, and quality data and information on trends in reef status, reef use practices and social conditions, all targeted at more effective management. There is a need to develop or strengthen local, national, and regional infrastructures for management planning and policymaking processes. On the regional and global level, there is a need to strengthen collaboration on observations and share data and new information.

We also need to develop scenarios to predict how climate change may manifest itself, and show how livelihoods of coastal populations could adapt to respond to this change. This requires interdisciplinary targeted research to understand how a changing climate impacts key biological processes and ecosystem functions.

As a overarching principle, coastal management solutions need to address the issue of poverty and involve people in the planning and development process in order to avoid disproportionably affecting those who are the poorest, and who typically have no other alternative to the reefs to fall back on.

IOC strategy and key activities

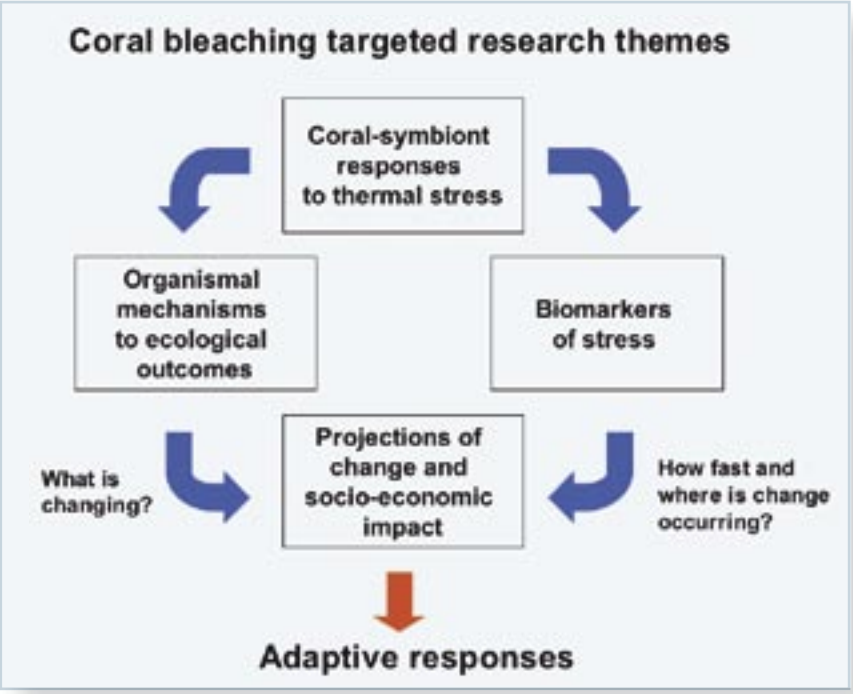
IOC works to revert the current decline of coral reefs through capacity building, targeted research and observations. This includes monitoring of status and trends, development of better knowledge and new tools, mitigating responses and management frameworks. In particular, IOC is concerned about the position of the poorest reef stakeholders in the development processes. The work is undertaken in corporation with a series of partners and agencies. IOC actively works to implement global frameworks such as the 'Call for Action' of the International Coral Reef Initiatives (ICRI), with its operational networks, as well as other pertinent fora, including the Integrated Global Observing System (IGOS). IOC pursues the commitments made at the WSSD in Johannesburg, September 2002, toward equitable and sustainable use of coral reef resources, and the International Development Goal of halving the world's severest poverty by the year 2015.

IOC is active in three areas addressing some of the core problems summarised above:

1. Understanding coral bleaching and predicting future change
2. Integrated coral reef monitoring – the GCRMN South Asia
3. Equitable and sustainable use of coral reefs

Understanding coral bleaching and predicting future change

Exactly how a changing climate may manifest itself on coral reefs and related ecosystems is not clear, although the signs



Investigative framework for targeted research on coral bleaching and associated effects

Global coral reef targeted research and capacity building network

so far point to severe negative impacts. Fundamental questions include:

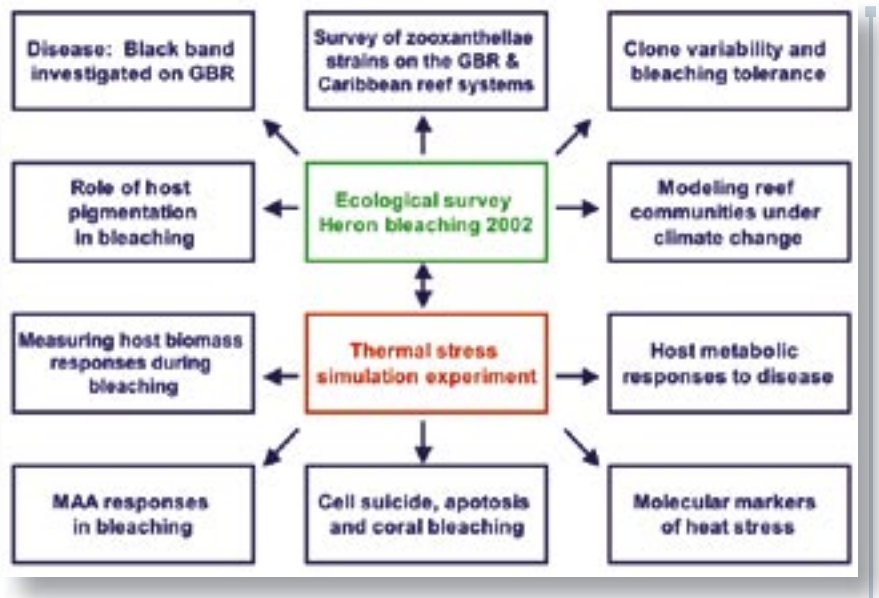
- How, and how fast, will change be occurring?
- Are reefs able to adapt to change?
- Are some coral species more robust at withstanding climate change than others?
- What are the impacts on associated fish communities?
- What are the impacts on coastal populations and wider societies depending on reefs?

To address such questions, IOC initiated an international expert group in the fall of 2000, the IOC Working Group on Coral Bleaching and Subsequent Effects, to integrate research efforts and further new findings into the development of indicators and other tools to observe, investigate, and predict key physiological and ecological processes and outcomes of coral bleaching.

The Coral Bleaching Group has subsequently linked up with five other research groups in a global research effort currently under development by the World Bank (WB) and the Global Environmental Facility (GEF). The objective of this initiative is to support and develop global targeted research that can address key questions relating to coral reef sustainability and resilience in the face of localised human stress and predicted climate change, and to develop reef management responses, tools, and policy advice. This effort will be implemented over the coming five years through a global network of collaborating universities and institutions in developing and developed countries.

2002 was a hectic year for the IOC/WB Coral Bleaching Group and involved two major field workshops to pilot future investigations and training activities.

A first Coral Bleaching Targeted Research & Learning Workshop was held on Heron Island, Southern Great Barrier Reef, 25 Feb–18 March, organised in partnership with the Centre of Marine Studies, University of Queensland, Australia. The workshop involved 30 scientists and 18 postgraduate students, who worked together on a large heat-simulation experiment in the laboratory, and on surveys on the surrounding reef. Hypotheses tested ranged through a series that was developed during earlier discussions. The coincidence of a major bleaching event across the Great Barrier Reef during the workshop led to some unusual opportunities for the targeted working group to pursue questions associated with a "natural" bleaching event. Among the highlights of the workshop were a major audit of symbiotic dinoflagellate strains, the discovery of new coral diseases for the GBR region, new insights into the role of cell suicide and apoptosis in bleaching, and the important role of



From molecular to local ecological aspects of coral bleaching
Joint heat simulation experiments, ecological surveys, scientific seminars and discussions reveal new insights on the impacts of climate change and the future state of coral reefs.

Collaborative heat-simulation experiment, Heron Island, Great Barrier Reef, Australia, March 2002. *Photo: Ove Hoegh-Guldberg*

Heron workshop, group photo.

clonal variability in coral stress tolerance. The seminar abstracts, which are collected in an IOC series, demonstrate the idea that encouraging collaboration of otherwise diverse groups of scientists is a successful stimulus to achieving the research that is so vitally needed to fill the critical knowledge gaps currently facing reef scientists, managers, and users.

A second 'test-of concept' workshop for the GEF/WB-IOC/UNESCO *Coral Reef Targeted Research Program* took place in Puerto Morelos, Mexico, 9-18 September, organised in partnership with the Institute of Marine and Limnological Sciences, National University of Mexico. It was equally successful, engaging 25 researchers and students from all over the world in further joint experiments, seminars, and discussions, and led to completion of the research and capacity building work plan, *Understanding Coral Bleaching Across Four Oceans*.

Outcomes: The expected outcomes of the Coral Bleaching Working Group over the next five years will be a more complete model of the mechanisms that trigger mass coral bleaching. This will enable better projections of the potential impact of climate change on coral reefs and associated after-effects, and also better prediction of the potential impacts on the human communities who depend on them.

A series of new tools and indicators will be developed, such as:

- Molecular markers that will rapidly and easily distinguish heat stress from other types of stress (e.g., sedimentation, metal contamination, nutrient stress) on coral reefs
- Cellular markers that will enable users to accurately anticipate and monitor the advent of coral bleaching or recovery
- Genetic markers that will enable insight into the tolerance and resilience of communities of reef-building corals

- Ecological markers that will enable users to monitor impacts of coral bleaching and to project how the changes are likely to impact on local ecosystem functions

The work will strengthen national capacities for research and management through the collaborative network of scientists and students from developed and developing countries engaging in targeted research and learning exchanges.

Project web site: <http://www.ioc.unesco.org/coralbleaching>

Integrated Coral Reef Monitoring – The GCRMN South Asia

The equitable and sustainable use of coral reef resources is critical if we are to maintain coral reefs and address the poverty of large numbers of reef-dependent coastal communities in tropical coastal areas. This can only be achieved to any great extent through informed and holistic reef management and policy development. The collection of key information on ecological status, environmental threats, reef use practices and social conditions, which is then effectively communicated to managers and policymakers in tailored formats and integrated into cross-sectorial planning, is a key principle in achieving more effective reef management. IOC is dedicated to building regional capacity and systems to provide such information through further development of the Global Coral Reef Monitoring Network (GCRMN).

Important steps in this direction have been taken by the GCRMN South Asia regional node in India, Maldives, and Sri Lanka, through a range of activities between 1997-2002, assisted by the UK Department for International Development (DFID) and IOC.

During 2002, GCRMN South Asia focused its efforts on developing and integrating the skills, expertise and information resources of the network partners into informing and influencing frameworks to better assist reef management planning and implementation. The GCRMN South Asia 'informing and influencing framework,' developed with the IMM Ltd., a UK based development and policy group, integrates the skills and outputs developed over five years of project activities. It involves a series of steps:

1. Understand the information needs for equitable and sustainable coral reef management planning, from community to governmental levels;
2. Develop skills and capacities to collect key information on reef status and reef user practices, including training in ecological and socio-economic monitoring techniques;
3. Undertake ecological monitoring and socio-economic assessments of reefs, using participatory livelihood assessment techniques;
4. Assist information sharing through information systems, networks, and partnerships among all relevant stakeholders, from local community to governmental levels;
5. Develop skills to use information to inform and influence management and policy processes;
6. Plan and implement management efforts for equitable and sustainable use of coral reef resources.

Simplistically summarised above, these are viewed by GCRMN South Asia as the fundamental first steps in the development of informed and integrated management interventions. In coming phases of GCRMN South Asia, it is envisioned that further strengthening of these skills and frameworks will lead to more effective and sustainable management of coral reefs.

(Top left) GCRMN South Asia name logo and GCRMN South Asia logo.

(Top) Coral reefs in South Asia and GCRMN South Asia training and monitoring demonstration sites (in red)
Map source: WCMC UNEP/ICRAN

Coordinated from the project office in Colombo, Sri Lanka by the GCRMN Regional Coordinator, Mr. Ben Cattermoul, three workshops were held in 2002 in Colombo (Sri Lanka), Male (Maldives), and Goa (India), to develop the skills of the GCRMN partners to inform and influence reef management planning and decision making.

One of the links in this management support chain completed in 2002 was the new *Regional Coral Reef Database* providing socio-economic and bio-physical data, background documents, guidance and strategies, details on on-going initiatives, national and regional contacts and partners, all to support regional networking and information sharing for improved management planning. The database can be downloaded from the GCRMN South Asia

Web site: <http://www.ioc.unesco.org/GRMN>.

Other important steps taken in 2002 were the establishment of National Coral Reef Stakeholders' Forums in both Sri Lanka and Maldives, while the Indian Coral Reef Monitoring Network (ICRMN), hosted by the Ministry of Environment and Forests, further strengthened its national activities.

A five-year regional review was undertaken by the GCRMN South Asia partners in November 2002, in Colombo, Sri Lanka, which led to a series of recommendations and a strategy paper on the next steps required to further implement the objectives of GCRMN South Asia.

All activities, outputs, and guidelines are presented in a series of working papers available from the GCRMN South Asia Web site: <http://www.ioc.unesco.org/gcrmn>.

Equitable and sustainable coral reef use: the complex relationship between poverty and reefs

While we value coral reefs as an important part of our global environment, many people, including some of the poorest in the world, depend upon reefs for their very survival. The relationship between poverty and reefs is complex and is only just beginning to be understood. However, there is a growing recognition that without a better understanding and consideration of poverty issues and the sustainable livelihoods of reef-dependent communities, coral reef conservation cannot meet its desired objectives.

The IMM Ltd., in parallel to working with GCRMN South Asia, and through support from DFID, in 2002 initiated a livelihoods assessment of the complex relationships between coastal poverty and reefs, with the goal of guiding future policy development and integrated reef management.

The "Reef Livelihood Assessment" is intended to provide background guidance discussion and policy development, and as a support to coral reef practitioners, managers, and agencies to address poverty and reef-related issues more effectively. It will include a global literature overview of what is known about poverty in coastal communities, and its relationship to coral reefs, supported by examples from case studies in India and Mozambique.

Cleaning the crab nets, Gulf of Mannar, India
© *Emma Whittingham, IMM Ltd.*

The study approaches the issue of reef management entirely from a "people and poverty" perspective. Most people view reefs from a predominantly resource-based perspective. They understand the people who interact with and use reefs in terms of what impact their activities have on reefs and how harmful impacts can be controlled or minimized to ensure reef conservation. In the global overview, it is attempted to view reefs in terms of those who are dependent on reefs for their livelihoods, how the reefs benefit them, how changes in the reefs have impacted their lives, and how they have responded and coped with these changes. It also considers wider responses to reef issues and how these interventions have impacted on the lives of the poor.

In 2002, local groups carried out field assessments, using a new participatory livelihoods assessment methodology. In India, research was undertaken with partners of GCRMN South Asia, trained in socio-economic monitoring and livelihoods assessments techniques. The initial findings of the studies indicate a very high dependence of poor people on coral reefs and associated resources, not only in economic terms, but socially and culturally as well. However, it also indicates that poor coastal communities are often not effectively included in reef management planning and implementation.

The work will be completed and published in 2003 by IMM–IOC/UNESCO–DFID, under the working title *Poverty & Reefs*. Further details are available at: <http://www.ex.ac.uk/imm/Poverty&Reefs.htm>.

Learn more

For further details on IOC activities on coral reefs, visit the project Web sites with working papers, reports and other information products, or contact Ole Vestergaard at email o.vestergaard@unesco.org.

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An Overview of the Year 2002 in IOC's

Ocean Services

By Peter Pissierssens, Head of Section

Development of Standards

Contribution by IODE to the development of a marine XML as a standard for Internet-based data interchange.

The Intergovernmental Oceanographic Commission of UNESCO, together with nine European partners, successfully applied for funding from the European Commission for the project titled, "Marine XML: A Pre-Standardization Development for Marine Data Interoperability Using XML." This project is being implemented over a period of two years (2003-04). The aim of Marine XML is to demonstrate that eXtensible Mark-Up Language (XML) technology can be used to develop a framework that improves the interoperability of data for the marine community and specifically in support of marine observing systems. The Marine XML project will realize a working prototype "Marine Mark-Up Language" (MML).

IOC co-organized with the International Council for the Exploration of the Sea (ICES) the 1st Session of the "IOC Study Group on the Development of Marine Data Exchange Systems using XML" (SGXML) in Helsinki, Finland, 15-16 April 2002. Participants at the meeting discussed developments in XML in their respective countries and formulated an Action Plan for the inter-sessional period. This Action Plan included defining a parameter dictionary, investigating and testing the use of XML to tag oceanographic point data, and constructing a general metadata model and mapping between existing metadata directories (including the IOC Marine Environmental Data Information Referral Catalogue (MEDI) system). The Group agreed to establish a Marine XML community portal Web site to be hosted by IOC <http://www.marinexml.net>.

Contribution by IODE to the development of a global directory system (MEDI) for databases, data catalogues, and data inventories

MEDI is designed for a broad user community, including IOC programmes, such as GOOS, and related activities within other global and regional programmes.

The objectives of MEDI are to maintain a global inventory of data holdings held in the IOC Member States and agencies. The MEDI metadata authoring tool was finalized, enabling scientists to describe data sets that they have collected into a metadata system that they can install on their office or field PC. This metadata system can be searched and data can be retrieved from, or uploaded to, the holding data centre. A Web-based metadata repository has also been established and is hosted by IOC/IODE on <http://ioc.unesco.org/medi/>.

Marine Information Management: IODE Group of Experts on Marine Information Management (GE-MIM)

The 7th Session of the IODE Group of Experts on Marine Information Management was held at UNESCO Headquarters, Paris, France, 23-25 October 2002. A comprehensive work plan with 32 action items was prepared. Details are available on <http://ioc.unesco.org/iode/contents.php?id=113>.

Ocean Information Technology Pilot Project

The 1st Session of the Steering Team of the Oceans Information Technology pilot project (ST-OIT) was held in Brussels, Belgium, on 29 November 2002, hosted by the Research and Development Department, Scientific Technical and Cultural Affairs (OSTC).

The Session members discussed the origins of the OIT pilot project initiative and presented an overview of current national and programme activities. The Session discussed the specific components of the OIT pilot project (metadata systems; data circulation and communication; data assembly, quality control and quality assurance; data archival; and user interface.) The Session developed an Action Plan based on the agreed action items arising from the meeting and assigned tasks to each member of the Group. More information on OIT can be obtained from the OIT Web site, hosted by IOC/IODE on <http://www.oceans-it.net/>.

Capacity Building

Development of comprehensive Ocean Data and Information Network (ODIN) projects in developing regions

Designed to assist developing countries with the establishment of national ocean data and information facilities,

to provide developing countries with access to up-to-date ocean data and information, and to foster the full and active participation of developing countries in the Internet-based society.

Africa Region

The implementation of the Ocean Data and Information Network for Africa (ODINAFRICA) continued with the organization of the 2nd ODINAFRICA Ocean Data Management-Training Course (Tunis, Tunisia, 29 April-10 May 2002) and the 2nd ODINAFRICA Ocean Information Management-Training Course (Tunis, Tunisia, 29 April-10 May 2002). 36 participants attended the two events, 20 from African countries, as well as seven lecturers. The courses were fully hands-on and were the second in a series of three 10-day training courses providing starting ocean data and information managers of the 20 ODINAFRICA participating countries with a basic training that will enable them to establish and maintain oceanographic data and information centers, share resources in Africa, and develop ocean data products and services for a variety of users. A special remedial training course in marine data management for Côte d'Ivoire was held in Abidjan, 21-29 March 2002,

Madagascar National Centre of Oceanographic Research
© Dominique Roger, UNESCO.

hosted by the Centre de Recherches Océanographiques (CRO).

Three new data centres were established in 2002 as part of the ODINAFRICA network.

The 3rd ODINAFRICA Review and Planning Workshop was held 19-23 November 2002 in Limbe, Cameroon, and was attended by all 20 ODINAFRICA partner countries. The Workshop reviewed progress made in 2002 and discussed the work plan for 2003. The Workshop also had preliminary discussions on the possible third phase of the ODINAFRICA project, and recommended that it should be a cross-cutting initiative linking IODE, GOOS and the Integrated Coastal Area Management (ICAM).

More information on ODINAFRICA can be obtained from the Web site <http://www.odinafrica.net> (hosted by IOC/IODE.)

Caribbean and South America Regions

The development of the Ocean Data and Information Network for the Caribbean and South America regions (ODINCARSA) started this year with the first ODINCARSA ocean data management-training course (Guayaquil, Ecuador, 20-31 May 2002.) Eleven participants from nine countries, and two lecturers, attended the event. This was followed by the first ODINCARSA training course in marine information management (Mazatlan, Mexico, 29 September-4 October 2002) attended by 17 participants from 13 countries.

A dedicated Web site was established on <http://www.odincarsa.net>, hosted by IOC/IODE and maintained by the ODINCARSA coordinator R. Martinez (Ecuador).

Other Regions

The IODE Regional Training Course in Data Management for the Caspian and Black Sea was held in Teheran, Iran, 20-30 October 2002, and was organized in cooperation with, and kindly hosted by, the Iranian National Center for Oceanography (INCO). Students attended the course from seven Caspian and Black Sea nations: Azerbaijan, Georgia, Islamic Republic of Iran, Romania, Russia, Turkey, and Ukraine. Resource personnel from the Islamic Republic of Iran and the IOC provided lectures.

Implementation of national and regional GODAR (Global Oceanographic Data Archaeology and Rescue) projects for the rescuing of endangered ocean data sets

With support from the Government of Flanders (Belgium) within the framework of the ODINAFRICA project, a CD-ROM was prepared by the Ocean Climate Laboratory of the National Oceanographic Data Centre of the United States (US-NODC) holding thousands of previously unavailable data sets collected around Africa. These data sets were digitized from various sources, quality controlled, and now made available to ODINAFRICA Member States on CD-ROM, and online via the Ocean Teacher Web site. (See: <http://ioc.unesco.org/oceanteacher/RegionalData/IOCINCWIO%20Data/index.htm> and <http://ioc.unesco.org/oceanteacher/RegionalData/IOCEA%20Data/index.htm>.)

OceanPortal: Global referral system for ocean data and information

OceanPortal <http://www.oceanportal.org> continued its development and reached 3,500 sites in December 2002. OceanPortal was adopted by the International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC) as a major Web reference tool.

Strengthened cooperation by IODE with ocean research and monitoring communities and contribution to open access to ocean data and information at all levels of society

The 2nd Session of the IODE Steering Group for Global Ocean Surface Underway Data (SG-GOSUD), previously known as SG-USSSDAP, was held in Ottawa, Canada, 16-17 September 2002, and was hosted by the Marine Environmental Data Service (MEDS). The objective of the project is to organize underway surface data that are currently collected, and to work with data collectors to improve data collection to meet the benchmarks of spatial and temporal sampling and data accuracies as set out by the Ocean Observations Panel for Climate (OOPC).

The 'Colour of Ocean Data' symposium was organized 25-27 November 2002, in the Palais des Congrès in the centre of Brussels, Belgium, by the Flanders Marine Institute, the Intergovernmental Oceanographic Commission of UNESCO, the Office of Scientific, Technical and Cultural Affairs of the Belgian Government, and the Census of Marine Life. Nearly 200 participants were registered; there were 44 oral presentations, 40 poster presentations, and eight demonstrations. The objective of the symposium was to bring together different communities with an interest in marine sciences and information management. Along one divide, participants from the physical oceanographic data management were invited, as were the marine biology data managers. Along a second divide, marine/oceanographic data managers were confronted with the user communities, mainly scientists and policymakers.

Colour of Ocean Data (COD) Symposium logo *Courtesy VLIZ*

Opening Session of the Colour of Ocean Data Symposium, Brussels, Belgium. From left to right: Mr. Frank Demeyere (Strategic Services and Secretariat of the Deputy Prime Minister and Minister for the Budget and Public Enterprise, Belgium), Dr. Rudy Herman (Ministry of Flanders, Science and Innovation Administration, Belgium), Dr. Patricio Bernal (IOC), Dr. Mark Costello (Huntsman Marine Science Center, Canada).
© Photograph by Misjel Decleer/VLIZ

General Bathymetric Charts of the Oceans (GEBCO) and Ocean Mapping (regional bathymetric charts)

The main GEBCO activities in 2002 were focused around the compilation of new data for the 6th Edition, and also on the constitution of a high resolution (one minute) grid to be incorporated in the 3rd Edition of the GEBCO Digital Atlas (DGA) published at the end of 2002 by the British Oceanographic Data Center (BODS), and is now available for users. Additionally, the GEBCO Guiding Committee was concentrated on preparation for the GEBCO Centenary Conference, scheduled for 14-16 April 2003 in Monaco, and organized and co-sponsored jointly by IOC and IHB. The Centenary Volume was published in The Netherlands and will be available during the GEBCO Centenary Celebration. The GEBCO Sub-Committee for Under Feature (SCUFN) advanced considerably in 2002, and approved more than 400 new geographical names. The 13th GEBCO Officers meeting, jointly organized by IOC and IHB, took place at the University of Durham, USA, in May 2002.

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

The last in the Geological/Geophysical Series of IBCM, The Seismicity Chart, was printed by HDNO, Russia, and widely distributed to users. Editorial Board activities mainly focused on the compilation of new multi-beam data available in Scientific Institutions and Hydrographic Offices of the Black Sea and Mediterranean region. The 12th Conference of the Mediterranean and Black Sea Hydrographic Commission strongly supported the production of a

Centenary Edition of the GEBCO Digital Atlas, published on CD-ROM on behalf of the Intergovernmental Oceanographic Commission and the International Hydrographic Organization by the British Oceanographic Data Centre, UK. <http://www.ngdc.noaa.gov/mgg/gebco>

CD-ROM version of the 2nd Edition of IBCM, and urged Member States of the International Hydrographic Organization (IHO) to contribute their data.

International Bathymetric Chart of the Western Indian Ocean (IBCWIO)

Sheets 03,06,09,04,07,10 printed by HDNO (Russia) and BSH (Germany) are now available for users. Since the compilation of new data was continuing successfully by correspondence, it was decided to postpone the 6th Session of the IBCWIO Editorial Board to November 2004.

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

At present, the IBCCA project is one of the most successful in the framework of the Ocean Mapping programme. The compilation of 95 percent of IBCCA sheets has been accomplished and now exists in digital form. The problem of printing of paper version was solved and sheets 1.01, 1.02, 1.03, 1.04, 1.05, 1.07, 0.09, 1.11 were printed by INEGI in cooperation with the Hydrographic Office of the Mexican Navy, and are now available to users. Since the IBCCA project was successfully developed in 2002 by correspondence, it was agreed to postpone the 9th Session of the Editorial Board, combined with the advanced training courses for South America's cartographers in marine cartography, to March 2003. The National Geophysical Data Center (NGDC) and the National Oceanic and Atmospheric Administration (NOAA) kindly agreed to host and co-sponsor the above-mentioned Session in Boulder, CO, USA.

International Bathymetric Chart of the Central Eastern Atlantic (IBCEA)

The sheets printed in SHOM (France) in 2002 are now available for users. In addition, sheet 04 has been completely digitized and introduced into the Centenary Edition of the GEBCO Digital Atlas (GDA). The paper version will be prepared by SHOM from the digitized chart included in GDA. Sheet 05 is now also ready for printing. It was decided not to have an Editorial Board meeting for IBCEA, before completion of the 12 bathymetric sheets.

International Bathymetric Cart of the Western Pacific (IBCWP)

Countries of the region, including China, Japan, and Russia, provided bathymetric data collected in 2002 for incorporation into the 3rd Edition of the GEBCO Digital Atlas. The 4th meeting of the IBCWP is planned to be in 2004.

International Bathymetric Chart of the Arctic Ocean (IBCAO)

The IBCAO Editorial Board decided to print a chart with the same cartographic parameters as GEBCO sheet 5.17, published by the Canadian Hydrographic Service. Accordingly, this chart was constructed in 2002 from an updated grid and presented to the 2nd meeting of the IBCAO Editorial Board in October 2002, in Honolulu, HI, USA. This new chart is more detailed and accurate than the GEBCO chart, which is hardly surprising in view of the paucity of information available to the builders of the earliest product. Data control for the new chart is available as a set of color-coded plots that show the locations and sources of data points. Other parameters, such as gravity and magnetic anomalies, physiographic provinces of the sea floor, and limits of regional seas, have been overlaid on the basic bathymetry.

International Bathymetric Chart of the EAST South Pacific (IBCSEP)

Chile, Colombia, Ecuador, and Peru are working with the objective of showing results to the 2nd meeting of the IBCESP Editorial Board in November 2003, in Lima, Peru. The color proof of Sheet 6 has already been prepared by the Hydrographic office of Chile.

Advanced Training in Marine Cartography

Advanced Training in Marine Cartography was organized and co-sponsored jointly by IOC, the National Geophysical Data Center (NGDC), and NOAA in Boulder, CO, USA, in February 2002, with the main objective being to increase knowledge in bathymetric data collection. Cartographers from South America were successfully trained for two weeks in modern hydrographic survey technology, in order to contribute in future to IBCESP implementation. The representatives of Madagascar were also trained in SHOM on a one-month training course in marine cartography, sponsored by IOC.

ITSU/IDNDR: Tsunami Warning System Development

Support to the International Tsunami Information Centre (ITIC) was provided in 2002. The International Workshop on "Local Tsunami Warning and Mitigation" was held 10-15 September 2002 in Petropavlovsk-Kamchatskiy, Russia.

An Overview of the Year 2002 in IOC's

Operational Observing Systems

By Colin Summerhayes, Head of Section

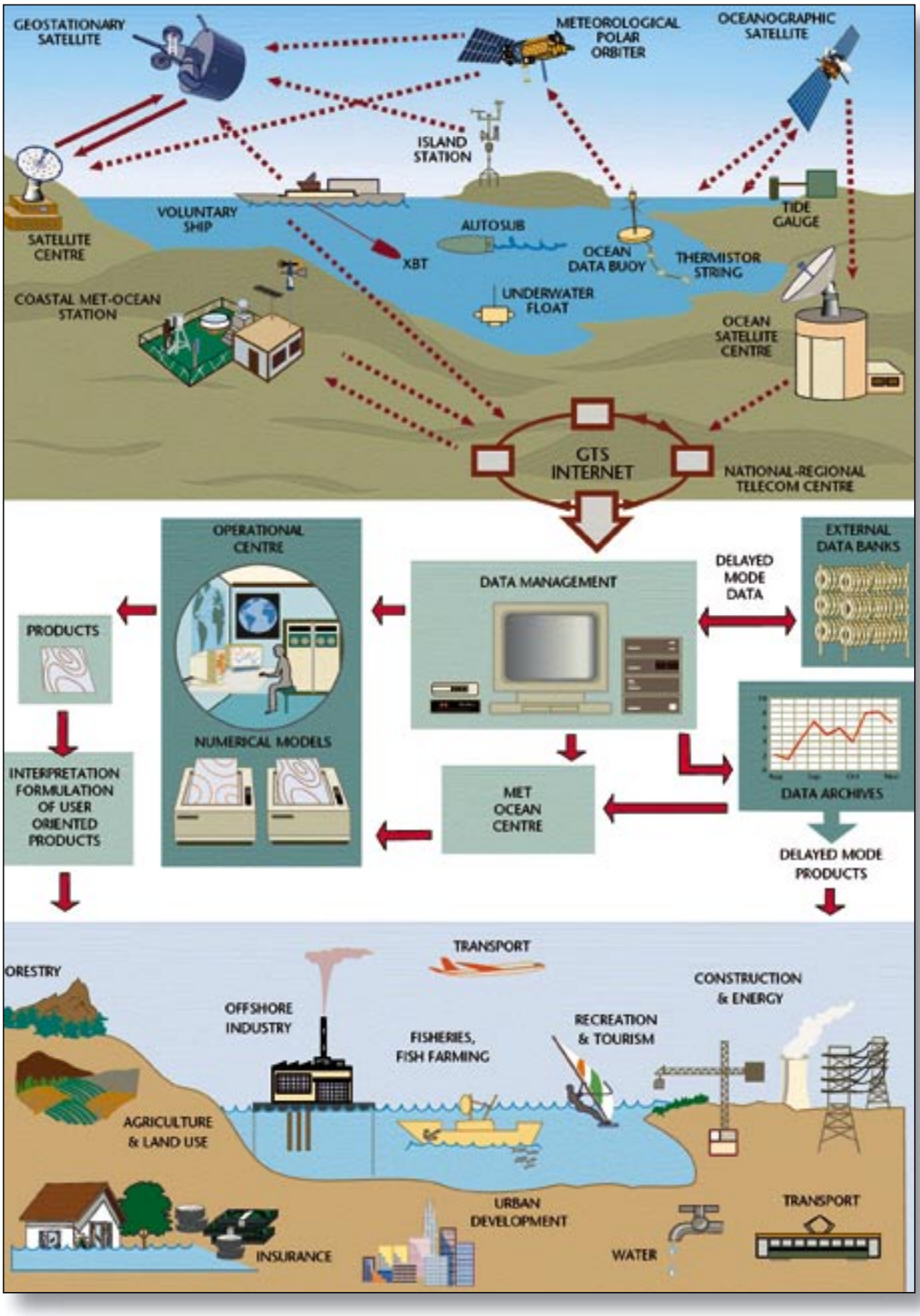
Agenda 21 demands that an integrated and comprehensive global ocean observing and information system be created to provide the information needed for oceanic and atmospheric forecasting, for ocean and coastal zone management by coastal nations, and for global environmental change research. In response to this demand, which was reinforced at the World Summit on Sustainable Development (WSSD), 26 August-4 September 2002, the Intergovernmental Oceanographic Commission (IOC) of UNESCO, together with the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP), and the International Council for Science (ICSU), are planning, implementing, and coordinating a Global Ocean Observing System (GOOS). The Implementation Plan of the WSSD calls for a significant increase in the use of *in situ* and satellite-based observations of the Earth System, and the provision of information based on those observations, in support of sustainable development.

GOOS provides descriptions in real-time of the present state of the sea and its contents, and forecasts of these for as far ahead as possible, for a wide range of users. At present, most of these data concern the physical characteristics of the ocean, which are currently the 'easiest' to measure. The climate component of GOOS is the ocean component of the Global Climate Observing System (GCOS). In that context, GOOS also meets the needs of the Framework Convention on Climate Change (FCCC) by providing ocean data to underpin forecasts of changes in climate. GOOS aims to meet the needs of the operational oceanographic community, as well as those of the research community, for systematic and sustained observations. Research to develop new operational approaches and tools is an integral part of GOOS. GOOS makes and integrates observations across all the data gathering media, from ships and buoys to satellites and aircraft, covering the sea and its contents, sea ice, and the air above the ocean. GOOS is designed to meet the needs of a broad user community for particular services or products. It will operate as an end-to-end, or production line, system, in which the data, and how they have been processed, are traceable from first observation to final product. All GOOS elements are accessible through the GOOS Web site <http://ioc.unesco.org/goos>. GOOS data can be accessed through the Global Observing Systems Information Centre (GOSIC) <http://www.gos.udel.edu./>. GOOS is managed by the GOOS Project Office within the IOC, operating under the overall direction of the Intergovernmental Committee for GOOS (I-GOOS), and following the scientific and technical advice of the GOOS Steering Committee (GSC). The GSC held its 5th Session in Paris, France, 1-3 May. The I-GOOS Board met in Paris, 2-3 June, and in Athens, Greece, on 6 December.

GOOS is being implemented by Member States following the GOOS design and coordinating their actions through the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), and its technical sub-groups, which are overseen by the JCOMM Management Committee (JCOMM-MAN) <http://ioc.unesco.org/goos/jcomm.htm>. JCOMM is responsible for the day-to-day management of many of the observing system elements. The JCOMM Operations Centre in Toulouse continued to improve the provision of services on ship and buoy and float data to the wider community <http://www.jcommops.org/>. GOOS and the IOC's Committee on International Oceanographic Data and Information Exchange (IODE) are among the members of the JCOMM-MAN, which held its first full session in Geneva, Switzerland, 6-9 February. JCOMM and GOOS are supporting, with IODE, the development of an Ocean Information Technology Project, plans for which were defined at a meeting in Brussels, Belgium, 28-29 November. The meetings of the JCOMM sub-groups were as follows:

- VOSClim Management Group-III & PMO Training Workshop, Southampton, U.K. 15-21 January;
- Ship Observations Team, Goa, India, 25 February-1 March;
- Services Coordination Group, Geneva, Switzerland, 3-6 April;
- Observations Coordination Group, La Jolla, CA, USA, 24-27 April;
- Data Management Coordination Group, Paris, France, 22-25 May;
- South Atlantic and Indian Ocean Buoy Programmes, Cape Town, South Africa, 29 July-2 August;
- Maritime Safety Services, Lisbon, Portugal, 11-14 September;

GOOS makes and integrates observations across all the data gathering media, from ships and buoys to satellites and aircraft, covering the sea and its contents, sea ice, and the air above the ocean.



- Sea Level Change, Toulouse, France, 17-19 September;
- Data Buoy Cooperation Panel, Martinique, 14-24 October;
- Western Indian Ocean Marine Applications Project, Mauritius, 1-2 November.

GOOS provides Member States with the ability to convert research results into useful products to meet societal needs. It is also influencing national thinking and planning. Many countries are now planning, or collecting, their own coastal and ocean observations in line with the GOOS Strategic Plan and Principles. Many countries have created National GOOS Committees to develop contributions to GOOS at the national or regional level, by improving the way in which they use oceanographic and marine meteorological information to meet management needs and address policy issues.

Advice on GOOS development comes from two main design panels: one, the Coastal Ocean Observations Panel (COOP), deals with all aspects of coastal seas <http://ioc.unesco.org/goos/coop.htm>, and the other, the Ocean Observations Panel for Climate (OOPC), deals with open ocean physical and biogeochemical processes <http://ioc.unesco.org/oopc/>. The advice helps Member States to implement GOOS in their own waters. The Integrated Coastal GOOS

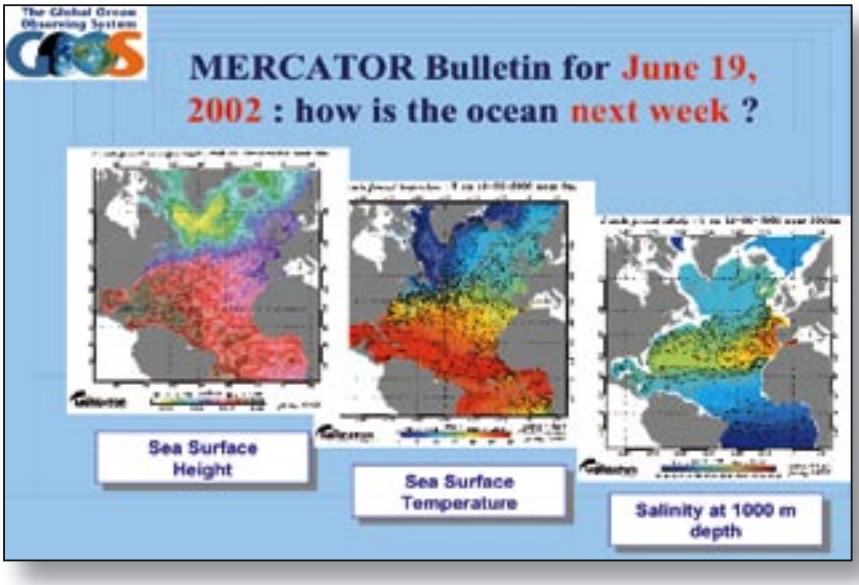
IOC provides scientific and technical guidance on operational ocean observations, and coordination between observations and climate research.

Design Plan was developed and finalized at sessions of COOP in Hanoi, Vietnam, 15-18 January, and in Cape Town, South Africa, 24-27 September, and will be published during 2003. The 7th Session of the OOPC was held in Kiel, Germany, 5-9 June. In 2002, the OOPC was responsible for publishing ocean advice for climate in the form of the book, *Observing the Oceans in the 21st Century*, by Koblinsky and Smith, available from the GODAE Office, Bureau of Meteorology, Melbourne, Australia.

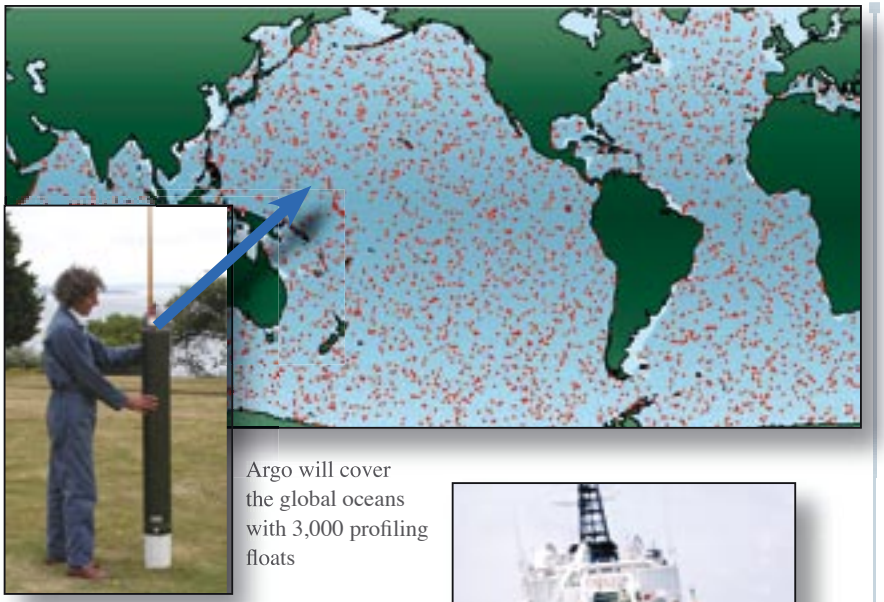
In association with COOP meetings, the user community is being consulted regularly about the GOOS design, through stakeholder workshops, to ensure that the end products meet users' needs.

New components of GOOS are being tested through pilot projects like the Global Ocean Data Assimilation Experiment (GODAE), for which Strategic and Implementation Plans have been published <http://www.bom.gov.au/bmrc/ocean/GODAE/>. GODAE products can be accessed through the U.S. GODAE Server operated by the U.S. Navy in Monterey, CA, <http://www.usgodae.fnmoc.navy.mil/>, and through the French MERCATOR project <http://www.mercator.com.fr/en/>. The first international conference on GODAE "*En Route* to GODAE" was held in Biarritz, France, 13-15 June. It brought together some 300 researchers to report on progress and agree on future priorities. A GODAE data management workshop was held in Ottawa, Canada, 18-20 September.

GODAE itself has pilot projects, which are also pilot projects of GOOS. A GODAE High Resolution Pilot Project on sea-surface-temperature (GHRSST) 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 <http://www.ghrsst-pp.org/>; the GHRSST team met at Frascati, Italy, 2-4 December.



The largest GODAE pilot project is the Argo project to seed the ocean with 3,000 profiling floats that will all be operational during the period 2003-06 <http://www.argo.ucsd.edu/>. Argo will provide the first ever global coverage of the temperature and salinity of the upper ocean, which is badly needed to improve numerical models and forecasts of the behaviour of the ocean, weather, and climate systems. Many countries have made financial commitments to the Argo project, including funds to support the Argo Technical Coordinator at the Argo Information Center in Toulouse <http://argo.jcommops.org/>. At the end of December



Argo will cover the global oceans with 3,000 profiling floats

An Argo float just after launch from the Japanese Coast Guard vessel *Takuyo*. © *Kensuke Takeuchi*

2002, there were 638 Argo floats in the water, and the planning looked secure for the entire project. The Argo Science Team met in Hobart, Australia, 12-14 March, to address issues such as the need to overcome technical faults, the need to obtain funds to facilitate truly global coverage, and the problems that may arise from floats drifting into Exclusive Economic Zones (EEZs). The sponsors of the GODAE and Argo projects in cooperation with the South Pacific Applied Geosciences Commission (SOPAC) decided to convene the Regional Workshop on the Potential of Applications of Ocean Observations for the Pacific Islands Region (PAOOP) in Nadi, Fiji, 4-7 October. The primary objective was to explore the potential (societal) applications of information products derived from the significant current and planned investments in ocean observations and data programmes in the Pacific such as GODAE, the Integrated Ocean Observing System (IOOS), the Argo Float Programme, as well as the Pacific Island GOOS regional alliance.

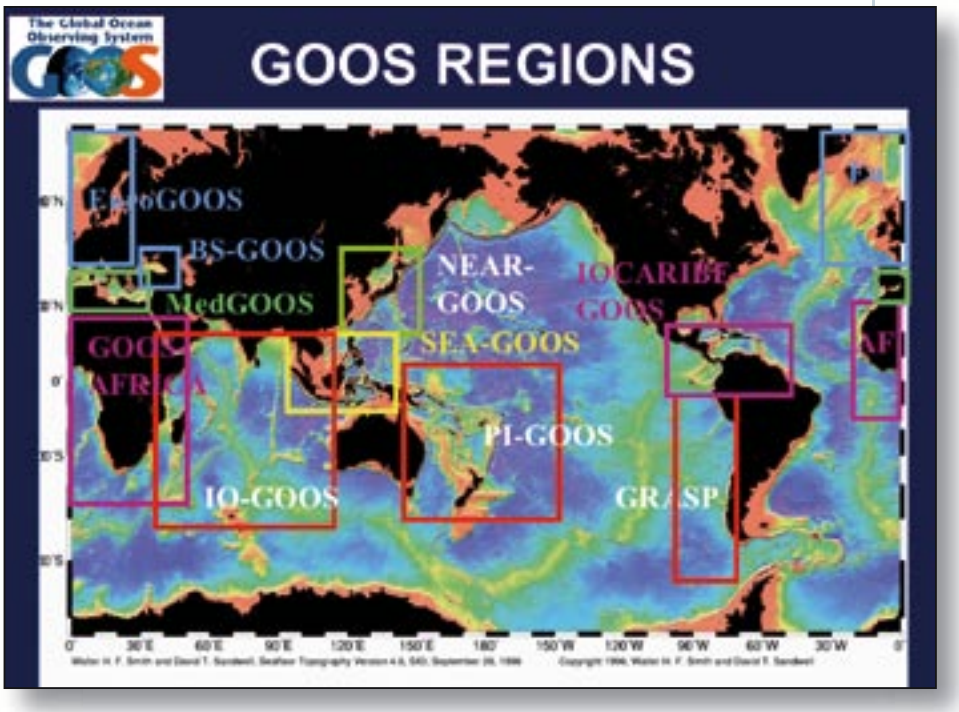
In order to facilitate the implementation of GOOS, groups of Member States with common interests in particular sea areas are encouraged to develop GOOS Regional Alliances (GRAs) <http://ioc.unesco.org/goos/key3.htm#reg>. A Regional Policy has been drafted for consideration by the 6th Session of I-GOOS in 2003 as the basis for managing the fast developing group of GRAs. Regional meetings were held to take forward the development of GOOS at the regional level. The Strategic Plan for IOCARIBE-GOOS was finalized in Veracruz, Mexico, 21-23 February, and approved that month by the 7th Session of the IOC Regional Sub-Commission for the Wider Caribbean (IOCARIBE). A Steering Group was formed to develop an Implementation Plan for IOCARIBE-GOOS. MedGOOS held the first meeting of its European Commission-funded project on "Mediterranean Network to Access and Upgrade the Monitoring and Forecasting Activity in the Region (MAMA)" in Paris, France, 11-13 March, and finalized the work plans for the nine work teams involved. The first Indian Ocean GOOS Conference took place in Mauritius, 4-9 November. Representatives of nine Member States signed the Indian Ocean GOOS (IOGOOS) Memorandum of Understanding. An IOGOOS Secretariat sponsored by India's Department of Ocean Development was established at the National Center for Ocean Information Systems (NCOIS) in Hyderabad, India. Planning is now underway for meetings designed to create Indian Ocean data management and remote sensing strategies and related capacity building strategies. An Indian Ocean Panel, jointly sponsored by IOC and the Climate Variability and Predictability Programme (CLIVAR), is also envisioned with the objective of creating an implementation plan for an ocean and coastal observing array. EuroGOOS published *Proceedings of the 2nd EuroGOOS Conference on Operational Oceanography*, in June 2002, and held the 3rd EuroGOOS Conference on Operational Oceanography in Athens, Greece, 3-6 December. The European Commission awarded funds to EuroGOOS's Baltic Operational Oceanographic System (BOOS) for the PAPA Project (a programme for a Baltic network to assess and upgrade an operational observing and forecasting system in the region) in September 2002. Through planning meetings in Niamey, Niger, 25 February-3 March, Abidjan, Côte d'Ivoire, 6-14 May, and Abuja, Nigeria, 17-19 June, representatives of GOOS-AFRICA finalized the development of a proposal for a Regional Ocean Observing and Forecasting System for Africa (ROOFS-AFRICA), which was accepted at the African Process meeting alongside the World Summit on Sustainable Development meeting in Johannesburg in September as a key contribution to the New Partnership for African Development (NEPAD). Further support for the proposal came from the 4th International Conference of the African Association for Remote Sensing of the Environment in Abuja, Nigeria, 14-18 October, and the Follow-Up to the African Process in Dakar, Senegal, 24-25 October. The PacificGOOS Steering Committee met in Fiji, 6 October, to

examine progress and plans, and decided to change its name to Pacific Islands GOOS. Finally, the 7th Session of the NEAR-GOOS Coordinating Committee (for the North-East Asian Region) met in Vladivostock, Russia, 1-5 October, to review progress, and develop plans for a new strategic plan. The first meeting of the GOOS Regional Forum, which brings all of the GRAs together to discuss matters of common interest, took place in Athens, Greece, 2-6 December, to enable participants to benefit from the EuroGOOS Conference; the key outcome was agreement to drafting a proposal for submission to the European Commission for funding for a GOOS Regional Alliances Network Development (GRAND).

Planning for GOOS developments in the Pacific and Indian Oceans was ably supported by the IOC Regional Project Office for GOOS in Perth, Western Australia, a review of which, in March, noted performance above expectation. At year-end, a new IOC Regional Programme Office for GOOS was created in Rio de Janeiro, Brazil, to support planning for GOOS developments in the South Atlantic and Equatorial Atlantic, with the assistance of the Brazilian Navy's Department of Hydrography and Navigation.

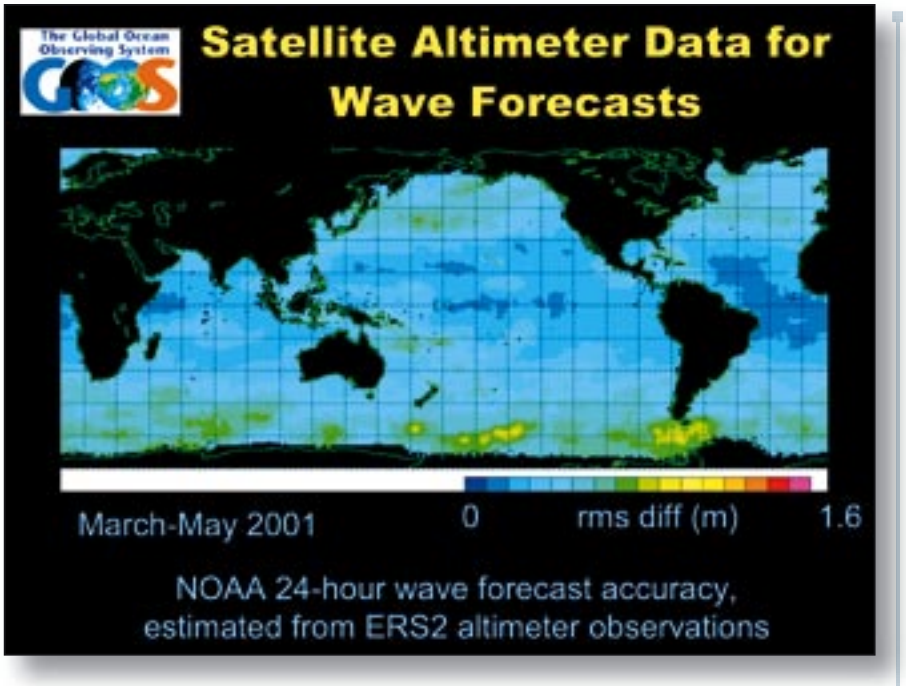
The joint IOC-International Council for the Exploration of the Sea (ICES) Steering Group on GOOS met in Halifax, Canada, 22-24 April, to begin development of plans for an ecosystem-based approach to fisheries and environmental management for the western North Atlantic. Members of the Steering Group joined an ICES-EuroGOOS Workshop in Bergen, Norway, 27 February-1 March, to finalise development of plans for a North Sea Ecosystem Pilot Project (NORSEPP) to stimulate development of an ecosystem approach to observations for fisheries and environmental management in the North Sea. GOOS figured prominently at the ICES Centennial Science Conference, in Copenhagen, Denmark, 1-2 October.

The GOOS community continued to work towards developing closer links with PICES (the North Pacific Marine Science Organization, also known as the Pacific ICES), through attendance of senior GOOS representatives at the PICES Annual Conference in Qingdao, China, 18-26 October.



Attempts to strengthen the link between GOOS and the United Nations Environment Programme (UNEP)'s Regional Seas Programme continued, through participation of the GOOS Project Office in the 6th meeting of the Parties to the Abidjan Convention, Abidjan, Côte d'Ivoire, 16-17 May.

In order to ensure that global observations are made in a coherent and integrated way, and that the space agencies' plans for global observation are consistent with those of GOOS, the IOC together with other UN agencies (World Meteorological Organization [WMO], UNEP, Food and Agriculture Organization of the United Nations [FAO], UNESCO) and the International Council for Science (ICSU), are members of the Committee on Earth Observation Satellites (CEOS), and, with CEOS, form the Partnership for an Integrated Global Observing Strategy (IGOS) <http://igospartners.org/>. The IGOS Partners Ocean Theme document of January 2001 indicates the capabilities of, and developments needed, in space-based measurements to make GOOS work. During 2002, the GOOS Project Office published *A Global Ocean Carbon Observation System—A Background Report* (GOOS Report 118), outlining the rationale and scientific background for ocean carbon observations, the general structure of an observing system, observing system elements, technology development, process studies, and a list of observation requirements. This document is a contribution towards an eventual IGOS Partners "Integrated Global Carbon Observing Theme." In addition, plans were agreed for a global network of sites for the measurement of time series of ocean properties including carbon. The progress and plans of CEOS and the IGOS Partners were examined at the IGOS Partners meeting, Paris, France, 31 May, and the CEOS Plenary meeting, Frascati, Ita-



ly, 19-21 November. In addition, IOC continued to play a part with WMO in the coordination of operational oceanographic and meteorological satellites, through participation in the Coordinating Group on Meteorological Satellites, Bangalore, India, 12-15 November.

Capacity Building to enable developing countries to participate in, contribute to, and benefit from GOOS is a key plank in the GOOS strategic plan. Much of the capacity building effort has been focused on the development of the GRAs (above). This year saw the first meeting of the GOOS Capacity Building (CB) Panel in Geneva, Switzerland, 24-26 June, which took place alongside, and at times in conjunction with, the meeting of the JCOMM Capacity Building Coordination Group. The CB Panel published an Action Plan <http://ioc.unesco.org/goos>, key elements of which were to increase access to, and training in the use of, remotely sensed ocean data from satellites; to increase access to, and training in the use of, numerical models; and (with IODE and JCOMM) to improve data and information management in support of GOOS. These remote sensing and modelling aspects form key elements of the ROOFS-AFRICA proposal mentioned earlier. In addition, remote sensing forms the core of the UNESCO Cross Cutting Project on Water Resources and Ecosystems in Africa, for 2002-03, which is managed by the GOOS Project Office. The Project involves 11 countries in Africa. During the year UNESCO sponsored them to develop national strategies for remote sensing. Presentation and examination of these plans, as an aid to their eventual implementation, took place during a UNESCO Chairs Workshop in Paris, France, 11-13 November. In addition, the Office participated in the UN/European Space Agency (ESA)/South Africa Symposium on "Space Technology Provides Solutions for Sustainable Development" in Stellenbosch, South Africa, 21-23 August, to help to broaden the network engaged in both ROOFS-AFRICA and the UNESCO cross-cutting project.

Capacity building in remote sensing took place through training programmes, including the Indian Ocean Remote Sensing Workshop, Mauritius, 1-9 November, and activities supported by the International Ocean Color Coordinating Group (IOCCG), which is co-sponsored by the IOC and the Scientific Committee on Oceanic Research (SCOR). IOCCG-sponsored activities for 2002 included a training course on "Primary Production: Theory, Modelling and Estimation by Remote Sensing" in Concepción, Chile, 21 October-1 November. In addition, the IOCCG Fellowship Programme offers the opportunity for young scientists from developing countries to conduct hands-on research, or to receive in-depth training, at a foreign institute. IOCCG sponsored two students in 2002.

Japan provided the 6th NEAR-GOOS data and information management training programme in Tokyo, 21 October-1 November.

GCOS is organizing a series of regional CB Workshops, each of which has a GOOS (ocean) component. Those for 2002 took place in San José, Costa Rica, 19-21 March, for Central America and the Caribbean, and in Singapore, 16-18 September, for East and Southeast Asia.

Each year some 12 GOOS-related Fellowships are awarded by the Partnership for Observations of the Global Ocean (POGO), for oceanographers from developing countries to spend up to three months in major global oceanographic laboratories learning various aspects of observational techniques, data analysis and interpretation.

Publications or articles on GOOS form another means of spreading information and raising awareness about GOOS. A recent example is the chapter on "Operational Oceanography" in *Oceans 2020* by Field, *et al*. (2002) Washington, D.C., Island Press.

In order to ensure that GOOS has the appropriate structure to meet the growing demands placed upon it by Member States, the 21st Session of the IOC Assembly in June 2001 called for a review of the organizational structure of GOOS to be carried out by an external independent group. That group, headed by Dr. Paul Mason of the UK Meteorological Office, was formed in April 2002 and met in Paris, France, 9-11 September, and later in Mauritius, in the margins of the IOGOOS Conference, 1-9 November.

New European Developments for Operational Oceanography

Jean-François Minster, President of Ifremer, France's Research Institute for Exploitation of the Sea, has played an important role in the development of the study of oceans by satellite. He has authored numerous scientific publications and works, including *La Machine Océan*, and is a member of France's prestigious European Academy of Sciences.

In the following excerpt from a recent speech to IOC's Assembly, President Minster delivers an update on the European Partners and Programmes that form part of the global observation network monitoring the oceans with an aim to predicting long-range weather conditions, natural disasters, and climate change.

Operational oceanography aims at providing services and products to users of the ocean, and to help in sustainable exploitation of its resources. It includes monitoring activities, systems allowing impact studies, and prediction systems; all three aspects being complementary. It is most appropriate that the Intergovernmental Oceanographic Commission of UNESCO puts its development as its central activity.

Jason-1 artist's concept
Courtesy NASA/JPL-Caltech

Jason-1 launch
Courtesy NASA/JPL-Caltech

The scheme of open ocean operational oceanography in France

The CNES (French Space Agency)/National Aeronautics and Space Administration (NASA) Jason-1 and its Jason-2 extension

Jason-1 was launched on 7 December 2001, on the same orbit as Topex/Poseidon. It carries an altimetry payload derived from Topex/Poseidon. The Jason-1 commissioning phase was successfully completed on 4 March 2002. Jason Operational Sensor Data Records are delivered within three hours.

An international effort is being made in the operational high precision satellite altimetry programme, with the recent decision of the National Oceanic and Atmospheric Administration (NOAA) and the European Organisation for the Exploitation of Meteorological Satellites (Eumetsat) to contribute to Jason-2.

Coriolis

Coriolis is the French contribution to ARGO (an international programme that calls for the deployment of 3,000 free drifting profiling floats distributed over the global oceans by 2006.) It includes instrument deployment and a near real-time global scale data centre. In the year 2002 there were data sets from XBT, CTD, and moorings providing global coverage with 165,190 profiles.

Argo profiling float

Prediction Systems

A number of preoperational or operational current-prediction systems have been implemented in Europe, one of them being the MERCATOR project.

The partners in this project are CNRS (the French national scientific research centre), METEO-FRANCE (the French national weather service), CNES (the French space agency), SHOM (the French Navy's hydrography & oceanography department), Ifremer, and IRD (the French development research institute), and their goal is to progressively develop an operational capacity to analyse and predict the global ocean, through assimilation of near real-time satellite and *in situ* data into an ocean model. Customers of the system will be public services, civil security, defence, and commercial applications of oceanography. MERCATOR already provides weekly bulletins graphically predicting the state of the ocean for the next two weeks, including outputs on the temperature and salinity of ocean currents at various depths, and sea surface height at a 5 km resolution in the North Atlantic and the Mediterranean Sea and at a lower resolution globally. It is a contribution to the Global Ocean Data Assimilation Experiment (GODAE).

The Next Step

Existing preoperational systems need to be transformed into operational systems using:

- Satellite recurrent systems
- *In situ* observation operational teams and tools
- Permanent modelling and prediction systems
- Service to intermediate and end users

Legislation

There is a lot of international legislation, as well as treaties and declarations on environmental protection, marine security, transport, fisheries, and policies to take into account. These include KYOTO, UNFCCC, UNCLOS, AMAP, OSPARCOM, MARPOL, BARCELONE, and HELCOM.

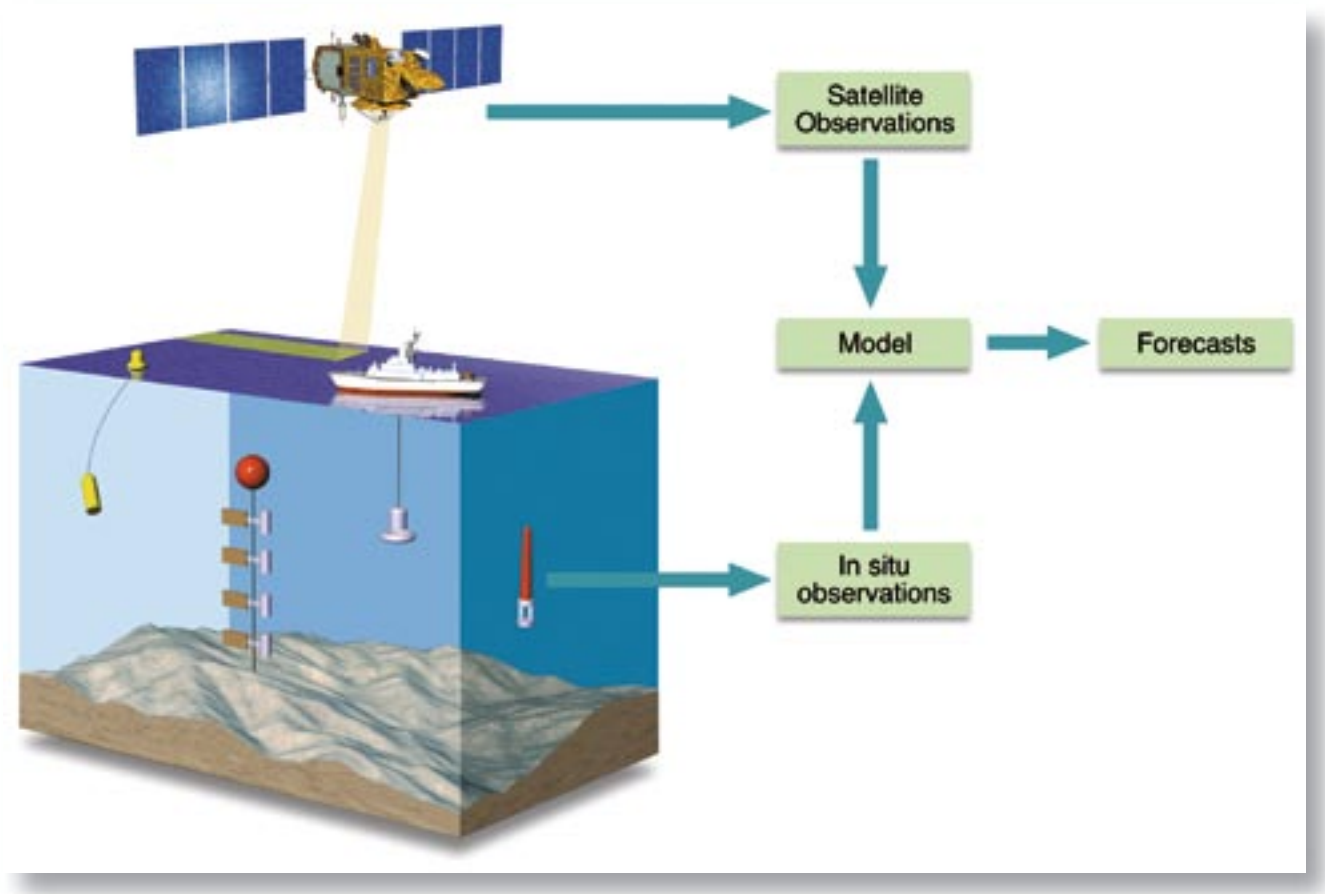
Users

The huge range of users interested in operational prediction systems include:

- European Environmental Agency (EEA)
- Meteorological services
- Coastal protection agencies
- National and international environment administrators
- Water basin authorities
- Climate and environmental research organizations and communities

GMES: Global Monitoring for Environment and Security

GMES is a joint initiative of the European Commission and the European



The Mercator system will describe and predict ocean conditions over the whole ocean column continuously and in real time, at scales ranging from global phenomena to regional eddies. *Credit: D. Ducros, Mercator Ocean*

Space Agency (ESA) to provide a sound basis for European policies related to environment and security. GMES will provide Europe with an independent access to global information useful, for example, for international conventions such as the Kyoto Protocol. GMES will also develop applications for global change, environmental security, and natural hazards.

GMES will function as an extended partnership between national space agencies (CNES, DLR, BNSC, ASI, etc.,) industry, and science. Development of GMES is based on the ESA GMES services element (funded €83M, 2002-06,) the 5th Framework Program (FP) call for proposals, and the 6th FP Integrated Projects and Networks of Excellence.

The MERSEA Concept

General objectives

MERSEA aims to produce, assess, and deliver real-time and continuous observations of the ocean's three-dimensional structure and associated biochemical components. MERSEA will also produce, assess, and deliver in real-time hindcasts and forecasts of the three-dimensional ocean variability at the highest resolution possible for the short time scales (a few weeks.)

MERSEA will deliver a global scale operational system. This will include support for shelf sea systems and interconnection with coastal zone systems.

A "European Centre for Ocean Monitoring and Forecasting" (ECOMF)

The ECOMF concept aims to operate a global system, with a short to medium-term (e.g., one month) prediction capacity at high resolution. The ECOMF should have strong research connections and build partnerships with national centres.

Some European countries are already running national global ocean systems for practical or political reasons (e.g., defence needs.) These national systems should enter into partnerships with the ECOMF, so as to share services and products for their mutual benefits. It is expected that several services currently operated under national systems will be transferred to the ECOMF.

Most practical issues and applications are regional and require very high resolution monitoring and modelling. Such systems can be best managed in a distributed manner. Regional "outcentres" can be run as integrated systems, carrying out observations, modelling and assimilation, real-time and off-line operation, validation, analysis, distribution of products, and regional services. They will use ECOMF outputs as boundary conditions and will contribute to data acquisition and model development useful for ECOMF. Outcentres will generally develop in an open and competitive manner, but some can be part of an institutional network (e.g. the Mediterranean, Baltic, and Arctic Seas.)

MERSEA Data Processing Modules

MERSEA does not contribute to infrastructures (e.g., ships, satellites, computers,) but will include modules necessary to ensure that ocean observations are adequately processed.

MERSEA *In Situ* Observations

A global *in situ* observation system is required, such as continuing ARGO and time series observations. MERSEA will include the European contribution to this world scale system. MERSEA will aim at creating real-time access to environmental ocean monitoring data, and at implementing their assimilation into numerical models to improve the value of this environmental monitoring.

The Biogeochemistry Component

There are a number of contrasting requirements. Global requirements include CO_2 fluxes (for climate change) and primary production. These are of interest to end-users and decision makers.

Regional requirements include trophic interactions to zooplankton and predators, and harmful algal blooms. These are interesting to intermediate and end-users such as fisheries, aquaculture, and tourism.

Local (coastal) requirements include complex ecosystems with benthic, pollutants, and suspended matter. These are important to intermediate and end-users, such as tourism managers and local policymakers.

This is a complex problem—preoperational systems are less developed and there is a lack of data. We need global primary production with ocean colour data assimilation. Models should have regional and local very high resolution with operational dispersion modelling, requiring preoperational complex systems.

"We are talking about an evolutionary system."

ECOMF and Research

ECOMF must maintain connections with research, such as:

- Evolution of the system will benefit from open research and technological developments
- Evolution of requirements and the general mission of the centre will lead its team to define research and development questions to be addressed
- Research activity devoted to outputs is an essential component of their validation, beyond the operational, in-house validation

- Research will be a customer of services and products

The system should maintain in-house research and development capability, networked with external research teams from institutes and academic organizations.

MERSEA Interfaces

MERSEA will have to establish interfaces with many other organizations, including:

- Marine science activities of relevance, including European networks of excellence and integrated projects
- Other operational systems, more particularly those dealing with meteorology, climate prediction, fisheries, and marine environment monitoring
- National agencies and private companies involved in the development of operational oceanography, whether at global or regional scales (likely to become members or associates of ECOMF)

The MERSEA general principles

MERSEA will build on incremental developments of ongoing science and technology. It will aim at establishing a European operational system.

MERSEA will identify and help organize a set of European agencies to implement and fund a long-term operational system as a component of a worldwide organization by 2008. It should have the capacity to adjust to new requirements, research results and technologies.

* * *

Conclusion

Europe should build a global component of the Global Ocean Observing System (GOOS), which is the goal of MERSEA. GMES is an opportunity to implement this European operational system for the ocean, by 2008, relying on existing experience.

Courtesy: Ifremer

World Summit on Sustainable Development

Courtesy NASA

A promising new, more optimistic, model for development…

The World Summit on Sustainable Development

Johannesburg, South Africa • 26 August–4 September 2002

"Governments have agreed here on an impressive range of concrete commitments and actions that will make a real difference for people in all regions of the world."

UN Secretary-General Kofi Annan

In one of the most widely attended summits ever held, over 60,000 people—including government delegates, NGOs, presidents, CEOs, and media representatives—spent ten days in formal talks examining both how to improve the lives of people living in poverty and also reverse the continuing degradation of our global environment, a concept referred to as sustainable development.

While the WSSD's precursor, the 1992 Earth Summit in Rio de Janeiro, produced international conventions on biodiversity and climate change, the WSSD led to important declarations of goals and dozens of proposals, rather than a traditional treaty.

A new chapter of responsibility, partnerships, and implementation

The WSSD is emblematic of a promising new, more optimistic, model for development—one in which voluntary initiatives will be widely accepted to establish international norms and standards for solving environmental issues.

At Johannesburg, there were two such important breakthroughs:

- A Plan of Implementation, negotiated by delegates, containing targets and timetables to spur action on a wide range of issues. The Plan contains commitments to be honored by governments, IGOs, NGO's, and the private sector. Paragraph 34(d) of the Plan states: "Strengthen the ability of the Intergovernmental Oceanographic Commission of the UNESCO … to build national and local capacity in marine science and the sustainable management of oceans and their resources."
- New-style partnerships between governments, private groups, foundations, and businesses.

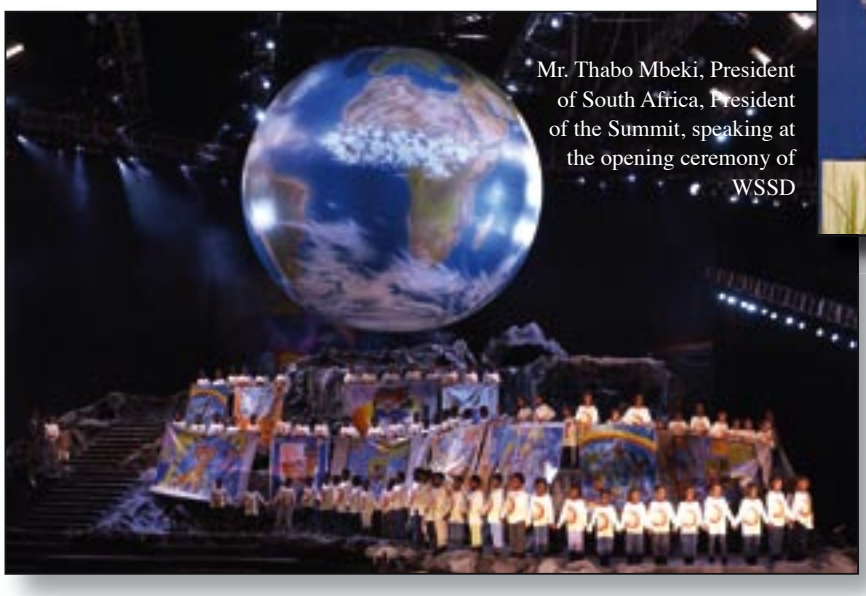
(See IOC's Declaration to WSSD on the next page.)

"The Summit," explained UN Secretary-General Kofi Annan, "represents a major leap forward in the development of partnerships with the UN, governments, business, and civil society coming together to increase the pool of resources to tackle global problems on a global scale."

Mr. Thabo Mbeki, President of South Africa, President of the Summit, speaking at the opening ceremony of WSSD

This is not the end. It's the beginning

The WSSD not only showed that governments were united on issues concerning sustainable development, it also generated hope and confidence by proving that policymakers were open to making and following voluntary initiatives. With ocean issues emerging high on the results of governments' agreements at WSSD, the Summit's outcomes will have a strong influence both on reinforcing IOC's current policies, and shaping those of its future.



South African Welcoming Ceremony for the World Summit on Sustainable Development at Ubuntu Village, Johannesburg, 25 August 2002 *Courtesy: UN/DPI Photos by Eskinder Debebe*

Declaration

by the Intergovernmental Oceanographic Commission of UNESCO to the World Summit on Sustainable Development

Johannesburg, 2002

The world oceans and their adjacent seas, and the living and non-living resources they contain, are a necessary element for the survival of life as we now know it. The sustainability of the air we breathe, the water we drink, the food we eat, and the climate in which we live is dependent upon the oceans. The oceans also provide for the cultural, social, and economic well-being of people. It is the oceans that make life on earth uniquely sustainable within the solar system. Sustainable development is highly dependent on the wise management of the oceans and coasts based on scientific knowledge.

Governments must work together. The collective effort of all States is required to resolve global issues. Government cooperation at global and regional levels is necessary. We need strong global and regional institutions to support this, and to bring science and policymakers together. The countries whose economies and social structures depend on the ocean must be able to address local problems. For this, it is essential that we build the capacity of all countries.

Governments placed the protection and preservation of the oceans and their resources at a high level of priority in Agenda 21 of the UN Conference on Environment and Development (UNCED).

As the sole UN organization specialized in ocean science and services, the Intergovernmental Oceanographic Commission of UNESCO has had many notable achievements over the last decade in support of UNCED:

- Support of research into ocean climate and long-term weather variations in cooperation with the World Climate Research Program, which allows early forecasting of El Niño events, such as those that occurred in 1997/98;
- The Global Ocean Observing System (GOOS) has been initiated in concert with companion UN agencies and the International Council for Science (ICSU), with an initial focus on the open ocean and a fast developing parallel focus on monitoring and forecasting in coastal seas;
- Improved systems for exchange and availability of ocean data and information;
- A programme on Integrated Coastal Area Management is focusing attention on many of the high priority environmental problems in coastal areas;
- Better knowledge of ocean features, processes, and the impacts of human actions on the state of the marine environment;
- Strengthened regional mechanisms in ocean sciences and in the capacity of developing countries in marine research and services;
- Leadership of the UN 1998 International Year of the Ocean;
- Substantial contribution to the UN Ocean Informal Consultative Process.

Much has been achieved. Much remains to be done over the coming years. The Intergovernmental Oceanographic Commission affirms its will to:

- Act as a focal point to encourage interactions in marine science and observations across relevant bodies of the UN system and other organizations;
- Further develop partnership in capacity building in marine science and services at regional and national levels, particularly with developing countries and taking also into account the African Process;
- Develop GOOS as an operational system;
- Promote the development and implementation of programmes on Integrated Coastal Area Management;
- Participate fully in the necessary assessment of the global ocean environment, and periodic reporting on the state of the oceans;
- Promote the use of scientific knowledge for management decisions and policymaking and facilitate access to this knowledge;
- Work to increase public awareness of the importance of the oceans and coasts for sustainable development and the future of humanity.

The Member States of the Intergovernmental Oceanographic Commission ask that the WSSD reaffirms the importance of the oceans for sustainable development; promotes the IOC as the key marine science body of the UN; and encourages governments and funding organizations to provide the resources necessary to implement IOC priorities, including support for IOC activities for marine science capacity building in developing countries.

Adopted by the Extraordinary Session of the IOC Executive Council, 11 December 2001

World Summit on Sustainable Development

Summit Results and Implications for IOC

IOC and its activities were recognized in the WSSD Implementation Plan (36.d), even though oceans were not specifically mentioned in the Political Declaration of the Summit. The Implementation Plan has several commitments pertaining to IOC's mandate and programmes. IOC participates in several partnerships on oceans and coasts.

The Partnership Conference of the African Process, held during the Summit at the Heads of State level, closed the first cycle of the Initiative in which IOC played a leading part, and was integrated into the Environment Component of the New Partnership for Africa's Development (NEPAD) Action Plan.

Finally, a vast coalition of intergovernmental organizations, non-governmental organizations, and stakeholders involved in ocean affairs decided to continue the *ad hoc* Coordinating Committee's work, co-chaired by IOC, and towards this purpose initiated a New Global Forum on Oceans, Coasts, and Islands. This Committee was created for the WSSD organization and represented the oceans' community before, and during, the Summit.

Mr. Kofi Annan, Secretary-General of the United Nations;
Mr. Thabo Mbeki, President of South Africa, President of the Summit.
Courtesy: UN/DPI Photo by Eskinder Debebe

Official outcomes of the WSSD relating to IOC's mandate and programme

1. Policy issues for the future

- Participate in the future interagency coordination mechanism on ocean and coastal issues within the United Nations system (30.c);
- Continue to strengthen regional cooperation and coordination between the relevant organizations and programmes and their regional and sub-regional bodies (30.f);
- Continue to assist developing countries in initiating and managing policies and programmes aimed at sustainable management of fisheries resources and the implementation of integrated coastal area management plans (30.g);
- Build national and local capacity in marine sciences and the sustainable management of oceans and their resources;
- Participate in the New Global Forum on Oceans, Coasts, and Islands, initiated at WSSD;
- Fully participate in the Global Marine Assessment (36.b).

2. Main programme issues for the future

- Contribute to the partnerships initiated at WSSD and, *inter alia*, continue to provide technical assistance to the African Process for the implementation of the Programme of Interventions, and the second generation of this Initiative;
- The three programmes of IOC will participate in the Global Marine Assessment;
- Set up the new cross-cutting section of Training, Education and Mutual Assistance in the Marine Sciences (TEMA) to strengthen IOC's efforts in capacity building, with mechanisms such as centers of excellence and training networks.

World Summit on Sustainable Development Implementation Plan

Specific Paragraphs of Relevance to the Intergovernmental Oceanographic Commission

Training, Education and Mutual Assistance in the Marine Sciences (TEMA)	36.d. Strengthen the ability of the Intergovernmental Oceanographic Commission of the United Nations Educational, Scientific and Cultural Organization, the Food and Agriculture Organization of the United Nations, and other relevant international and regional and sub-regional organizations to build national and local capacity in marine science and the sustainable management of oceans and their resources.
IOC Policy and Ocean Governance	30.c. Establish an effective, transparent and regular interagency coordination mechanism on ocean and coastal issues within the United Nations system.
Integrated Coastal Area Management (ICAM)	30.e. Promote integrated, multidisciplinary and multisectoral coastal and ocean management at the national level, and encourage and assist coastal States in developing ocean policies and mechanisms on integrated coastal management.
Science for Ocean Ecosystems and Marine Environmental Protection (SOEMEP)	32.d. Develop national, regional, and international programmes for halting the loss of marine biodiversity, including coral reefs and wetlands.
SOEMEP	36. Improve the scientific understanding and assessment of marine and coastal ecosystems as a fundamental basis for sound decision making, through actions at all levels to:
SOEMEP Global Ocean Observing System (GOOS)	36.a. Increase scientific and technical collaboration, including integrated assessment at the global and regional levels, including the appropriate transfer of marine science and marine technologies and techniques for the conservation and management of living and non-living marine resources and expanding ocean observing capabilities for the timely prediction and assessment of the state of the marine environment.
GOOS	37.c. Strengthen the institutional capacities of countries and promote international joint observation and research, through improved surface-based monitoring and increased use of satellite data, dissemination of technical and scientific knowledge, and the provision of assistance to vulnerable countries.
Climate and Oceans GOOS	37.e. Improve techniques and methodologies for assessing the effects of climate change, and encourage the continuing assessment of those adverse effects by the Intergovernmental Panel on Climate Change.

Ocean Services	37.h. Develop and strengthen early warning systems and information networks in disaster management, consistent with the International Strategy for Disaster Reduction.
POLITICAL DECLARATION	No part on Oceans.
TYPE II PARTNERSHIPS	1. African Process 2. International Network of Practitioners and Academics to Support Implementation of Coastal and Ocean Management Programs 3. Partnership for Observation of the Global Oceans (POGO)-IOC Initiative for Intelligent Use and Management of the Oceans 4. Application of Isotope Techniques for Sustainable Water Resources and Coastal Zone Management (SWARCOZM) Science and Technology 5. The H2O (Hilltops-to-Oceans) Partnership 6. White Water to Blue Water 7. Application of Nuclear and Non-Nuclear Techniques for the Monitoring and Management of Harmful Algal Blooms in the Benguela Coastal Region 8. Global Ocean Data Assimilation Experiment (GODAE) 9. Integrated Global Observing Strategy (IGOS) Partnership

Focus on Africa

Managing Africa's coastal and marine resources…

"Nowhere is a global commitment to poverty reduction needed more than in Africa south of the Sahara, because no region of the world endures greater human suffering."

UN Secretary-General's Millenium Report

Fishing village in Senegal. *Courtesy Dominique Roger, UNESCO*

Africa's struggle against poverty and lack of ready alternatives to overexploiting resources pose serious threats to its coastal and marine environments. Unsustainable harvesting practices, destruction of habitats, and pollution are some of the factors endangering coastal areas and therefore the long-term welfare of populations and potential for economic growth and social stability.

The African Process for the Development and Protection of the Marine and Coastal Environment in Sub-Saharan Africa, to which the Intergovernmental Oceanographic Commission of UNESCO is a Partner, addresses the problems affecting the region's coastal and marine environments. It seeks to promote sustainable management of the coastal interface through project proposals involving different partnerships that are effective from an environmental, financial, and institutional perspective, and which have galvanized a significant degree of political support.

In June 2002, The Super Preparatory Committee Meeting of the African Process (popularly referred to as "PrepCom,") convened in Abuja, Nigeria to set its agenda prior to attending the World Summit on Sustainable Development. The following extracts of the meeting demonstrate the participating Member States' unified political awareness of the need to develop an integrated approach for the management and preservation of Africa's coastal and marine resources.

Statements at the Super PrepCom Meeting, Abuja, Nigeria, June 2002

Statement by Otu-Ekong (Dr.) Imeh Okopido, the Honourable Minister of Environment (State) of Nigeria, and Vice-President of the Advisory Committee on the Protection of the Sea (ACOPS)

Courtesy: IPPL File Photo

Our Experience

Having gone through several stages of the African Process and three days of intensive deliberations at the Abuja Super PrepCom, experience has shown that Africa's ecological base is fragile and under various threats. The region is experiencing an array of serious environmental challenges and problems that threaten to undermine the region's economic development prospects. Therefore, our economies are critically dependent on maintaining ecological integrity. For example, it is obvious that the marine resource base, which constitutes a crucial sector of the economy of several sub-Saharan African countries, is directly dependent on environmental goods and services. In addition, Africa's rich cultural and budding political structures are intricately tied to the genetic resource base, thereby linking any erosion of ecological systems to the erosion of social and political systems.

In order to boost Africa's prospects of achieving environmental sustainability and economic growth, major efforts must be made to entrench, and nourish, a mechanism that can download requisite pragmatic actions. These actions must be oriented towards the building and strengthening of national and regional capacities in the assessment of the status of the environment, and the means for requisite intervention.

Therefore, in this light, this Ministerial Segment must view the African Process as a project largely about the actions that African countries should collectively invest in, or undertake, in order to ensure entry into, and full occupancy of, sustainable development trajectories. Today, this may be our only option to ensure the timely improvement of our environmental status, and thus, the effective enhancement of the socio-economic lives of our people.

The Challenge

We know that our ability to invest in the search for and implementation of environmental sustainability programmes is largely influenced by the current economic environment. We also know that our countries are mostly preoccupied with short-term economic recovery measures. However, although our nations appreciate the importance of environmental management, we are confronted with pressing and often short-term economic crises that undermine social and political stability. Under these conditions of low economic growth, it is difficult to invest or re-direct resources to environmental management issues. The paradox, however, is that we need to invest in environmental management activities in order to achieve long-term economic recovery. Therefore, our sincere search for Africa's environmental sustainability must be founded on those measures that will renew and enlarge the continent's economies as per the African Process initiative.

Although significant progress has been made towards greater awareness of the implications of degradation of our marine and coastal environment, there is the need to link economic development with environmental sustainability. Gladly, we note that many sub-Saharan African countries have made efforts to integrate environmental considerations into their national economic development policies and plans. But the transition of these into concrete actions may have been hampered by constraints on financial resources and limited institutional capacity. To this end, a concrete programme of intervention based on innovative partnerships and novel-funding mechanisms must necessarily be envisaged as a timely bail out.

"A concrete programme of intervention based on innovative partnerships and novel-funding mechanisms must necessarily be envisaged as a timely bail out."

Vehicle for Change

Today, through the consolidation of gains emanating from the African Process, our understanding of Africa's environmental status has grown considerably. The notable gains are a result of new knowledge and information on resources of environmental degradation and its consequent socio-political, ecological, and economic impacts. Hence, the role of the African Process as a vehicle for positive economic change and growth cannot be disputed, and therefore must be enhanced.

The upcoming World Summit on Sustainable Development (WSSD) will usher in the 30th anniversary of the

Science teaching in Nigeria © *Gary Fullerton, UNESCO*

1972 UN Conference on Human Environment, and also the 10th anniversary of the 1992 UN Conference on Environment and Development. Though both were watershed events generating major changes in policies and strategies for sustaining development, crucial decisions still need to be made if we must sincerely chart a "common future" for Africa. Therefore, for the upcoming WSSD to also become a watershed event for Africa, the crucial path will depend, to a great deal, on what key policy issues we address here, how it is organized and packaged, and our level of preparatory work. It is good enough that we are here today.

Until recently, environment and economic sectoral policies in our continent have largely proceeded on parallel paths, which too often forced choices between environment and development. The African Process must reconcile both, and create a Pan-African strategy for our sustainable future.

At the 1992 Rio Conference and Earth Summit, a comprehensive Agenda 21 and action plan for integrating environment and development was agreed upon. Although Agenda 21 led to some notable successes for the developed nations, for many of our developing countries it failed to address the top policy priority to alleviate the poverty of the poor majority of our people. In this regard, we note that in the wide-ranging Agenda 21 "combating poverty" is just one of 38 goals, and "enabling the poor to achieve sustainable livelihoods" is only one of 131 priority programmes. To fully integrate environment and development in our setting, support and commitment to the African Process must be made a priority, in order to make sustainable development more relevant for the poor majority of our people. As poverty is now a cardinal cause and major consequence of environmental degradation, our key priority is to alleviate poverty by harnessing beneficial partnerships and innovative mechanisms to address and implement the targeted Programme of Interventions.

Our Lessons and Resolve

A major lesson that we must learn from the current state of our coastal and marine environment is that economic growth policies that degrade the environment and resource base are not ecologically or economically sustainable. Today, as we package the African Process to be showcased at the WSSD, we must energize it to illuminate the African Ministerial Conference on the Environment's (AMCEN) message that "economic and environment policies which do not improve the lives and livelihoods of the poor majority of our people are not socially or politically sustainable."

Today, we are called to meet and exceed this challenge. It must be our resolution to:

- Recognize the role of our environment as the framework for our life support system and basic source of food, energy, biomass and genetic resources, industrial raw materials, climate stability and regulation, water supply, income generation and poverty alleviation, and livelihoods of millions of our people.
- Acknowledge that the development and protection of sub-Saharan Africa's marine and coastal environment is essential for maintaining ecosystem functions, goods, and services.
- Realize that our future development path is threatened by existing and emerging environmental hot spots that require urgent innovative intervention mechanisms, given that technology and available funds for intervention projects are very limited.
- Note the synergetic roles of the African Process to related conventions, and instruments such as Agenda 21 and the New Partnership for Africa's Development (NEPAD).

This Ministerial segment should:

I. Urge all partners as stakeholders to use the African Process as a platform for highlighting, profiling, and promoting the role

of marine resource development and protection in sustainable development at the WSSD.

II. Request partners, governments, donors, and the international community to assist our continent to develop and implement national and regional strategies for the management of key ecosystems and habitats, as these initiatives hold promise for promoting sustainable development, food security, poverty alleviation, and provision of livelihood alternatives.

III. Call upon the international community to commit itself to a partnership of mutual trust and accountability to effect the necessary changes in sub-Saharan Africa, as represented by the African Process (and NEPAD). This partnership must be an ambitious commitment to solving problems together, in a spirit of joint responsibility among governments, and with the private sector and civil society.

IV. Extend our warm appreciation to all participants who have made the Abuja Super PrepCom the vehicle for a successful Partnership Conference during the upcoming WSSD.

My colleagues, we are on the path to achieving our noble initiative.

Statement by the Chairperson of the Preparatory Committee for the Partnership Conference, the Honourable Ms. Rejoice Mabudafhasi MP, Deputy Minister of Environmental Affairs and Tourism of South Africa, and ACOPS Vice-President

I want to use this occasion to extend a word of thanks to His Excellency, President Obasanjo and all representatives of the Government of the Federal Republic of Nigeria for hosting this Super PrepCom in your country, which is a favourable milestone in the African Process. Let me also use this occasion to thank my Vice Chair Minister Kachamila of Mozambique and Dr. Okopido for their continued moral and professional support throughout the Process. You have supported me and we have supported each other in this process through many difficult times.

It is through this wonderful support, the hard work of the experts, implementing agents, executing agents, and our partners, some of whom are here today, that we can collectively claim the success of the African Process for the Development and Protection of the Marine and Coastal Environment in Sub-Saharan Africa.

We have been and will continue to be faced with many challenges, until we finally eradicate poverty, which is the greatest challenge for Africa. One of the most immediate challenges that we face as we are seated here today is how to take the African Process forward beyond the Partnership Conference, which will be held at the level of Heads of State at WSSD in Johannesburg.

Before I ask you to apply your minds to this very pertinent issue, let me indicate that the ocean is precious, and if there is anything uniting all of us in this room today, it is indeed the ocean, which we in Africa are attempting to develop and protect through the African Process. It is a Process that presents us with an opportunity to work together as Africans in our common quest to achieve sustainable development levels. I have no doubt in my mind that we are succeeding.

I want to tell the following story, that most of you know, which relates to three young boys who wanted to trick a wise old African Chief. Essentially these boys were concerned about the fact that whenever they asked the Chief a question, he always had the right answer. So one day, the three of them went to the Chief and one boy was holding a bird in his hand. He asked the Chief, "since you know all the answers to everything, can you tell me whether the bird I am holding in my hand is dead or alive?" The Chief realized that if he said the bird was alive, the boy could just squeeze it to death. Alternatively, if he said the bird was dead, the boy could just open his hands and let it fly away. Under these difficult circumstances, the wise Chief responded, "the future of that bird lies in your hands." Essentially, the Chief's message was that they could decide to kill the bird, or to let it live.

Distinguished participants, let me indicate to my fellow African Ministers here today, and all role players in the African Process, that the future of the African Process is in our hands—we can decide whether we are going to kill it at the Partnership Conference, or let it live beyond then.

As I mentioned in my opening address during the technical segment of this Super PrepCom, the African Process, on the basis of this hard work, now enjoys the support of the Chairman's Report of the Preparatory Committee

of the World Summit in both Chapters 4 and 8, where it is indicated that assistance should be given to developing countries, especially to regional initiatives. The African Process is specifically mentioned as a regional initiative in Chapter 8. This, in my humble opinion, signals to me that the African Process is held in high esteem.

As evidence of this, let me remind you that the Heads of State segment of the Partnership Conference will be held for one hour during the second week of WSSD, whereas the technical and ministerial segments will be held during the first week. These segments will be held over two days towards the end of the first week of WSSD. As promised, I will be sending you invitations shortly, but in the meantime, I repeat, let me extend an invitation to each and everyone of you to join us at the Partnership Conference. I want to extend this invitation in the context of the Nigerian hospitality that I always experience when I come here, by saying, "You are welcome" to the Partnership Conference and to South Africa.

The Partnership Conference at the WSSD will present us as Africans, together with our partners and the implementing agents, as well as executing agents for the African Process, with yet another opportunity amongst others to influence the global agenda; in particular, issues pertaining to coastal and marine resources. There are tremendous opportunities for African States to address the very pertinent issues hindering sustainable development on our continent. The underlying problems of poverty, food, and economic security cannot be overemphasized.

The African Process will be used as a vehicle to drive the oceans and coasts focus area of the Environmental Action Plan of the New Partnership for Africa's Development (NEPAD).

As we proceed on our journey to the WSSD in Johannesburg, Africa needs to prepare itself to show the world that we, as Africans, can determine our own destiny. The African Process will be one of Africa's shining examples that we will showcase under the oceans and coasts agenda of WSSD, that is, putting Africa's contribution within the overall global context.

It is my hope that the African Process will not end with the Partnership Conference. In fact, I hope that this could just be a vehicle for co-opting a new generation of countries with new issues, and possibly new themes that may be emerging for the next analysis phase.

I shall continue to engage all governments in Africa to make this African Process a true African-led initiative—by Africans for Africans.

The final project proposals, which have now been compiled into the Programme of Interventions, are uniquely placed to provide concrete activities: concrete projects that address national issues of regional significance and that will result in poverty eradication and enhanced sustainable development opportunities for the region and continent at large. Potential partners had the opportunity to participate in the development of project proposals at an early stage. The objective is to jointly prepare the terrain for the Partnership Conference.

During the last three days, five thematic groups have presented actual projects. These have been able to transcend a purely national vision, and to provide for integrated project proposals that build upon issues common to several countries. The five thematic working groups consist of: Coastal Erosion, Management of Key Habitats and Ecosystems, Pollution, Sustainable Use of Living Resources, and Tourism.

"GOOS for Africa, as an integral part of the African Process, is a viable scientific and technical framework for sustainable management of the coastal and marine environment of Africa. "

Also part of the African Process is the Global Ocean Observing System (GOOS) Africa Project. The Regional Ocean Observing and Forecasting System of GOOS for Africa, as an integral part of the African Process, is a viable scientific and technical framework for sustainable management of the coastal and marine environment of Africa.

Some of the most fundamental messages that came through during the technical segment in various presentations relate to capacity building, national consultations, sustainable funding, community involvement, risks, linkages in programmes, establishment of interagency task teams, government endorsements, and bankable projects, to mention a few.

On the basis of some of the interventions, I want to urge my fellow African countries to go back and look at additional means to increase in-country contributions, so that our projects do not become donor-driven, but country-driven.

I want to thank all the distinguished participants for their contributions, either through constructive critical comments or questions. As a consequence of these meaningful interventions we can now go back and refine the Programme of Interventions, and identify future projects to continue on our route towards sustainable development for Africa. Thanks to your contributions, we can now ensure that all these elements and missing links will be incor-

porated into the Programme of Interventions.

I am now confident that we are really in position to showcase these projects at the Partnership Conference at WSSD as concrete projects that we, as Africans, have developed together with implementing and executing agents, and our partners.

Over the last three days, through vigorous interrogation of the Programme of Interventions, we are now in a position to package our projects for the Partnership Conference with clear programmes of action, timeframes, and mechanisms to implement. This is exactly what we want to achieve with WSSD in general. The African Process is therefore a shining example for WSSD.

As we are preparing to depart for our respective destinations, I am delighted to go back to South Africa to report to my President, Honourable Thabo Mbeki, that we have emerged from Abuja with a concrete agenda for implementation that will demonstrate that African countries themselves are determined to seek solutions to the challenges facing the continent. We are continuing to seek solutions in the spirit of NEPAD to include mechanisms to ensure meaningful and positive engagement between African countries and their developed counterparts on common developmental issues. Your Excellency President Obasanjo, Honourable Minister Okopido, Ministers, Members of the Diplomatic Corps, Distinguished Ladies and Gentlemen: I will leave Abuja tomorrow with a sign of hope, as this Super PrepCom was a success. Let us continue this accomplishment as we commence our journey to the Partnership Conference, where we intend to achieve similar success stories.

Before I conclude, I want to indicate that the Global Environment Facility Medium-Sized Projects (GEF-MSP) are coming to an end at the Partnership Conference. It is now up to African Ministers to determine the way forward, which is the implementation phase. Over the next few days, I will continue to engage my fellow African Ministers to apply our minds pertaining to the implementation phase, so that I can make an announcement in this regard at the Partnership Conference.

Special thanks to: GEF (which brought life to the African Process to enable it to start financially), the Advisory Committee on the Protection of the Sea (ACOPS), the Intergovernmental Oceanographic Commission (IOC) of UNESCO, and the United Nations Environment Programme (UNEP). Thanks also to the countries that came to support us: Sweden, Norway, the USA, Finland, and the European Union.

I am sure you have something positive about the African Process to take home. We rely on you to be our ambassadors.

"People, Planet, Prosperity" are our goals as African Ministers. Let us all rejoice for success.

Statement by the Vice-Chairman of the Preparatory Committee for the Partnership Conference, the Honourable Mr. John W. Kachamila, Minister for Coordination of Environmental Affairs of Mozambique, and ACOPS Vice-President

On behalf of the Government of the Republic of Mozambique, allow me to convey to your Excellency our appreciation for the excellent organization of this Super PrepCom on the African Process. Special thanks to the Government of Nigeria, and to His Excellency Olusegun Obasanjo, President of the Republic of Nigeria, for hosting this conference here in Abuja. Also, I would like to congratulate the Advisory Committee on Protection of the Sea (ACOPS) for its role as coordinating agent for the whole process, and for tirelessly informing us on the progress of organizational and other technical matters.

The African Process must be a proactive movement, and cannot be turned into a summary of good ideas.

Mozambique has a large, rich, and diverse coast. Coastal and marine resources play an important role in its social, cultural, and economic development. About 41 percent of the Mozambican population live in coastal districts and gain their living out of coastal and marine resources, and all the major cities are along the coast. Fisheries, agriculture, tourism, and maritime transports are some of the sectors of the economy fundamental for the development of Mozambique and its export earnings.

As stated, marine resources are a basis for the survival of a large number of coastal populations and are one of the major sources of income in many African economies.

Despite the widely recognised socio-economic importance of marine resources, they are, however, at risk, both from human activity and the

natural physical environment itself. The human threat is mainly due to higher pressure and uncontrolled exploitation of resources, use of wrong harvesting techniques, and pollution. This is mostly attributed to poverty, lack of expertise and relevant data for environmental management, as well as lack of financial resources for governments to boost sustainable development alternatives.

The Pan-African Conference on Sustainable Integrated Coastal Management, PACSICOM, which took place in Maputo, Mozambique, in July 1998, offered a unique opportunity for discussing the state of the coastal and marine environment in Africa, with a focus on the need for concerted intergovernmental dialogue. The African countries recognised that our marine environment is being threatened and that a united front is necessary to reverse the catastrophe that the continent may otherwise expect.

PACSICOM was followed by the Cape Town Conference in the Republic of South Africa, which focused on the promotion of inter-African cooperation in the implementation of regional conventions, programmes, and action plans to protect, manage, and develop Africa's marine and coastal environment. One of the main outputs of the Cape Town Conference was the recommendation to organize a partnership conference, which would bring African States and their international partners together with a view to develop and seek support for the development of project proposals for sub-Saharan Africa.

These two events resulted in the building-up of unified political awareness amongst African Countries of the need to develop an integrated approach for the development and preservation of coastal and marine resources, encapsulated in the African Process.

The African Process provides an opportunity for a wide range of regional and international partners to work with local stakeholders on projects with a high degree of national ownership. It actively engages the private sector, setting the scene for the development of public-private partnerships based on jointly developed proposals. The African Process will contribute to the Environment Initiative of the New Partnership for Africa's Development (NEPAD), which basically aims at joining efforts and setting strategies towards alleviating poverty and promoting sustainable development in Africa.

We are glad to notice that, under the guidance of our Heads of State and Governments, and with local expertise, we did manage to meet the goals that we set for ourselves when the Process started. In fact, this meeting in Abuja was only able to take place because we successfully completed both Phase I and Phase II of the African Process, aimed at Integrated Problem Analysis, and Preparation of the Programme of Interventions.

Based on the findings of the Integrated Problem Analysis of the coastal and marine environment in sub-Saharan Africa, a cluster of project proposals was finalized recently and presented at this Conference in Abuja, covering issues of national and regional significance, including management of fisheries resources, control of coastal erosion, integrated management of river basins and coastal zones, pollution control, protection of biological diversity, restoration of degraded habitats, and others.

The preparation of the Programme of Interventions was a challenging, learning and didactic process, which allowed us to consolidate our understanding about common aspects of the coastal and marine environment in sub-Saharan Africa, identify common aspects and complementarities among national and regional problems and needs, linkages between Community empowerment, environmental conservation, and poverty alleviation. All this effort has paved the way for the Partnership Conference to be held, as a side event, during the World Summit on Sustainable Development.

This Super PrepCom is a starting point for a new phase of the African Process. From now on, our main task is to keep the momentum of the Process, galvanizing political and financial support for the Programme of Interventions. As we have previously said, the African Process must be a proactive movement, and cannot be turned into a summary of good ideas to be forgotten under our desks. The African Process should therefore:

- Guarantee that the projects to be implemented in participating countries be geared towards promoting institutional capacity, partnership between governments, business and civil society, thus contributing in very concrete ways to poverty alleviation and socio-economic development in sub-Saharan Africa.
- Be a model of a successful process in poverty alleviation, and facilitate the mobilization of more partners and financial resources in support of further initiatives.
- Go beyond the Partnership Conference, capitalizing on lessons learned to date and bringing on board more African countries.

"Our main task is to keep the momentum of the Process, galvanizing political and financial support for the Programme of Interventions."

The creation of an implementation and follow-up body responsible for the Super PrepCom and Partnership Conference decisions is recommended.

I want to express my deep appreciation for the strong political support from our Heads of State and Governments shown at the Organization of African Unity (OAU) Summit 2001, in Lusaka, Zambia, which will lead us to a successful Partnership Conference in Johannesburg. Their personal involvement has brought this Process to the highest level, both in Africa and at the international level. Their vision and support will serve as a compromise for all of us to fully commit ourselves to this Process. I am sure that the African Process will significantly contribute to the WSSD and to the integrated and sustainable management of the coastal and marine environment in general.

Allow me to reiterate my thanks and that of my delegation, to the Government of the Republic of Nigeria for its hospitality. I also want to address my sincere compliments to our African experts and officials, as well as to ACOPS, UNEP, UNESCO, IOC, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA), GEF, and all other partners for their support to the African Process.

Lastly, a special word to the Chairperson of the African Process, the Honourable Ms. Rejoice Mabudafhasi, Deputy Minister of Environmental Affairs and Tourism of the host country of the WSSD, the Republic of South Africa. Her role has been of great importance for the success of the Process. She has been assisted by the tireless (Dr.) Imeh Okopido, State Minister of Environment of Nigeria. To both of you, my congratulations. I have enjoyed your collaboration.

Statement by the Honourable Ms. Anna Nyamekye, Deputy Minister of Environment and Science of Ghana

I convey to you warm greetings from my Head of State, His Excellency, President J.A. Kuffuor and the people of Ghana.

Chairpersons, Ghana considers the African Process as the ultimate programme of action for sustainable development and management of its coastal zone in the coming decade. We believe the same is true with our sister participating countries in this new initiative, which is linked to previous and existing projects, such as the Gulf of Guinea Large Marine Ecosystem, and the Abidjan and Nairobi Conventions.

"It is our firm belief that this Process will indeed culminate in remarkable sustainable growth for the coastal zones of sub-Saharan Africa as well as positively contribute to poverty alleviation, minimize environmental degradation, and promote socio-political stability."

Several formal and informal in-country consultations took place with Ghana's participation in the African Process. This involved consultations with relevant sector ministries and their departments, e.g., Fisheries, Tourism, Works & Housing, NGOs, civil society, etc. Two key meetings were held. The first was a consultative meeting of experts, which not only provided inputs to the projects, but also prepared them for the eventual acceptance of the proposals into their respective departments and institutions during the implementation phase of the Process.

The second meeting was national in character. It involved heads and/or representatives of 15 institutions (including the Ministry of Finance), NGOs, and other stakeholders. The objective of this second meeting was to discuss, assess, and obtain views, which will be useful for the implementation of the projects to which Ghana has subscribed. These projects, which span all the five major

Fishermen in Ghana © *Philip Gaunt, UNESCO*

themes (coastal management, pollution, tourism, management of key habitats, and sustainable use of living resources), will be further prioritised to fall in line with my Government's short-term accelerated programme of development, popularly known as "Ghana's Vision 2010." We are particularly interested in enhancing the use of coastal tourist destinations in the Central Region (Elmina and Cape Coast) and to the East, the Volta Estuary, as tourism is fast becoming the main breadbasket for Ghana.

Based on the outcome of the consultations and the confidence we have in the African Process, my Ministry, on behalf of the Government of Ghana, has endorsed the selected projects (subject to further prioritisation.) The endorsement entails the commitment of the Government of Ghana to assign institutional and technical support, as well as some financial resources towards the execution of the projects.

From the above account of the efforts in my country on this important Process, it is certain that the necessary administrative mechanisms have been put in place for the take off of the implementation phase of the African Process in Ghana. It is our firm belief that this Process will indeed culminate in remarkable sustainable growth for the coastal zones of sub-Saharan Africa as well as positively contribute to poverty alleviation, minimize environmental degradation, and promote socio-political stability.

Finally, on a more regional and perhaps personal level, I noticed in the presentations of the past few days, the recurring issue of alternative sustainable livelihoods as a remedial option in curbing habitat degradation and loss. It was mentioned in the Tourism, Key habitats, Sustainable Management of Living Resources components of the proposals. May I suggest that we consider setting up a Regional Centre for Sustainable Livelihood Development to serve as a resource unit for ensuring continued and successful implementation of the sustainable livelihood projects identified in the Process.

Statement by the Honourable Mr. Joseph Kamotho, Minister for Environment of Kenya, and ACOPS Vice-President

Almost four years ago in 1998, we came together in Maputo and later in Cape Town to deliberate on the sustainable development and conservation of Africa's vast ocean and coastal resources, which have for a long time been neglected and left to wasteful exploitation. The two conferences refocused the continent's attention and enabled us to move issues of coastal and marine environment high onto the development agenda.

It is encouraging to note that the resolutions and agreements reached in those meetings have borne fruit through the excellent work of the implementing agencies of the African Process. As we all know, quite often good-intentioned conference declarations find little expression beyond the letters of the words. But the African Process has proved to be different, and I would like to commend the Advisory Committee on Protection of the Sea (ACOPS), IOC of UNESCO, and UNEP for their success in translating the Conference Declarations into tangible actions. Kenya, as an active participant in the Process since its inception, is impressed and satisfied with the progress made.

From the outset, therefore, let me reaffirm my Government's commitment to the African Process and to the sustainable management of coastal and marine resources. When we were developing the National Environment Action Plan (NEAP) and the Policy on Environment and Development, we recognised the crucial role played by the country's biodiversity in the socio-economic development of the nation. Kenya recognises that conservation and proper management of marine resources represent an investment in national prosperity. To this end, the

Young Kenyan students *Credit: P. Lissac, UNESCO*

Government has taken concrete steps to put in place appropriate policies and institutional arrangements for effective environmental management.

The Environmental Management and Coordination Act, enacted in 2000, sets out a legislative framework for proper resource use within the broad goals of sustainable development. The Act, which entitles every Kenyan to a healthy environment, is a remarkable document and the first of its kind in the country. It recognizes the need to conserve the environment for the benefit of present and future generations of Kenyans, as well as for global posterity. The implementation approach of the Act emphasizes that people who are affected by decisions should take part in making those decisions. As part of the requirements of the Act, we are in the process of developing a comprehensive ocean and coastal policy to guide sustainable use of these resources.

At the regional level, Kenya takes an active role in all regional and sub-regional initiatives, and as the depository nation, we continue to strongly support the Nairobi Convention for the Protection, Management and Development of the Coastal and Marine Resources of Eastern Africa. In this regard, I would like to recognize the invaluable support of the UNEP Regional Seas office, in developing and implementing a range of biennial work programmes to address priority issues in the region.

The African Process has been a major tool for effecting the work plans of the Nairobi Convention. The Problem Analysis Phase of the Process, I am told, identified common issues of concern that gave rise to the comprehensive interventions being presented in this meeting.

Kenya has held extensive national consultations at each stage of the African Process to give ownership and needed support to the Process. The National Report, which identified and characterised the main causes of environmental degradation, was validated through national workshops. The proposals and Programme of Interventions developed on the basis of those reports coherently support and complement our national efforts and ongoing programmes. It is for this reason that Kenya has identified itself with almost all the proposals as relevant interventions for the country to take part in.

On the eve of the World Summit for Sustainable Development in Johannesburg, the Kenyan Government believes it is critical for African countries to address the challenges of sustainable management and conservation of the coastal and marine environment. The World Summit has already attracted and focused world attention on Africa. This wonderful opportunity should be seized through the African Process to mainstream and gain support for our efforts to attain social equity and sustainable development. Development is crucial to ensure that we can eradicate the scourge of poverty that stalks our land. Too many of our people are poor and in need of targeted solutions to stem the vicious cycle of poverty and environmental degradation. Coastal and marine resources, providing a way for the poorest of people to survive and make a living, are crucial in the eradication of poverty.

As we all know, partnerships and initiatives to implement Agenda 21 are expected to become one of the major outcomes of WSSD, especially the so-called "Type II" partnerships. In the present post-industrial world, where more emphasis is placed on the role of the private sector and broadly on the role of partners, the Partnership Conference and this Abuja meeting offer us the opportunity to push forward priority concerns of the region. I believe the Programme of Interventions developed by our national experts, fits well into this new development construct, which promotes the need for projects to be time-bound, financed, and partnered. Our governments lack sufficient resources to achieve sustainable development on their own, but through the mix of partnerships and incentives, we hope to attract all those willing to join us in making change for our collective environment.

"The Kenyan Government believes it is critical for African countries to address the challenges of sustainable management and conservation of the coastal and marine environment."

The problems afflicting the African continent in general are too well known. The African Process has contributed to the understanding of the causes of the environmental degradation of our coastal and marine environments. We therefore need to get on with actual implementation to correct the identified problems and to make progress in implementing the Programme of Interventions carefully put together in the past two years. It is my hope that the Partnership Conference will be able to effectively mobilize support for the African Process and for sustainable development. In this way, the Conference will produce results, rather than the many high-sounding rhetoric gatherings of the past.

The African Process was a good start. It should certainly not end with the Partnership Conference. Rather, the conference should catalyse the beginning of new and dynamic initiatives to progressively address the myriad problems affecting our coastal and marine environment.

While the African Process has done well thus far, it should continue to operate within the established regional legal frameworks and institutional mechanisms. The Process should closely work with, and be part of, the Nairobi and Abidjan Conventions. In Bali, during the last WSSD PrepCom, the need to strengthen Regional Seas Programmes was strongly supported by all nations. Therefore, any programme initiatives in the area of oceans and seas should clearly identify, and operate from, these regional arrangements.

I wish to reiterate that Kenya will be a full partner in the African Process and we will take every opportunity to interest our development partners as we prepare for the Partnership Conference.

Annexes

Courtesy Luc Cuyvers, MN Films

IOC Officers

Chairman

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

Vice-chairman

Dr. David Pugh
(United Kingdom)
Southampton Oceanography
Centre

Vice-chairman

Admiral Marcos Leal
(Brazil)
Director
Directorate of Hydrology
and Navigation (DHN)

Vice-chairman

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

Vice-chairman

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

Vice-chairman

Dr. K. Radhakrishnan
(India)
Director
Indian National Centre
for Ocean Information
Service (INCOIS)

Past-Chairman

1995 - 1999
Mr. Geoffrey L. Holland
(Canada)
Canadian Oceans Ambassador,
Department of
Fisheries & Oceans

The IOC Rules of Procedure indicate that the Officers of the Commission shall consist of the Chairperson and five Vice-Chairpersons. The five Vice-Chairpersons shall be nationals of Member States of different electoral groups (as listed in Appendix II of the Rules of Procedure).

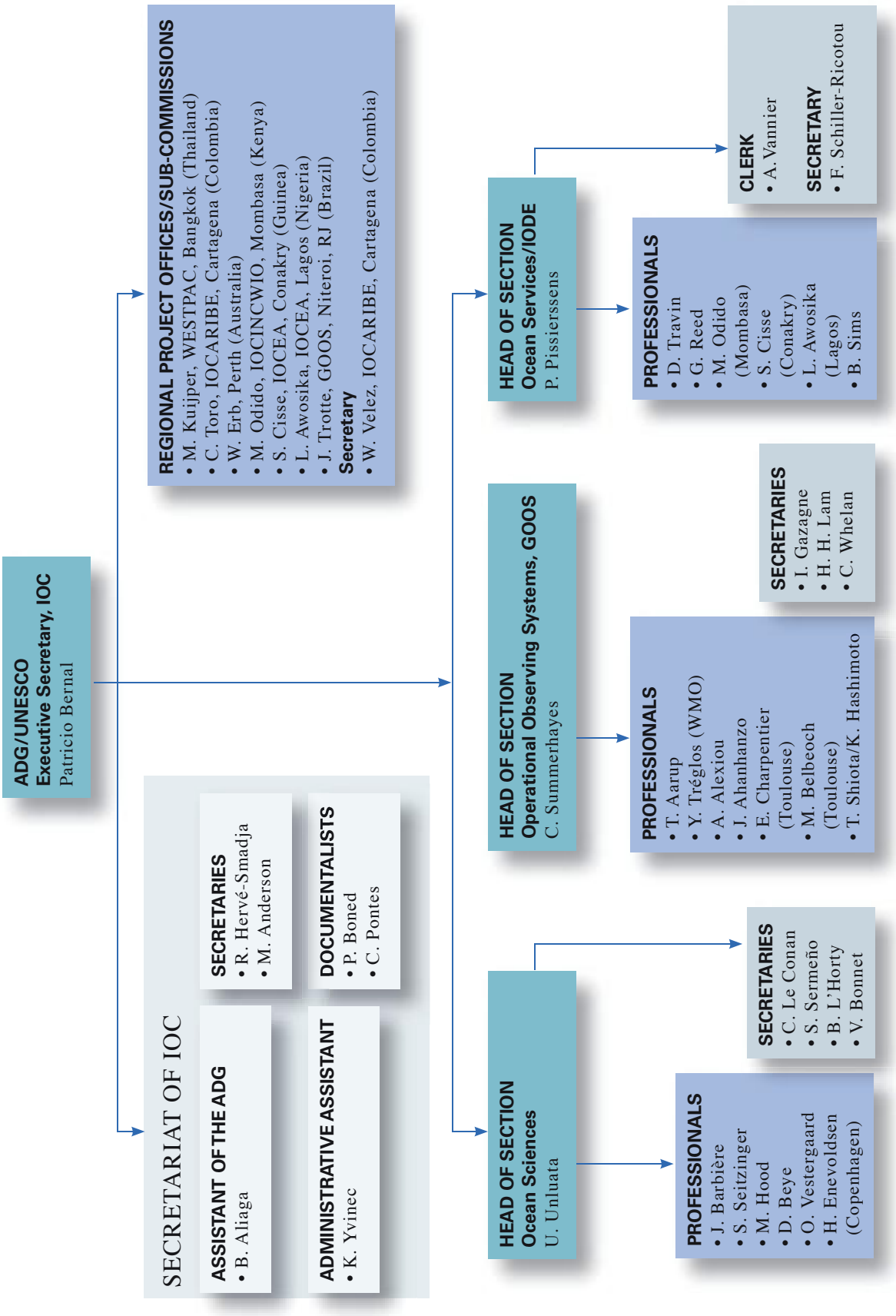
IOC Member States

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 REP.	(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)
NAMIBIA	(25 April 2001)
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 REP.	(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

IOC Structure

Organization of Secretariat Staff



IOC Personnel

Headquarters personnel shown in the photo (left to right):
Front row: Silvia Sermeño, Ho Hien Lam, Boram Lee, Réjane Hervé-Smadja, Cigié Pontes, Colin Summerhayes, Thorkild Aarup, Greg Reed
Second row: Yves Tréglos, Patricio Bernal, Ksenia Yvinec, Peter Pissierssens, Maria Hood, Mehret Michael
Third row: Christiane Le Conan, Virginie Bonnet, Sonia Guiraud, Dimitri Travin, Françoise Schiller-Ricotou, Umit Unluata, Arthur Alexiou, Dianaba Beye, Bernardo Aliaga
Fourth row: Irène Gazagne, Ole Vestergaard, Adrien Vannier, Kazuya Hashimoto, Patrice Boned

Personnel not shown in the above photo:
Justin Ahanhanzo, Julian Barbière, Benjamin Sims, Cherie Whelan, Melissa Anderson, Sybil Seitzinger, Henrik Enevoldsen, Etienne Charpentier, Mathieu Belbeoch, Maarten Kuijper, Cesar Toro, William Erb, Mika Odido, Sékou Cissé, Larry Awosika, Patricia W. Velez, Janice R. Trotte

In Memoriam

In 2002 the Intergovernmental Oceanographic Commission expressed great sorrow at the passing of two of oceanography's valued scientists and visionaries, Elisabeth Mann Borgese and George Needler. They will be greatly missed and always remembered, both within the larger oceanographic community, and here amongst their friends and colleagues.

Patricio A. Bernal
Executive Secretary, IOC of UNESCO

"The Mother of the Oceans"

Elisabeth Mann Borgese
(1918–2002)

"The oceans are a great laboratory for the making of a new world order, based on new forms of international cooperation and organization, on a new economic theory, on a new philosophy."

Courtesy of International Ocean Institute

Professor Emerita of Political Science, Elisabeth Mann Borgese died suddenly on February 8, 2002, while on a skiing trip. She was 83.

The daughter of renowned author Thomas Mann, she studied piano before her extensive studies in political science and law. A citizen of the world, she lived in Germany, Switzerland, Italy, and the United States, before settling in Canada and becoming a Canadian citizen.

Her most famous role was as an advocate for sustainable ocean development, and its preservation as the common heritage of mankind. "Many of the ideas that I developed early, and that were considered idealistic at the time have entered now into the political arena," she said. "Our early efforts to integrate economics and ecology, development, and environmental concerns, are now universally pursued … The oceans are a great laboratory for the making of a new world order, based on new forms of international cooperation and organization, on a new economic theory, on a new philosophy."

In a life marked by movement, one constant was Mann Borgese's fascination with the ocean. She explained, "The oceans are a medium different from land ... they force us to think differently about boundaries, which neither fish nor pollution respect, about sovereignty, about property, about cooperation, about sharing and mutual aid, about the relations between human beings and nature."

She was convinced that the UN, by promoting and adopting the United Nations Convention on the Law of the Sea (UNCLOS), was finally opening a much-needed new stream of development in international law. "The area of the sea-bed and ocean floor and the subsoil thereof, beyond the limits of national jurisdiction, as well as its resources, are the common heritage of mankind," she wrote, "the exploration and exploitation of which shall be carried out for the benefit of mankind as a whole, irrespective of the geographical location of States."

She was the founder and Honorary Chair of the International Ocean Institute (IOI) in Halifax, Canada. She was a consultant to the United Nations, the World Bank, and a host of other international organizations, and over the years helped to train civil servants and university faculty from developing countries in marine resource management and conservation.

She organized a pioneering conference called *Pacem in Maribus*, or "Peace in the Oceans," on The Law of the Sea in 1970. The conference has since become a remarkable event on ocean governance, with thirty more having taken place worldwide to date.

A prolific author, she recently completed a research project on ocean mining, and published dozens of books and hundreds of articles, including *The Drama of the Oceans, Ocean Governance*, and *The United Nations, Ocean Frontiers and Oceanic Circle*.

A dynamic woman, she kept regular office hours and taught courses in political science, maintaining an exhausting schedule right up until her death. Her work earned her many accolades, including an honorary Doctor of Laws degree from Dalhousie University, Canada, and an Order of Canada. The Government of Germany awarded her the Gosses Bundesverdienstkreuz, one of its highest honors.

One of the greatest tributes came in her recent nomination for the 2002 Nobel Peace Prize. She was described as "the brightest star in the firmament of the galaxy of those who have dedicated their life to the cause of global peace and justice." Indeed, she was called "the Mother of the Oceans" and will be justly remembered for encouraging world leaders to rethink both our relationship with the oceans, and our management of marine resources in terms of global issues.

Parts used by permission of Dalhousie University, Halifax, Nova Scotia, Canada

"One of the leaders in climate research and the development of Canadian oceanography"

Dr. George Treglohan Needler, FRSC
(1935–2002)

Courtesy of Allyn Clarke

The founding director of the World Ocean Circulation Experiment (WOCE) International Planning Office, George Needler, died on June 7, 2002 in his native Canada. He was 67.

The success of WOCE as a global oceanographic experiment to describe and better understand the oceans' general circulation as a key element of the Earth's climate system is, to a large extent, due to the firm foundation set in early years with George's strong input. He remained with International WOCE until 1992 as its Chief Scientist, and since that time, contributed greatly to the planning of its successors, the Climate Variability and Predictability Programme (CLIVAR), and the Global Ocean Observing System (GOOS).

George Needler was born in Summerside, Prince Edward Island into a family of marine biologists and fisheries scientists and was raised in the small Atlantic Canadian towns that were home to Fisheries Research Board Stations.

He joined the Bedford Institute of Oceanography (BIO) in 1962, and was sent almost immediately to the UK National Institute of Oceanography, Wormley, UK, to study the science of ocean circulation under Michael Longuet-Higgins, George Deacon, John Swallow, and Jim Crease. He returned to Halifax in 1992, where he led a small theoretical oceanography group and established a strong link to graduate student training by teaching a course in ocean dynamics at Dalhousie University. He was later very involved in the development of Ocean Observing Systems.

George was especially gifted in bringing scientists together to contribute their knowledge and expertise to collaborative programmes and to issues important to society. From 1975-1985, he was heavily involved in the assessment of the risks associated with the dumping of low level radioactive wastes in the ocean and the burial of high level wastes in the seabed. He chaired both a Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) working group and an International Atomic Energy Agency (IAEA) committee that provided the scientific basis for these assessments and established dumping limits for low level radioactive wastes in the ocean. In this task, he both maintained the integrity of the scientific assessment and developed a better understanding of the role of mixing and circulation in the ocean.

He also played important roles in the development of ocean climate science. He was part of the Scientific Committee in Oceanic Research (SCOR) working group that planned and coordinated the oceanographic components of the GARP Atlantic Tropical Experiment (GATE) in 1974. He was also part of the POLYMODE program, a bilateral US-USSR project to study mesoscale dynamics in the North Atlantic. In 1985, he became the first director of the International Planning Office for the World Ocean Circulation Experiment (WOCE). Over the next six years, he oversaw the development of WOCE's Science and Implementation Plans, represented the program at various national, international and intergovernmental fora, and evolved the planning office and management structure to that of a project office.

George played a key role in the development of Canadian oceanography. As a founding member of BIO, he helped shape its scientific program. He also served as Head of the Ocean Circulation Division 1975–78, and as Director of the Atlantic Oceanographic Laboratory 1978–85. After his return to BIO in 1991, he served on the Canadian Global Change Planning Board and its Research/Policy Committee and facilitated the development of an initial Canadian plan for GOOS.

In everything that he did scientifically, George always tried to understand what was happening at its most fundamental level. Whether at a seminar, or in an international meeting or, more often, around a restaurant table following an international meeting, he would ask probing questions, looking for what was really important in a paper or presentation.

He will be sorely missed as we continue to meet and discuss important ocean science issues.

Courtesy of Peter Koltermann, John Gould, Allyn Clarke, Ocean Circulation, Bedford Institute of Oceanography

Publications and Public Awareness

IOC Publications

Each year the IOC publishes numerous documents and publications. These publications support its programme activities and communicate the scientific and organizational information resulting from the various conferences, meetings, training courses, and other activities that benefit from IOC's support. Many of these publications are available on the Internet; certain titles are also available in print in cases where the Internet is not an option.

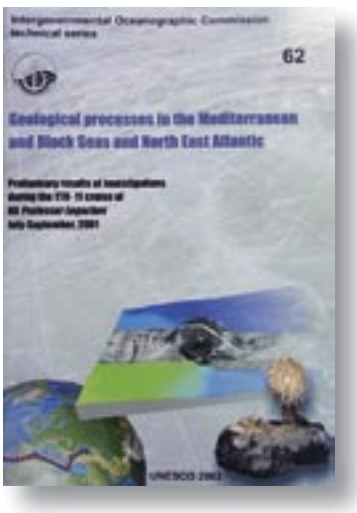
IOC TECHNICAL SERIES

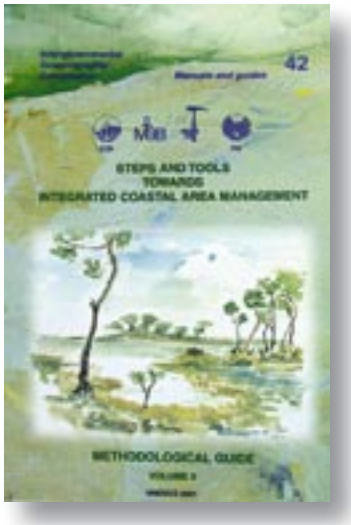
- Seibold, E. (2002) *The Potsdam Lecture: Forecasting Ocean Science? Pros and Cons*. (Technical Series, 61) 23 pp. (English)

- Kenyon, N.H., Ivanov, M.K., Akhmetzhanov, A.M. & Akhmanov, G.G. (eds.) (2002) *Geological Processes in the Mediterranean and Black Seas and North East Atlantic*. (Technical Series, 62) 113 pp. (English)
- SCOR Working Group 107. (2002) *Improved Global Bathymetry; Final Report*. (Technical Series, 63) 111 pp. (English)

IOC MANUALS AND GUIDES

- *Instrumentos y personas para una gestión integrada de zonas costeras: guía metodológica*. (2002) (Manuals and Guides, 42). Vol. 2. (Spanish) Also available in English: Steps and Tools towards Integrated Coastal Area Management: Methodological Guide. Also available in French: *Des outils et des hommes pour une gestion intégrée des zones côtières: guide méthodologique*.





IOC WORKSHOP REPORTS

- *Abstracts of Presentations at Workshops during the 7th Session of the IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Honolulu, Hawaii, USA, 23-27 April 2001*, org. in coop. University of Hawaii Sea Level Centre. (2002) (Manuals and Guides, 180) 16 pp. (English)
- Cunha, M., Pinheiro, L. & Suzyumov, A. (eds.) (2002) *Geosphere/Biosphere/Hydrosphere Coupling Processes, Fluid Escape Structures and Tectonics at Continental Margins and Ocean Ridges. Aveiro, Portugal, 30 January–February 2002*. (Workshop Report No. 183) 59 pp. (English)

TRAINING COURSE REPORTS

- *First ODINCARSA Training Course in Marine Information Management, Mazatlan, Mexico, 29 September-4 October 2002*. (2002) (Training Course Reports, 66) (English, Spanish; electronic version only)

IOC ANNUAL REPORT

- *IOC Annual Report 2001*. (2002) (Annual Report Series, 8) 148 pp. (English)
- *Floating University Facility—Training Through Research Programme, Annual Report 2001*.

(2002) (Hors series) 29 pp. (English)

INFORMATION DOCUMENTS

IOC/INF-1152 *Meeting of the Officers of the International Coordination Group for the Tsunami Warning System in the Pacific (ICG/ITSU), Honolulu, HI, 2001*. (2001) 31 pp. (English)

IOC/INF-1153 *Report of the IOC Consultative Group on Ocean Mapping (CGOM) to the 21st Session of the IOC Assembly, Paris, 3-13 July 2001*. (2001) 38 pp. (English)

IOC/INF-1154 Publications from the GIPME Open Ocean Baseline Study. (2001) 4 pp. (English)

IOC/INF-1155 *IOC Ocean Section: A Basis for Restructuring*. (2001) 40 pp. (English)

IOC/INF-1156 Summary Report: *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, Lisbon*. (2001) 14 pp. (English)

IOC/INF-1158 *Principles of the Global Ocean Observing System (GOOS) Capacity Building*. (2001) 19 pp. (English, French, Spanish)

IOC/INF-1165 *Position Paper on the Status of GLOSS in Africa, Contributed to the GOOS-AFRICA Meeting, Nairobi, 2001*. (2001) 13 pp. (English)

IOC/INF-1167 *The Final Design Plan for the HOTO Module of GOOS*. (2002) 84 pp. (English)

IOC/INF-1168 *Data and Information Management Strategy and Plan of the Global Ocean Observing System (GOOS), June 2001*. (2002) 57 pp. (English)

IOC/INF-1169 *The African Process for the Development and Protection of the Marine and Coastal Environment in Sub-Saharan Africa*. (2002) 8pp. (English, French)

IOC/INF-1170 *The Case for IOCARIBE-GOOS: A Strategic Plan*. Version 2.0, Draft. (2002) 41 pp. (English, French, Spanish)

IOC/INF-1171 *ODINAFRICA Progress Report*. (2002) 10 pp. (English)

IOC/INF-1172 *One Planet One Ocean; Sustainable Development of Oceans and Coasts: A Commitment of 129 States, Johannesburg, 2002*. (2002) 32 pp. (English, French, Spanish, Russian, Arabic, Chinese)

IOC/INF-1173 *A Global Ocean Carbon Observation System; A Background Report*. (2002) 50 pp. (English)

IOC/INF-1174 *An Intra-Americas Sea Tsunami Warning System Project Proposal*. (2002) 22 pp. (English)

IOC/INF-1175 *Second Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange*. (2002) 39 pp. (English, French, Spanish, Russian)

REPORTS OF GOVERNING AND MAJOR SUBSIDIARY BODIES

Thirty-fifth Session of the Executive Council, France. (2002) (Reports of Governing and Major Subsidiary Bodies, 91) 87 pp. (English, French, Spanish, Russian)

Eighteenth Session of the International Coordination Group for the Tsunami Warning System in the Pacific, Colombia, 2001. (2002) (Reports of Governing and Major Subsidiary Bodies, 93) 52 pp. (English, French, Spanish, Russian)

Fifth Session of IOC-WMO-UNEP Committee for the Global Ocean Observing System (I-GOOS-V), France, 2001. (2002) (Reports of Governing and Major Subsidiary Bodies, 94) 50 pp. (English, French, Spanish, Russian)

Seventh Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions (IOCARIBE), Mexico, 2002. (2002) (Reports of Governing and Major Subsidiary Bodies, 95) 49 pp. (English, Spanish)

REPORTS OF MEETINGS OF EXPERTS AND EQUIVALENT BODIES

Second Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Morocco, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 177) 27 pp. (English, French)

Second Session of the IOC-SCOR Ocean CO_2 Advisory Panel, USA, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 180) (English; electronic version only)

IOC Workshop on the Establishment of SEAGOOS in the Wider Southeast Asian Region, Republic of Korea, 2001. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 181) (English; electronic version only)

Fourth Session of the IOC-IUCN-NOAA Consultative Meeting on

Large Marine Ecosystems (LMEs), France, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 183) 43 pp. (English)

Seventh Session of the IODE Group of Experts on Marine Information Management (GEMIM), France, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 184) (English)

Sixth Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional-Global Ocean Observing System (NEAR-GOOS), Republic of Korea 2001. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 185) 35 pp. (English; electronic version only)

First Session of the Global Ocean Observing System (GOOS) Capacity Building Panel, Switzerland, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 186) (English; electronic version only)

Fourth Session of the Ad Hoc Advisory Group for IOCARIBE-GOOS, Mexico, 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 187) 13 pp. (English, French, Spanish)

Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IBCWIO), Mauritius 2000. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 188) 25 pp. (English)

Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific (IBCWP), China, 2000. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 189) 37 pp. (English)

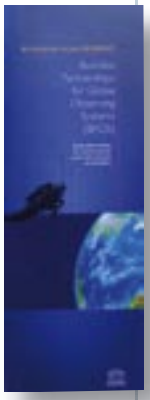
Third Session of the Coastal Ocean Observations Panel, GOOS Users' Forum, Vietnam 2002. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 190) 34 pp. (English)

Eighth Session of the IOC Consultative Group on Ocean Mapping, Russian Federation, 2001. (2002) (Reports of Meetings of Experts and Equivalent Bodies, 191) 40 pp. (English)

NEWSLETTERS

- *Harmful Algae News*. Paris, Special Issue, August 2002; No. 23, September 2002
- *Window*. Western Indian Ocean Waters. Paris, Vol. 13, No. 1, June 2002; No. 2, October 2002

BROCHURES



- IOC (2002) *Business Partnerships for Global Observing Systems* (BPOS). Paris.
- IOC (2002) *Ocean Science Section*. Paris.
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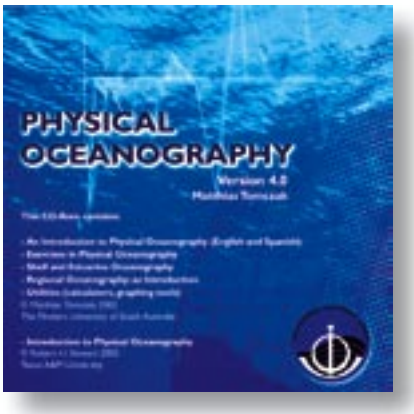

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Field, J.G., Hempel, G., & Summerhayes, C. (eds.) (2002) *Oceans 2020; Science, Trends, and the Challenge of Sustainability*. Washington, D.C., Covelo, London, Island Press. 365 pp. (English)

Wilkinson, C. (ed.) (2002) *Status of Coral Reefs of the World: 2002*. Townsville, Queensland, Australian Institute of Marine Science/ Global Coral Reef Monitoring Network. Joint UNESCO-IOC, UNEP, IUCN, World Bank Biennial Report. 378 pp. (English)

Further information can be found on the IOC Web site: <http://ioc.unesco.org>

Enquiries or requests for any of the above titles may be addressed to the IOC Documentalist: Patrice Boned p.boned@unesco.org Fax: +33 1 45 68 58 10

IOC Participation in 2002 Events

Event	Date	Venue	IOC Department
4th Consultative Meeting on Large Marine Ecosystems (IOC-NOAA-IUCN)	8-9 January	Paris, France	Ocean Sciences
3rd Session Coastal Ocean Observations Panel/ GOOS—COOP III	15-18 January	Hanoi, Vietnam	Operational Observing Systems
1st Session of the JCOMM Management Committee	6-9 February	Geneva, Switzerland	Operational Observing Systems
2nd Session SCOR-IOC Advisory Panel on Ocean CO_2	9-10 February	Honolulu, USA	Ocean Sciences
2nd Working Group Meeting on Programme of Intervention for the African Process	18-20 February	Accra, Ghana	Ocean Sciences
UN Ocean Atlas Meeting	25-27 February	Rome, Italy	Ocean Services
7th Session of the IOC Sub-Commission for the Caribbean and Adjacent Regions	25-28 February	Vera Cruz, Mexico	IOCARIBE (IOC Sub-Commission)
1st Session of the JCOMM Ship Observations Team	25 February-2 March	Goa, India	Operational Observing Systems
2nd Meeting of IOC Coral Bleaching Study Group	25 February-18 March	Heron Island, Australia	Ocean Sciences
International GODAR Workshop	5-7 March	Tokyo, Japan	Ocean Services
ICES-IOC Working Group on Harmful Algal Bloom Dynamics (WGHABD)	7-10 March	Bermuda	IOC Science & Communication Centre on Harmful Algae
MAMA Kickoff Meeting	11-13 March	Paris, France	Ocean Services
Mediterranean Global Ocean Observing System (MedGOOS) Meeting	11-13 March	Paris, France	Operational Observing Systems
23rd Session of the WCRP Joint Scientific Committee	18-23 March	Hobart, Australia	Operational Observing Systems
2nd Steering Group MEDI	2-4 April	Hawaii, USA	Ocean Services
1st Session of the JCOMM Services Coordination Group	3-6 April	Geneva, Switzerland	Operational Observing Systems
Marine XML Workshop	15-16 April	Helsinki, Finland	Ocean Services
ICES Marine Data Management Group (MDM)	17-19 April	Helsinki, Finland	Ocean Services
GETADE-9	20-22 April	Helsinki, Finland	Ocean Services
2nd Session of ICES/IOC Steering Group on GOOS	22-24 April	Halifax, Canada	Operational Observing Systems
5th Meeting of IOC Benthic Indicator Group	22-26 April	Heraklion, Greece	Ocean Sciences
ODINAFRICA Data Management Training Course	29 April-10 May	Tunis, Tunisia	Ocean Services
ODINAFRICA Information Management Training Course	29 April-10 May	Tunis, Tunisia	Ocean Services
3rd Working Group Meeting on Programme of Intervention for the African Process	May 2002	Dakar, Senegal	Ocean Sciences
Workshop on the Role of Indicators in ICAM	1-3 May	Ottawa, Canada	Ocean Sciences
5th Session of the Global Ocean Observing System Steering Committee (GSC-V)	1-3 May	Paris, France	Operational Observing Systems
Second Meeting of the IOC Advisory Body of Experts on the Law of the Sea (ABE-LOS)	6-9 May	El Jadida, Morocco	Ocean Sciences
Land-Atmosphere Ocean Biogechem Working Group, 1st Meeting	13-15 May	Paris, France	Ocean Sciences
International Ocean Exploration Feasibility Study Meeting	13-15 May	Paris, France	Ocean Sciences
Regional Ocean Portal Training Course	13-17 May	Paris, France	Ocean Services
GEBCO Officers Meeting	15-21 May	USA	Ocean Services
ODINCARSA Data Management Training Course	20-31 May	Guayaquil, Ecuador	Ocean Services
1st Session of the JCOMM Data Management Coordination Group	22-25 May	Paris, France	Operational Observing Systems
GEOHAB SSC	27-31 May	Helsinki, Finland	IOC Science & Communication Centre on Harmful Algae

Event	Date	Venue	IOC Department
7th Meeting of the Sponsors Group for the Global Observing Systems (GOOS) & 9th Meeting of the Integrated Global Ocean Observing Strategy Partners (IGOS-P)	30 May-1 June	Paris, France	Operational Observing Systems
35th Session of the Executive Council of IOC	4-14 June	Paris, France	All
7th Session of the Ocean Observations Panel for Climate—OOPC	5-9 June	Kiel, Germany	Operational Observing Systems
International GODAE Symposium	13-15 June	Biarritz, France	Operational Observing Systems
2nd Session of the Intergovernmental Working Group on IOC Oceanographic Data Exchange Policy	17-18 June	Paris, France	Ocean Services
ASFA Board	18-21 June	Rome, Italy	Ocean Services
1st Session of the IODE Group of Experts on Biological and Chemical Data Management and Exchange Practises (GE-BCDMEP)	24-26 June	Washington, D.C., USA	Ocean Services
First GOOS Capacity Building Meeting	24-26 June	Geneva, Switzerland	Operational Observing Systems
6th Editorial Board Meeting for the International Bathymetric Chart of the Western Indian Ocean	14-18 July	Maputo, Mozambique	Ocean Services
Black Sea Fluxes Workshop	21-24 July	Varna, Bulgaria	Ocean Services
5th Session of the IOC Sub-Commission for the Western Pacific	26-30 August	Freemantle, Australia	WESTPAC (IOC Sub-Commission)
6th Session of the IOC Black Sea Regional Committee	September	Albena, Bulgaria	Ocean Services
3rd Meeting of IOC Coral Bleaching Study Group	September	Mexico	Ocean Sciences
5th WESTPAC Session	9-13 September	Hangzhou, China	WESTPAC (IOC Sub-Commission)
1st Session of the JCOMM Expert Team on Maritime Safety Services	11-14 September	Lisbon, Portugal	Operational Observing Systems
Workshop on Vertical Crustal Motion and Sea Level Change	17-19 September	Toulouse, France	Operational Observing Systems
5th Session of the IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean	23-26 September	Nairobi, Kenya	IOCINCWIO (IOC Regional Committee)
4th Session Coastal Ocean Observations Panel/ GOOS—COOP IV Meeting	24-27 September	Cape Town, South Africa	Operational Observing Systems
ODINCARSA IM TC	30 September -5 October	Mazatlan, Mexico	Ocean Services
IAMSLIC	6-11 October	Mazatlan, Mexico	Ocean Services
8th Editorial Board Meeting for the International Bathymetric Chart of the Caribbean and Gulf of Mexico	8-12 October	USA	Ocean Services
18th Session of the Data Buoy Cooperation Panel	14-18 October	Martinique	Operational Observing Systems
Mediterranean-Black Sea Conference	14-18 October	Ankara, Turkey	Ocean Sciences
6th Session of the IOC Intergovernmental Panel on Harmful Algal Blooms	17-19 October	Florida, USA	IOC Science & Communication Centre on Harmful Algae
Regional Ocean Data Management Course for Caspian and Black Sea	20-30 October	Tehran, Iran	Ocean Services
22nd Meeting on Argos Joint Tariff Agreement	21-23 October	Martinique	Operational Observing Systems
6th NEAR-GOOS Data Management Training Course	21October-1 November	Tokyo, Japan	Operational Observing Systems
9th Session ABLOS	23-25 October	Tokyo, Japan	Ocean Sciences
7th Session of the IODE Group of Experts on Marine Information Management	23-25 October	Paris, France	Ocean Services
WIOMAP Implementation Coordination Meeting	1-2 November	Mauritius	IOC Perth Programme Office
1st Conference of the Indian Ocean—GOOS (IOGOOS)	4-9 November	Mauritius	IOC Perth Programme Office
WOCE Final Conference	18-22 November	Texas, USA	Operational Observing Systems
ODINAFRICA Annual Review and Planning Workshop	19-23 November	Limbe, Cameroon	Ocean Services
Color of Ocean Data Conference	25-27 November	Brussels, Belgium	Ocean Services
1st Session of the Steering Team for the Ocean Information Technology Project	28-29 November	Brussels, Belgium	Ocean Services
Informal Session of the JCOMM Expert Team on Data Management Practises	28-29 November	Brussels, Belgium	Ocean Services
1st Regional GOOS Forum	2-6 December	Athens, Greece	Operational Observing Systems
IOC/SCOR Working Group—119 Quantitative Ecosystem Indicators for Fisheries Management	4-6 December	Cape Town, South Africa	Ocean Sciences
GLOBEC/SPACC Working Group on Environmental Indices in Management of Pelagic Fish Populations	9-11 December	Paris, France	Ocean Sciences

Funding for IOC Programmes

This Annual Report describes a wide spectrum of activities that highlight the relevance of the IOC programmes in 2002. Together with national and non-governmental initiatives, the implementation of IOC programmes and related staff costs during 2002 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 and partner organizations through their contributions to the Intergovernmental Oceanograpic Commission of UNESCO Special Account (Trust Fund) and contributions for specific projects through creation of UNESCO Funds-in-Trust. This Financial Report does not consider other contributions (either direct or in-kind) provided by Member States in support of the Commission's programme execution, which do not enter into the budgetary flow of IOC.

The 21st Session of the IOC Assembly (July 2001) approved the programme and budget based upon anticipated resources, which for 2002-2003 were expected to amount to $13,507,800 (the regular budget allocation of $7,007,800 provided by UNESCO to finance direct programme costs [$3,243,900] and staff costs [$3,763,900]; expected voluntary contributions from Member States and international organizations were estimated at $6,500,000.)

The Approved Programme and Budget of UNESCO for 2002-2003 (document 31 C/5) confirmed the funding for the Intergovernmental Oceanographic Commission at the level approved by the Assembly.

The allocation of $3,243,900 for programme costs represents an increase of 26 percent (representing $666,000 more) compared to the previous biennium.

Table 1. Summary of IOC Income in 2002 (in US$)

Type of Funding	Programme	Personnel	Total
Regular Programme Allocation (UNESCO budget according to 31 C/5, before running costs)	1,621,950	1,881,950	3,503,900
Contributions to the IOC Special Account (IOC Trust Fund)	1,219,234	224,312	1,443,546
SUB-TOTAL	2,841,184	2,106,262	4,947,446
Contributions for Specific Projects to UNESCO Funds-in-Trust	1,219,816	368,459	1,588,275
GRAND TOTAL	**4,061,000**	**2,474,721**	**6,535,721**

The total amount of resources available for programme implementation in 2002 was $4,061,000, of which $2,439,050 came from sources other than the UNESCO regular budget. The contribution from the regular budget towards programme implementation represents 40 percent of the total available funding. The ratio between regular programme funding and outside sources is approximately 1:1.5 ($1,621,950 for regular budget versus $2,439,050 from outside sources.)

The most relevant fraction of the fixed cost of the operation of the IOC is personnel, representing 38 percent of the total expenditure. $2,474,721 was allotted for personnel in order to finance a total of 45 employees: Headquarters (33) and Field (12). Of these, 31 are professional staff and 14 provide administrative and secretarial assistance.

I. Regular Programme Allocation

Table 2. Approved Regular Programme Budget for Programme Implementation:
- 2002-2003 allocation breakdown by main lines of action and actions (before running costs)
- 2002-2003 allocation (after running costs deduction)
- 2002 allotment breakdown

	Allocation before running costs deduction	Allocation after running costs deduction	Allotment 2002
Main Line of Action 1 – Ocean Sciences – Reducing scientific uncertainties about coastal and global ocean processes in the context of marine ecosystems			
Action 1 – Oceans and Climate	260,000	260,000	130,000
Action 2 – Oceanic & Coastal Processes in the Ecosystem Approach	240,000	242,400	121,200
Action 3 – Marine science for ICAM	135,000	140,000	63,300
Action 4 – TEMA & Regions	240,300	192,600	96,300
Action 5 - Policy	215,200	177,000	91,000
SUB-TOTAL	1,090,500	1,012,000	501,800
Main Line of Action 2 – Global Observing Systems – To further develop, within the GOOS and GCOS, the monitoring and forecasting capabilities needed for the management and sustainable development of the open and coastal ocean			
Action 1 – Overall GOOS Design & Policy	290,000	136,000	68,000
Action 2 – TEMA & Regions	637,700	465,400	232,700
Action 3 – Policy	381,700	304,000	153,000
Action 4 – Coastal Ocean Observations Design		74,000	37,000
Action 5 – Implementation of Ocean Observations		82,600	41,300
SUB-TOTAL	1,309,400	1,062,000	532,000
Main Line of Action 3 – Ocean Services – To further develop and strengthen the IODE system as a global mechanism to ensure open and full access to ocean data and management of relevant information for all			
Action 1 – IODE	215,000	215,000	121,000
Action 2 – Ocean Mapping	45,000	45,000	22,500
Action 3 – TEMA & Regions	326,700	258,100	136,800
Action 4 – Policy	257,300	208,000	141,000
Action 5 – ITSU		61,000	28,000
SUB-TOTAL	844,000	787,100	449,300
GRAND TOTAL	**3,243,900**	**2,861,100**	**1,483,100**

2002 Allotment Breakdown by Main Programme Axes

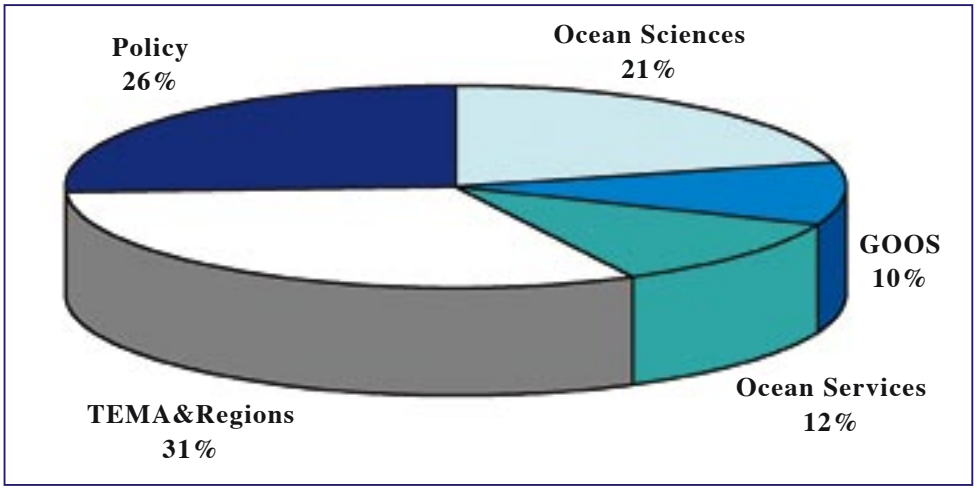


Table 3. Status of the Implementation of the Regular Programme Allotment 2002 (in US$)

		Allotment	Expenditure	Implementation	Carry-forward	Allotment 2003	Total Available
		2002	2002	Rate (%)			2003
MLA 1 - Ocean Sciences (Without Policy - Action 5) - Person in charge of implementation: Dr U. Unluata							
Action 1	Oceans & Climate	130,000	107,387	82.6	22,613	130,000	152,613
Action 2	Oceanic & Coastal Processes in the Ecosystem Approach	121,200	115,242	95.1	5,958	121,200	127,158
Action 3	Marine Science for ICAM	63,300	42,586	67.3	20,714	76,700	97,414
Action 4	TEMA & Regions	96,300	65,159	67.7	31,141	96,300	127,441
	SUB-TOTAL	410,800	330,374	80.4	80,426	424,200	504,626
MLA 2 - Global Observing Systems (Without Policy - Action 3) - Person in charge of implementation: Dr C. Summerhayes							
Action 1	Overall GOOS Design & Policy	68,000	66,080	97.2	1,920	68,000	69,920
Action 2	TEMA & Regions	232,700	194,538	83.6	38,162	232,700	270,862
Action 4	Coastal Ocean Observations Design	37,000	33,780	91.3	3,220	37,000	40,220
Action 5	Implementation of Ocean Observations	41,300	31,208	75.6	10,092	41,300	51,392
	SUB-TOTAL	379,000	325,606	85.9	53,394	379,000	432,394
MLA 3 - Ocean Services (Without Policy - Action 4) - Person in charge of implementation: Dr P. Pissierssens							
Action 1	IODE	121,000	107,173	88.6	13,827	94,000	107,827
Action 2	Ocean Mapping	22,500	22,311	99.2	189	22,500	22,689
Action 3	TEMA & Regions	136,800	113,036	82.6	23,764	121,300	145,064
Action 5	ITSU	28,000	21,500	76.8	6,500	33,000	39,500
	SUB-TOTAL	308,300	264,020	85.6	44,280	270,800	315,080
Cross-cutting activity - Policy - Person in charge of implementation: Dr P. Bernal							
	Policy component of MLA 1	91,000	87,709	96.4	3,291	86,000	89,291
	Policy component of MLA 2	153,000	148,641	97.2	4,359	151,000	155,359
	Policy component of MLA 3	141,000	128,601	91.2	12,399	67,000	79,399
	SUB-TOTAL	385,000	364,951	94.7	20,049	304,000	324,049
	GRAND-TOTAL	**1,483,100**	**1,284,951**	**86.6**	**198,149**	**1,378,000**	**1,576,149**

II. Contributions to the IOC Special Account (Trust Fund)

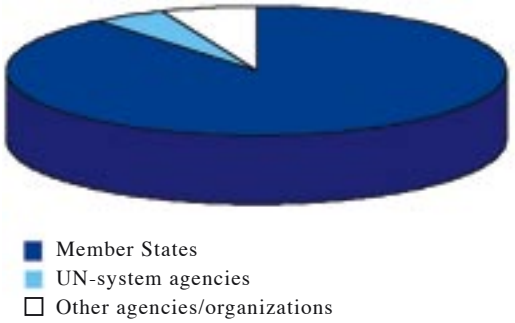
Table 4. Contributions by Member States to the IOC Special Account (IOC Trust Fund) as of 31 December 2002

Contributor	Total	Component	Purpose
ACOPS	**48,980.00**	24,980.00	Regions/Africa
		24,000.00	Regions/Africa
Australia	**8,865.44**		IODE
Belgium	**4,926.10**		IODE
Brazil	**18,798.55**		IOC Programme Activities (emphasis on TEMA)
Canada (DFO)	**4,558.86**		Rio+10 Hospitality Expenses
China	**20,000.00**		Programme Activities (emphasis on WESTPAC)
Denmark (via Univ. Of Copenhagen)	**26,000.00**		HAB Manual Publication
EUMETSAT	**1,500.00**		GOOS-Africa Workshop
European Commission	**14,372.81**		MAMA Project
FAO	**25,000.00**	10,000.00	UN Atlas Project
		3,000.00	UN Atlas Reception
		12,000.00	COOP-IV
France (IFREMER)	**8,412.68**		Argo Coordinator
France (Nat.Comm.)	**39,370.00**	10,000.00	ABE-LOS
		11,000.00	GOOS-Africa
		9,000.00	GLOSS
		9,000.00	Coral Bleaching Study Group
	8,806.23	4,000.00	IOCINCWIO
		4,806.23	IO-GOOS
ICSU	**20,000.00**		GOOS
Korea (Rep. of) Met. Adm	**1,000.00**		ITSU
SCOR	**1,620.00**		Purchase Oceans 2020
SCOPE	**1,944.00**		Purchase Oceans 2020
Spain	**28,356.00**		HAB/Vigo Centre
United Kingdom (NERC)	**28,000.00**	10,000.00	GLOSS as Contributor to JCOMM
		18,000.00	GOOS
United Kingdom (Met. Office)	**10,200.00**		Argo Coordinator
UNEP	**20,000.00**	2,000.00	Coastal GOOS
UNEP		18,000.00	Coastal GOOS
United States of America (Total)	**10,81792.33**		
USA (Department of State)	50,0000.00		IOC Programme Activities (General)
USA/ONR	10,000.00		COOP-IV
USA/ONR	10,000.00		GOOS-Africa
USA/ONR	5,000.00		IOCARIBE-GOOS
USA/ONR	6,000.00		LME Workshop (January 2002)
USA/ONR	5,000.00		Conf. Eastern Mediterranean & Black Sea
USA/Univ. of Rhode Island	630.97		Rio+10 Hosp. (Reimbursement)
USA/Squillante/Univ. of Rhode Island	157.73		Rio+10 Hosp. (Reimbursement)
USA/NOAA	2,500.00		CLIVAR Workshop (Reimbursement)

Contributor	Total	Component	Purpose
USA/NOAA	15,000.00		POGO
USA/NOAA	20,000.00		Rio Office
USA/NOAA	185,700.00	75,700.00	Argo Information Centre
		7,000.00	GODAE Symposium
		50,000.00	GODAE Office Support
		13,000.00	Seconded Personnel – Oceans & Climate
		40,000.00	Workshop on Ocean Observations Applications to the Pacific Islands
	20,000.00		GLOSS
	10,000.00		ICAM-Workshop on Indicators, Canada
USA/NOAA	20,000.00		IOCARIBE
USA/NOAA	32,700.00	20,000.00	Seconded Personnel – Oceans & Climate
		4,200.00	Argo Data Management Meeting
		8,500.00	Argo Coordinator
USA/NOAA	12,6598.00	88,500.00	Contract Support for Ocean Science
		18,098.00	Initiative re: Effects of Human Activities on Nutrient Inputs to Coastal Ecosystems
		20,000.00	Workshop on Regime Shifts
USA/NOAA	50,000.00		Indian Ocean GOOS Conference
USA/NOAA	50,000.00		Business Partners for Observing Systems
USA/NOAA	10,000.00		JCOMM
USA/NAS	2,505.63		Reimbursement for Global Ocean Exp. Workshop
WMO	21,043.33		GOOS
Interests	**45,689.00**		
TOTAL 2002	**14,892,35.33**		

Earmarked funds	90,4747.78
Non-Earmarked funds	58,4487.55

Contributions Analysis – By Donor Type



Contributions Analysis – Programme versus Personnel Ration

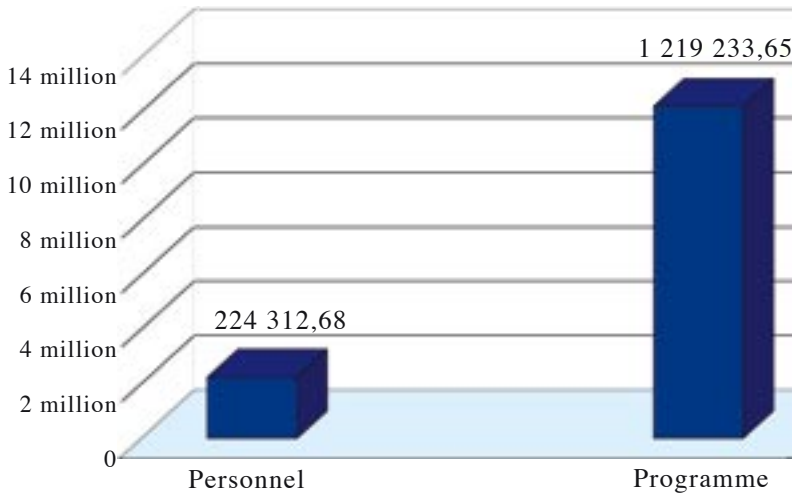


Table 5. Breakdown by Main Programme Axes and Staff

Programme Axes	Amount
Oceans and Climate	159,324
Oceanic & Coastal Processes	46,083
ICAM	37,589
GOOS	258,393
IODE	77,392
Ocean Mapping	269
ITSU	6,754
Tema & Regions	339,234
Policy	326,599
Staff	661,687
TOTAL	**1,913,324**

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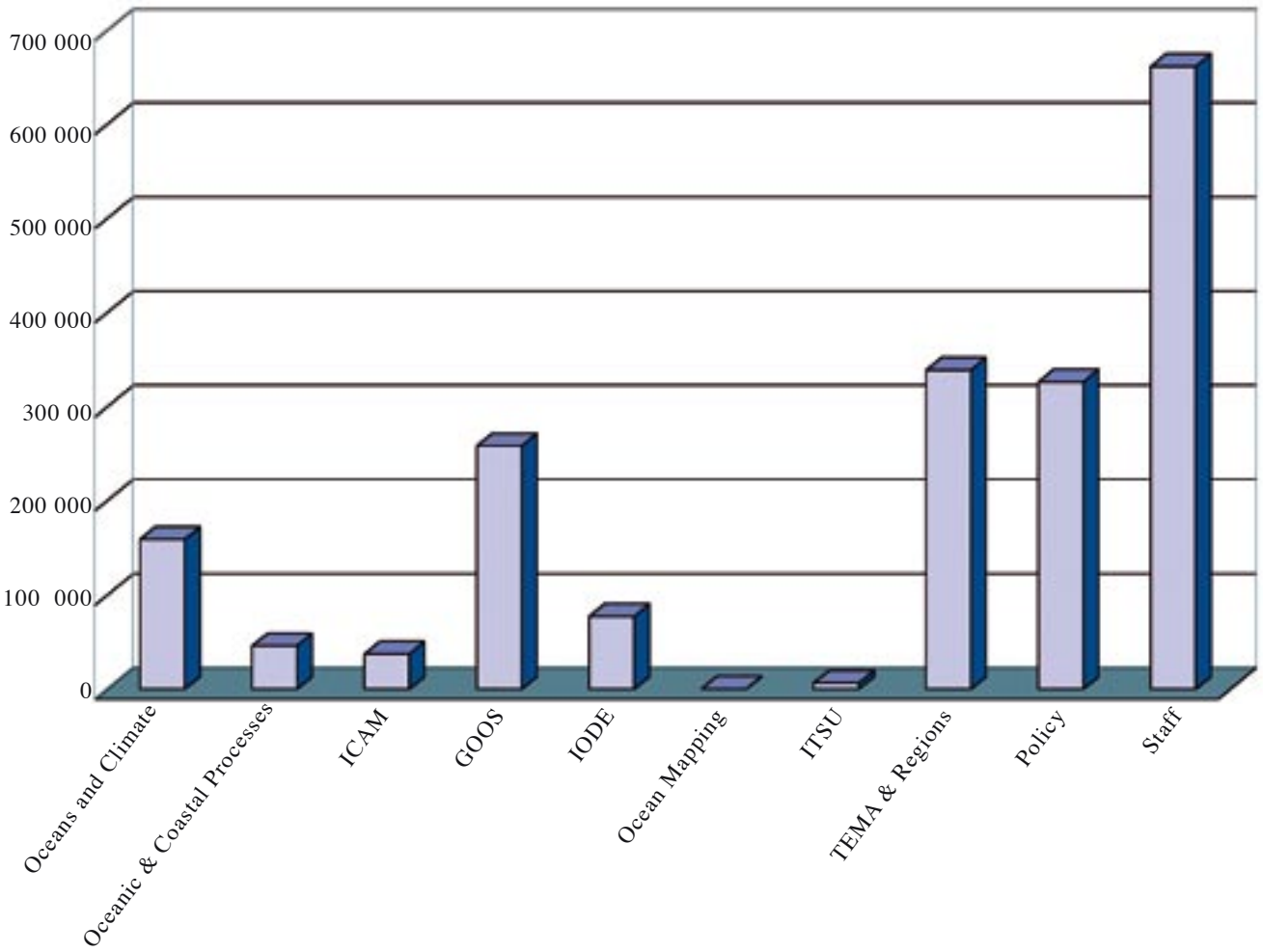
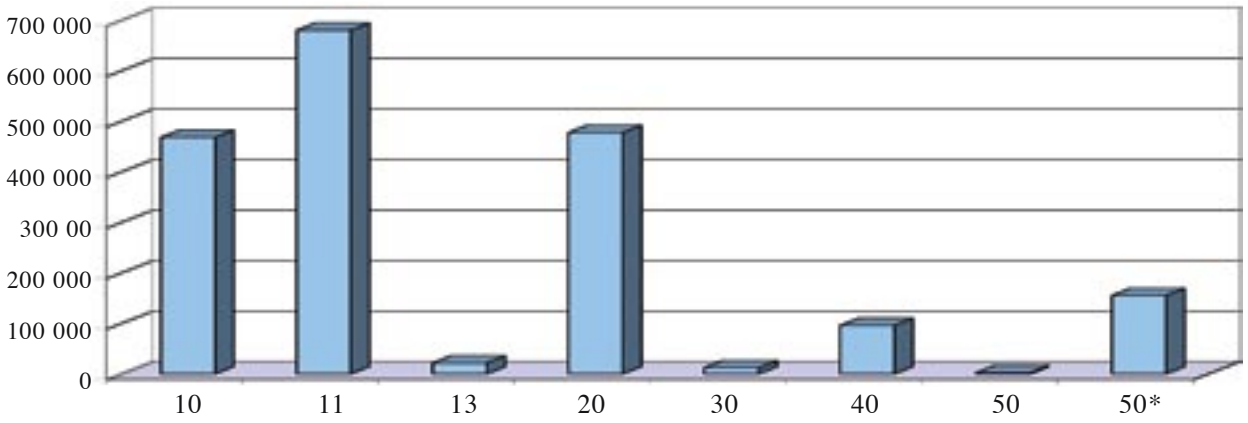


Table 6. Breakdown by Type of Expenditure

Commitment Item		
10	Travel (includes staff travel)	468,227
11	Temporary Staff - Consultants & Experts (temp. posts)	680,524
13	Support Personnel (includes interpreters)	21,571
20	Sub-Contracts	477,606
30	Training (grants & letters of agreement)	12,002
40	Equipment (includes computers and office supplies)	96,159
50	Miscellaneous*	2,235
50*	*50 *Contributions to WCRP & GCOS*	155,000
	TOTAL	**1,913,324**



III. Contributions for Specific Projects through Creation of UNESCO Funds-in-Trust

Table 7. 2002 Contributions to the UNESCO/IOC Funds-in-Trust (US$)

Contributor	Purpose	Project code	Total
Belgium (The Government of Flanders)	ODINAFRICA	513RAF2041	802,000
United Kingdom (DFID)	GCRMN	193UKM2041	104,980
Denmark (DANIDA)	HAB	193DEN2020	132,259
Denmark	Associate Expert	801GLO2043	63,100
WMO	DBCP	193GLO2001	118,000
UNEP	GCRMN	213GLO2046	175,000
UNEP	Land & Nutrient Enrichment	213GLO2000	10,000
UNEP	Global Patterns of Human Activities	213GLO2001	20,000
UNDP/GEF	Sustainable Management of Shared Marine Resources of the Caribbean Large Marine Ecosystems	RLA01G4201	18,836
The Government of Japan	WESTPAC	506RAS2001	75,000
The Government of Japan	Associate Expert	804GLO2043/44	69,100
TOTAL			**1,588,275**

IV. Expenditure on Regional Activities

Expenditure on Regional Activities (excluding personnel) in 2002: covering Regular Programme (UNESCO funds), IOC Special Account and contributions of the Government of Flanders (for ODINAFRICA), Government of Japan (for WESTPAC), the Western Australian Government's Department of Industry and Technology, and the Australian Commonwealth Government's Bureau of Meteorology (for Perth).

Region	USD
IOCINCWIO	49,060
IOCEA	5,000
ODINAFRICA	590,430
GOOS/Africa	55,310
African Process	150,710
IOCINDIO	15,000
Mediterranean & Black Seas	51,100
WESTPAC	114,370
IOCARIBE	131,500
Rio Office	20,000
Perth	223,000
TOTAL	**1,405,480**

Acronyms

ABE-LOS	Advisory Body of Experts on the Law of the Sea (IOC)
ABLOS	Advisory Board of Experts on the Technical Aspects of Law of the Sea
ACC	Administrative Committee on Coordination (of the UN System)
ACOPS	Advisory Committee on Protection of the Sea
ACSYS	Arctic Climate System Study (WCRP)
ADCP	Acoustic Doppler Current Profiler
AECI	Agencia Española de Cooperación Internacional (Spanish Agency for International Cooperation)
AGU	American Geophysical Union
AIMS	Analysis, Interpretation, Modelling and Synthesis (WOCE)
AMCEN	African Ministerial Conference on the Environment
ANCA	HAB working group for the Caribbean
ANMP	Association Nationale des Moniteurs de Plongée (professional diving instructors' association, France)
AOML	Atlantic Oceanographic and Meteorological Laboratory (NOAA)
AOPC	Atmospheric Observation Panel for Climate
APEC	Asia-Pacific Economic Cooperation
Argo	GODAE global profiling float project (not an acronym)
Argos	Service Argos, Inc. (global data telemetry and geo-positioning services company)
ASAP	Automated Shipboard Aerological Programme
ASLO	American Society of Limnology and Oceanography
BATHY	Bathythermograph Report, or code for reporting temperature profile observations
BBC	British Broadcasting Corporation
BC	British Columbia (Canada)
BMRC	Bureau of Meteorology Research Centre (Australia)
BoM	Bureau of Meteorology (Australia)
BOOS	Baltic Operational Oceanographic System
BUFR	Binary Universal Form for the Representation of Meteorological Data (WMO) [BUFR is the new WMO standard for point data (i.e. observations at discrete points, as opposed to gridded data)]
BUOY	BUOY is the name of the code for reporting buoy observations
CalCOFI	California Cooperative Oceanic Fisheries Investigations (USA)
CariBas	Caribbean Basins project (LOICZ)
CARICOM	Caribbean Community
CARICOMP	Caribbean Coastal Marine Productivity (launched by UNESCO)
CBD	Convention on Biological Diversity (Rio de Janeiro, 1992)
CBS	Commission for Basic Systems (WMO)
CD-ROM	compact disk – read only memory
CEB	United Nations System's Chief Executives Board for Coordination (new name for ACC)
CEOP	Coordinated Enhanced Observing Period (GEWEX)
CEOS	Committee on Earth Observation Satellites
CIESM	International Commission for the Scientific Exploration of the Mediterranean Sea
CIRAD	Centre de coopération Internationale en Recherche Agronomique pour le Développement (center for international cooperation in agronomy research for development, France)
CLCS	Commission on the Limits of the Continental Shelf (UN)
CliC	Climate and Cryosphere project (WCRP)
CLIVAR	Climate Variability and Predictability Programme (WCRP)

CLME	Large Marine Ecosystem of the Caribbean and Adjacent Regions
CMM	Commission for Marine Meteorology (WMO)
CMS	Centre for Marine Studies (University of Queensland, Australia)
CNES	Centre National d'Etudes Spatiales (French national space centre/agency)
CO_2	Carbon Dioxide
COASTS	Coastal Ocean Advanced Science and Technology Studies
COMEST	World Commission on the Ethics of Scientific Knowledge and Technology (UNESCO)
CoML	Census of Marine Life
COOP	Coastal Ocean Observations Panel (GOOS)
COP	Conference of the Parties (to the UNFCCC), also CoP
CPACC	Caribbean Planning for Adaptation to Climate Change
CRP	coordinated research project
CSD	Commission on Sustainable Development (UN)
CSIRO	Commonwealth Scientific and Industrial Research Organization (Australia)
CSMP	Center for the Study of Marine Policy (University of Delaware, USA)
CTD	conductivity-temperature-depth probe
DANIDA	Danish International Development Assistance
DBCP	Data Buoy Cooperation Panel (WMO-IOC)
DFID	Department for International Development (UK)
DINARA	Dirección Nacional de Recursos Acuáticos (Uruguay's aquatic resources authority)
DNA	Designated National Agency (IODE)
DOALOS	See UN/DOALOS
DODS	Distributed Oceanographic Data System
DWD	Deutscher Wetterdienst (German weather service)
EC	European Commission, also Executive Council (e.g. WMO or IOC)
ECMWF	European Centre for Medium-Range Weather Forecasts
EDIMAR	Estación de Investigaciones Marinas de Margarita (marine research station, Venezuela)
EDIOS	European Directory of the Initial Ocean-observing System
EEZ	Exclusive Economic Zone
EGOS	European Group on Ocean Stations (DBCP)
EI	Environmental Indices
ENSO	El Niño-Southern Oscillation (ocean/atmosphere interaction study)
EOS	AGU's weekly newspaper of geophysics, also NASA's Earth Observing System
ESA	European Space Agency
ESEAS	European Sea Level Service
ET	Evaluation Team (GESAMP)
EURASLIC	European Association of Aquatic Sciences Libraries and Information Centres
FANSA	HAB working group for South America
FAO	Food and Agriculture Organization of the United Nations
G30S	Sponsors Group for the Global Observing Systems (GCOS, GOOS and GTOS)
GAW	Global Atmosphere Watch (WMO)
GC	Governing Council (of UNEP)
GCOS	Global Climate Observing System (WMO-ICSU-IOC-UNEP)
GCRMN	Global Coral Reef Monitoring Network
GDA	GEBCO Digital Atlas (GEBCO Database)
GEBCO	General Bathymetric Chart of the Oceans
GEBCDMEP	IODE Group of Experts on Biological and Chemical Data Management and Exchange Practices
GEF	Global Environment Facility (World Bank-UNEP-UNDP)
GEOHAB	Global Ecology and Oceanography of HABs (IOC-SCOR)

GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (IMO-FAO-UNESCO-WMO-WHO-IAEA-UN-UNEP)
GEWEX	Global Energy and Water Cycle Experiment (WCRP)
GIPME	Global Investigation of Pollution in the Marine Environment
GIS	Geographic Information System
GIWA	Global International Water Assessment
GLOBEC	Global Ocean Ecosystems Dynamics Programme (SCOR, IOC, IGBP/ICSU)
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)
GOSIC	Global Observing Systems Information Center
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (UNEP)
GPO	GOOS Project Office
GSC	GOOS Steering Committee
GSN	GCOS Surface Network
GTN-H	Global Terrestrial Network – Hydrology
GTOS	Global Terrestrial Observing System (FAO-UNEP-WMO-UNESCO-ICSU)
GTS	Global Telecommunication System (WWW)
GTSPP	Global Temperature and Salinity Profile Programme (IOC-WMO)
GUAN	GCOS Upper-Air Network
HAB	Harmful Algal Bloom
HAE-DAT	Metadata database on Harmful Algal Events
HAMM	Harmful Algal Management and Mitigation (international conferences)
HELCOM	Baltic Marine Environment Protection Commission (Helsinki Commission)
HLCM	High-Level Committee on Management
HLCP	High-Level Committee on Programmes
HTDB/PAC	Historical Tsunami Database for the Pacific
IABO	International Association for Biological Oceanography (member of SCOR)
IABP	International Arctic Buoy Programme (DBCP)
IAEA	International Atomic Energy Agency
IAG	International Association of Geodesy
IAMSLIC	International Association of Aquatic and Marine Science Libraries and Information Centres
IAPSO	International Association for the Physical Sciences of the Ocean (IUGG)
IASI	Intra-American Seas Initiative
IBCCA	International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
IBCEA	International Bathymetric Chart of the Central Eastern Atlantic
IBCM	International Bathymetric Chart of the Mediterranean
IBCSEP	International Bathymetric Chart of the South Eastern Pacific
IBCWIO	International Bathymetric Chart of the Western Indian Ocean
IBCWP	International Bathymetric Chart of Western Pacific
ICAM	Integrated Coastal Area Management (also name of IOC programme)
ICES	International Council for the Exploration of the Sea
ICG/ITSU	International Coordination Group for the Tsunami Warning System in the Pacific (IOC)
ICM	Integrated Coastal Zone Management
ICP	Informal Consultative Process (full name: UN Open-ended Informal Consultative Process on Ocean Affairs)
ICRAN	International Coral Reef Action Network
ICSU	International Council for Science

ICT	Information and Communication Technology
IDGs	International Development Goals
IEO	Instituto Español de Oceanografía (Spanish institute of oceanography, in Vigo)
IFREMER	Institut Français de Recherche pour l'Exploitation de la Mer (French Research Institute for the Exploitation of the Sea)
IGBP	International Geosphere-Biosphere Programme (ICSU) also known as Global Change Programme
IGO	Intergovernmental Organization
I-GOOS	Intergovernmental GOOS Committee (IOC-WMO-UNEP)
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System (IOC-WMO)
IGST	International GODAE Steering Team
IHDP	International Human Dimensions Programme on Global Environmental Change (ISSC-ICSU)
IHO	International Hydrographic Organization
IHP	International Hydrological Programme (UNESCO)
IMO	International Maritime Organization
IMS	Institute of Marine Sciences (Tanzania)
INCO	Iranian National Centre for Oceanography
INCOIS	Indian National Centre for Ocean Information Service
INEGI	Instituto Nacional de Estadística, Geografía e Informática (Mexican institute of statistics, geography and computer science)
IOC	Intergovernmental Oceanographic Commission (UNESCO)
IOCARIBE	IOC Sub-Commission for the Caribbean and Adjacent Regions
IOCCG	International Ocean Colour Coordinating Group
IOCEA	IOC Regional Committee for the Central Eastern Atlantic
IOCINCWIO	IOC Regional Committee for the Cooperative Investigation in the North and Central Western Indian Ocean
IOCINDIO	IOC Regional Committee for the Central Indian Ocean
IODE	International Oceanographic Data and Information Exchange (IOC)
IOGOOS	Indian Ocean GOOS
IOI	International Ocean Institute (Malta)
IOS	Initial Observing System (GOOS)
IOSLON	Indian Ocean Sea Level Observing Network
IPCC	Intergovernmental Panel on Climate Change
IPHAB	IOC Intergovernmental Panel on Harmful Algal Blooms
IPIMAR	Instituto de Investigação das Pescas e do Mar (Portuguese institute for fisheries and sea research)
IPO	International Project Office (for GEOHAB)
IRD	Institut de Recherche pour le Développement (France's research institute for development. Formerly: France's scientific research institute for development through cooperation – ORSTOM)
ISABP	International South Atlantic Buoy Programme
ISO	International Organization for Standardization
ISRO	Indian Space Research Organization
ISSC	International Social Science Council
ITIC	International Tsunami Information Center
IUCN	World Conservation Union (formerly International Union for the Conservation of Nature)
IUGG	International Union of Geodesy and Geophysics
IWG	Intergovernmental Working Group (on IOC Oceanographic Data Exchange Policy)
JAFOOS	Joint Australian Facility for Ocean Observing Systems
Jason	USA-France oceanographic/climate monitoring/research and prediction mission
JCOMM	Joint Technical Commission for Oceanography and Marine Meteorology (WMO-IOC)
JGOFS	Joint Global Ocean Flux Study (IGBP)

JSC	Joint Scientific Committee for the WCRP (WMO-ICSU-IOC)
JSG	Joint Study Group
JTA	Joint Tariff Agreement (Argos)
JODC	Japan Oceanographic Data Centre
LME	large marine ecosystem
LOICZ	Land-Ocean Interaction in the Coastal Zone (IGBP)
MAMA	Mediterranean Network to Access and Upgrade Monitoring and Forecasting Activity in the Region
MAMCOMP	Monitoring and Modelling of Coastal Marine Processes
MAP/NAI	Millenium Africa Recovery Programme/New African Initiative
MEDAR/ MEDATLAS	Mediterranean Data Archaeology and Rescue / Mediterranean (and Black Sea) Atlas
MedGLOSS	Mediterranean GLOSS
MedGOOS	Mediterranean GOOS project
MEDI	Marine Environmental Data Information Referral Catalogue
MEDS	Marine Environmental Data Service (Canada)
MFSPP	Mediterranean Forecasting System Pilot Project
MIP	Marine Integrated Programme
MON-DAT	IOC Metadata Database on Design and Implementation of Some Harmful Algal Monitoring Systems
MOU	Memorandum of Understanding
MP	Member of Parliament
MPA	Marine Protected Area
MSP	Medium-Sized Project (GEF)
MSR	Marine Scientific Research
MSVPA	Multi-Species Virtual Population Analysis
NASA	National Aeronautics and Space Administration (USA)
NASDA	National Space Development Agency of Japan
NCDC	National Climatic Data Center (USA)
NEAR-GOOS	North-East Asian Regional GOOS
NEPAD	New Partnership for Africa's Development
NetCDF	Network Common Data Form: an interface for array-oriented data access and a freely-distributed collection of software libraries for C, Fortran, C++, Java, and perl that provide implementations of the interface
NGO	Non-Governmental Organization
NMFS	National Marine Fisheries Service (NOAA)
NOAA	National Oceanic and Atmospheric Administration (USA)
NODC	National Oceanographic Data Centre (IODE)
NOOS	Northwest Shelf Operational Oceanographic System
NOWPAP	Northwest Pacific Action Plan
NRC	National Research Council (USA)
NRT	Near Real Time
OAU	Organization of African Unity
OCM	Ocean Colour Monitor
ODIN	Ocean Data and Information Network
ODINAFRICA	Ocean Data and Information Network for Africa (IOC and Flanders)
ODINCARSA	Ocean Data and Information Network for the IOCARIBE and South America regions
ODINEA	Ocean Data and Information Network for Eastern Africa (IODE)
ONR	Office of Naval Research (USA)
OOPC	Ocean Observations Panel for Climate (GCOS-GOOS-WCRP)
OOS	Operational Observing Systems (IOC programme section)
OPC	Ocean Products Center (USA)

OS	Ocean Services (IOC programme section)
OSLNR	Ocean Sciences in Relation to Non-Living Resources
OSLR	Ocean Sciences in Relation to Living Resources
OSS	Ocean Sciences Section (IOC programme section)
PACSICOM	Pan-African Conference on Sustainable Integrated Coastal Management
PASS	Pan-African START Secretariat
pCO_2	measurement of CO_2 concentrations in the atmosphere and ocean
PICES	North Pacific Marine Science Organization
PIRATA	Pilot Research Moored Array in the Tropical Atlantic
POGO	Partnership for Observation of the Global Oceans
PR China	People's Republic of China
PSMSL	Permanent Service for Mean Sea-Level
PTWC	Pacific Tsunami Warning Center
QC	quality control (of data)
RDFM	Rapid Determination of Focal Mechanism
RNODC	Responsible National Oceanographic Data Centre (IODE)
RONMAC	Red de Observación del Nivel del Mar para América Central (sea-level observing network for Central America)
ROPME	Regional Organization for the Protection of the Marine Environment (HQ in Kuwait)
R/V	Research Vessel
SAHFOS	Sir Alister Hardy Foundation for Ocean Science
SBSTA	Subsidiary Body for Scientific and Technological Advice (UNFCCC)
SCOPE	Scientific Committee on Problems of the Environment (ICSU)
SCOR	Scientific Committee on Oceanic Research (member of ICSU)
SEAGOOS	South East Asia regional GOOS
SEFSC	Southeast Fisheries Science Center (Miami, FL, USA)
SG	Study Group or Steering Group
SGD	Submarine Groundwater Discharges
SHIP	Report of Surface Observation from a Sea Station
SHOM	Service Hydrographique et Océanographique de la Marine (France)
SIO	Scripps Institution of Oceanography (University of California, USA)
SOA	State Oceanic Administration (PR China)
SOC	Specialized Oceanographic Centre (JCOMM), also Southampton Oceanography Centre (UK)
SOCA	Sub-Committee on Oceans and Coastal Areas (of UN ACC)
SOCIO	Sustained Observations of Climate in the Indian Ocean (workshop)
SOEMEP	Science for Ocean Ecosystems and Marine Environmental Protection (IOC programme)
SOLAS	Surface Ocean – Lower Atmosphere Study (WCRP)
SOOP	Ship-of-Opportunity Programme
SOOPIP	SOOP Implementation Panel
SOPAC	South Pacific Applied Geoscience Commission
SPACC	Small Pelagic Fishes and Climate Change Programme (of GLOBEC)
SSC	Scientific Steering Committee
SST	Sea Surface Temperature
START	Global Change System for Analysis, Research and Training (IGBP)
SVP	Surface Velocity Programme (WOCE)
SVP-B	SVP barometer (Lagrangian drifters)
TAFIRI	Tanzania Fisheries Research Institute
TAO/TRITON	Tropical Atmosphere Ocean project / Triangle Trans-Ocean buoy Network (Japan)
TEMA	Training, Education and Mutual Assistance in the Marine Sciences (IOC cross-cutting provision/programme)
TESAC	code for reporting temperature, salinity and currents from a sea station

3-D	three-dimensional
TIME	Tsunami Inundation Modelling Exchange Project (IOC)
TIP	TAO Implementation Panel
TMT	Transfer of Marine Technology
TOC	Total Organic Carbon
TOPC	Terrestrial Observation Panel for Climate
ToR (or TOR)	terms of reference
TRACKOB	report of marine surface observations along a ship's track
TREMORS	Tsunami Risk Evaluation through Seismic Moment from a Real-time System
TSG	Thermo-Salino-Graph
TTR	Training-through-Research
TWS	Tsunami Warning System in the Pacific (or TWSP)
UAE	United Arab Emirates
UDSM	University of Dar Es Salaam
UK	United Kingdom (of Great Britain, Scotland and Northern Ireland)
UN	United Nations
UNCED	UN Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UN/DOALOS	UN Division for Ocean Affairs and the Law of the Sea
UNDP	United Nations Development Programme
UNDG	UN Development Group
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UOT/DAC	Upper Ocean Thermal Data Assembly Centres (WOCE Coordination Group)
URL	Uniform (or Universal) Resource Locator (address of a www page)
USA	United States of America (also US)
USSSDAP	Underway Sea Surface Salinity Data Archiving Pilot Project (IODE)
UV	Ultra Violet
VCP	Voluntary Cooperation Fund Programme (WMO or IOC)
VLIZ	Flanders Marine Institute (Belgium)
VOS	Voluntary Observing Ship (for WMO)
VOSClim	VOS Climate Project
WAGOOS	Western Australia GOOS
WCMC	World Conservation Monitoring Centre
WCRP	World Climate Research Programme (WMO-ICSU-IOC)
WDC	World Data Centre
WESTPAC	IOC Sub-Commission for the Western Pacific
WGIPA	Working Group on Integrated Problem Analysis (see ICAM events)
WHO	World Health Organization
WIOMSA	Western Indian Ocean Marine Science Association
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (WCRP)
WSSD	World Summit on Sustainable Development (Johannesburg, 2002)
WWW	World Weather Watch (WMO)
www	World-Wide Web
XBT	Expendable Bathythermograph
XCTD	Expendable Conductivity-Temperature-Depth Probe
XML	eXtensible Markup Language

Intergovernmental Oceanographic Commission (IOC)

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