Global Ocean Observing System

Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

Coastal Ocean Observations Panel
GOOS Users' Forum

Third Session
Hanoi, Vietnam
15 and 16-18 January 2002

GOOS Report No. 114

UNESCO

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ABSTRACT

This report presents a summary of the topics discussed at the third GOOS Users' Forum and the third meeting of the Coastal Ocean Observations Panel (COOP). The objectives of the GOOS Users' Forum was to: (i) seek user input to the design and implementation process of the coastal module of GOOS; (ii) raise awareness of the coastal GOOS module among stakeholders, decision makers, industry and scientists in the South-East Asia region. Background information on current observing activities and monitoring projects in the South China Sea and Gulf of Thailand were presented. The objective of the COOP session was to review the draft of the integrated strategic design plan for the coastal module of GOOS. Draft chapters of the integrated plan were presented and a plan was developed for finalizing the remaining components of the plan. Information on several partnership activities that are linked with COOP was also provided.

(SC-2002/WS/51)

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ANNEXES

A. GOOS USERS' FORUM

3rd Session, 15 January 2002

The third session of the GOOS Users' Forum was held in Hanoi, Vietnam 15 January 2002. The local organizing committee was Dr. Nguyen The Tuong, Prof. Dang Ngoc Thanh, Dr. Tran Duc Hai, Dr. Bui Van Duc, and Mr. Bui Dinh Khuoc. The agenda of the meeting is given in Annex I and the list of participants is provided in Annex III.

Thorkild Aarup, the Technical Secretary, welcomed the meeting participants on behalf of the Executive Secretary of the Intergovernmental Oceanographic Commission (IOC) and the sponsors of the Global Ocean Observing System (GOOS) – the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP) and the International Council for Science (ICSU). Thorkild Aarup provided a brief history of the GOOS design process and the charge for the Coastal Ocean Observations Panel (COOP). He also mentioned the role of the GOOS Users' Fora and how they serve as mechanism for GOOS stakeholders to provide input to the design of the coastal module of GOOS. In closing he thanked the Food and Agricultural Organization (FAO), UNEP, ICSU and the Natural Environmental Research Council of the United Kingdom for financial support of the meeting. He also acknowledged the fine work done by the local organizing committee and all the help Mr. Bui Dinh Khuoc had provided in advance of the meeting. Following these remarks Johannes Guddal lead the remaining part of the meeting.

Nguyen The Tuong and Dang Ngoc Thanh both offered welcoming remarks on behalf of the National Marine Hydrometeorological Centre of Vietnam and on behalf of the Vietnamese National IOC committee respectively.

Bui Cong Que gave an overview of current marine environmental issues in Vietnamese waters. A full report on this topic is enclosed in Annex IV.

Nguyen Minh Son gave a presentation on the "Partnerships in Environmental Management for the Seas of East Asia" (PEMSEA) project. From 1994 to 1999, the Global Environmental Facility (GEF) funded (US$ 8 million) a project for addressing marine pollution problems under the Regional Programme for Marine Pollution Prevention and Management in the East Asian Seas region. This was followed by a follow-on phase to build stronger partnerships in addressing environmental management problems of the region. A new Regional Programme PEMSEA was thus launched in October 1999 with GEF contributing US$ 16.2 million and another US$ 12.5 million co-financed primarily by the participating governments and other partners. The partnerships share a common vision, implement strategies and action plans to ensure that the seas of East Asia can continue contributing to the well being of the people of the region.

PEMSEA aims to establish a multi-country, multi-sectoral shared vision for the seas of East Asia, along with supporting strategies and environmental action programmes for attaining that vision. The Environmental Strategy shall provide a regional collaborative framework for natural resource and environmental governance and for integrated implementation of multilateral environment instruments to addressing transboundary environmental problems. A functional regional framework is the ultimate target of PEMSEA.

PEMSEA activities focus on (i) enabling local governments to effectively manage coastal and marine resources and their environment through strengthening local capacity in integrated planning and management of their coastal areas in collaboration with civil society and other stakeholders; (ii) promoting multi-country and multi-agency cooperation in managing sub regional sea areas and marine pollution hotspots through shared vision, strategies and common action programmes; (iii) developing management-related methodologies, techniques, working models, and standards to

strengthen practical efforts in the field; (iv) providing policy support and scientific advice to decision-makers; (v) identifying and demonstrating the synergies and linkages between related international environmental instruments and facilitating their integrated implementation; and (vi) creating environmental investment opportunities, sustainable financing mechanisms and institutional arrangements for implementing international marine environment-related conventions and action programmes.

Some of the PEMSEA fields of work are: (i) integrated coastal management; (ii) managing hot spots; (iii) capacity building; (iv) internship/fellowship programme; (v) scientific research; (vi) integrated information management systems (IIMS); (vii) civil society; (viii) coastal and marine policy; and (ix) regional mechanism. Nguyen Minh Son provided a description on these activities in the context of the PEMSEA ICM demonstration project in Danang City, Vietnam. He also described how environmental risk assessment was used to identify and prioritise environmental issues at the Danang project. More information on PEMSEA and its demonstration projects can be found at http://www.pemsea.org.

Maarten Kuijper provided an overview of the Gulf of Thailand (GoT) Project.

The International Cooperative Study of the Gulf of Thailand is a regional research programme for the sustainable management of the Gulf of Thailand. This is a non-profit network sponsored by the Intergovernmental Oceanographic Commission-Sub Commission for the Western Pacific (IOC/WESTPAC, Southeast Asian Programme in Ocean Law, Policy and Management (SEAPOL), and Southeast Asia START Global Change Regional Centre (SEA START RC).

The overall goal of The International Cooperative Study of Gulf of Thailand aims at strengthening the capacity of national and regional institutes' to produce and present (visualize) the necessary data for the management of the Gulf of Thailand and thus contribute to the sustainable development.

Specific objectives are to:

- establish an institutional and information network on scientific and socio-economic data collection, exchange, analysis and integration;
- develop the capacity of the region to collect and analyse data, and to integrate multidisciplinary data into formats practically useable by various sectors;
- establish a regional synoptic programme to collect data that is relevant to the management purpose;
- coordinate efforts to determine boundary conditions for modelling and remote sensing tools;
- promote and support the use of a marine information system for the management of the Gulf of Thailand.

Some of the activities to date have been: (i) providing on-line data visualization - access to near-real time data (Sea-WiFS, TOPEX/POSEIDON, NOAA) and delayed mode oceanographic data, links to other data and information resources and provide routine data services; (ii) maintaining an e-mail discussion group on the Gulf of Thailand; (iii) providing advice on oceanographic data and information systems and networking to national and regional institutes upon request; (iv) conducting workshops as a capacity-building activity; and (v) coordinating oceanographic cruises and surveys in the Gulf of Thailand. More information on the GoT project is available at http://www.start.or.th/got/index.htm.

Maarten Kuijper mentioned that an open data policy is being promoted by the GoT project but many donor-financed projects in the region often have different data policies that put restrictions on access to project data. He suggested that COOP should develop a short statement with convincing arguments that expresses the demands for a data policy so this can be incorporated, for instance, into GEF contracts to alleviate these restrictions.

Yihang Jiang provided an overview of the East Asian Seas Regional Coordinating Unit (EAS/RCU), which is the Secretariat for the Coordinating Body on the Seas of East Asia (COBSEA). It is conceived as an action-oriented programme (and not a convention) having concern for the consequences and causes of environmental degradation, and encompassing a comprehensive approach to compacting environmental problems through the management of marine and coastal areas. It is responsible to ten countries (Australia, Cambodia, China, Indonesia, R. Korea, Malaysia, Philippines, Singapore, Thailand and Viet Nam). Its mandate is to coordinate, where appropriate, the activities of governments, non-government organizations, donor agencies, UN agencies and individuals in caring for the marine environments of East Asian Seas. Apart from coordination, the Unit obtains funds to carry out marine management issues and is the lead agency for the United Nations in marine environmental matters in the region. The Unit is situated in Bangkok but has a regional mandate to act in East Asian Seas.

A number of recent activities which the EAS/RCU is involved in were described. These included: (i) a regional programme under the Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities; (ii) coral reef monitoring in collaboration with ICRAN; (iii) a recently GEF-funded project “Reversing Environmental Degradation in the South China Sea and the Gulf of Thailand”.

Yihang Jiang outlined some areas for possible collaboration between EAS/RCU and GOOS. Generally GOOS is seen as a tool for enhancing the dialogue and cooperation at the national level. At the regional level, UNEP and its regional seas units can use recommendations from the GOOS/COOP design documents when establishing regional monitoring programmes. In that context he used the design document from the Health of the Oceans Panel (HOTO) as an example of good concrete design advise which is being used in the region.

Bui Xuan Thong provided an overview of the Marine Hydrometeorological Centre (MHC) of Hanoi, Vietnam. MHC manages an observation network of 17 fixed hydrometeorological stations. In addition the MHC has a 1,000-ton vessel, which carries out two monitoring cruises per year on the shelf of Vietnam. Storm surge forecasts, wave forecasts, flood warning and tide predictions are examples of the major products MHC provide to the National Council for Typhoon and Flood Control, Local Province Authorities and offshore companies.

Finally Johannes Guddal led a discussion on the offshore industry’s relation to GOOS and COOP. The product needs of this industry are generally related to: (i) offshore construction (which requires time-series data from national/regional data archives and perhaps hind cast modelling); (ii) short-term forecasts of typically meteorological conditions and sea state; (iii) monitoring of discharge (which may require data exchange and assessments). The discussion brought up a recurring theme concerning data policy. During the discussion it was mentioned that in the Gulf of Thailand the offshore industry has been reluctant to release their hydrometeorological data as they provide a competitive advantage for a company. For environmental data there is also reluctance to release such data, as there is a fear that these data may be used against the industry. In conclusion it was stated that COOP could help enhance the data policy in coastal regions.

B. COASTAL OCEAN OBSERVATIONS PANEL

3rd Session, 16-18 January 2002

1. OPENING

Tom Malone and Tony Knap, co-Chairmen of the Coastal Ocean Observations Panel (COOP) opened the meeting at 09.00 am. They acknowledged the hard work of the local organizing committee and the fine meeting arrangements.

Tom Malone then went over the agenda (Annex II) and it was adopted.

2. GOOS USERS' FORUM

Tony Knap gave a summary of the GOOS Users' Forum held on 15 January 2002 (see separate report earlier in this issue).

3. OCEANS AND COASTS AT RIO+10

Tom Malone reported on his participation in the "Global Conference on Oceans and Coasts at Rio+10: Toward the 2002 World Summit on Sustainable Development: Assessing Progress, Addressing Continuing and New Challenges", held at UNESCO in Paris from 3-7 December 2001. The conference involved more than 400 participants from 61 countries, with experts from a wide range of sectors including governments, UN agencies and other intergovernmental organizations representing environmental, industry and scientific/technical perspectives. The conference statement and the summary report from the conference chairs are available at http://ioc.unesco.org/icam/rio+10_outputs.htm.

Many coastal zone managers had attended the "Oceans and Coasts" conference and the panel discussed ways to reach out to that community. This also led to a discussion on which the target audience is for the Integrated Strategic Design Plan for the coastal module of GOOS. Some panel members suggested that a few examples of good pragmatic value products should be listed in the design plan. Others emphasized the need for a robust and strong design noting that the user part and involvement could be expanded later. The panel concluded that the target audience for the design plan should be the most likely users that would benefit in the beginning such as government decision makers and expert users.

4. THE INTEGRATED, STRATEGIC DESIGN PLAN FOR THE COASTAL OCEAN OBSERVATIONS COMPONENT OF THE GLOBAL OCEAN OBSERVING SYSTEM

Tom Malone provided an overview of the plan (see Annex V for the table of contents of the plan). Following that the status of some of the chapters were presented by the lead authors or a representative of the drafting group. Draft chapters had been circulated to the panel in advance of COOP III. Tom Malone presented Chapters 1 and 3 on "Introduction" and "Design Framework".

Robert Bowen presented Chapter 2 on "An Integrated Systems Approach" which makes the case for an integrated observing system.

John Cullen presented Chapter 4 that describes the process for selecting the common variables. Representative lists of (i) user groups; (ii) phenomenon of interest; (iii) variables for

detecting or predicting the occurrence of or changes in the phenomena of interest; and (iv) predictive models for the global coastal module of GOOS had been established. The ranking process is based on the matrix-approach established in the C-GOOS Design Plan (GOOS report No. 90; http://ioc.unesco.org/iocweb/iocpub/iocpdf/i1146.pdf).

Keith Thompson presented Chapter 5 "Combining Observations and Models".

Savi Narayanan presented Chapter 6 on the "Communications and Data Management Subsystem".

Tom Malone presented Chapter 7 "Guidelines for the development of an operational system" which sets the stage for implementation.

While it had been the plan to complete the integrated design plan for the coastal module at COOP III the panel discussions revealed that significant modifications of the initial draft were required if the plan is to have the desired impact. These include the following:

(i) Specify products associated with each of the phenomena of interest in Chapter 1.

(ii) Re-draft Chapter 2 to focus on the value-added nature of an integrated systems approach.

(iii) Conduct a more comprehensive and rigorous analysis to identify the common variables and replace "Preliminary List of Common Variables" with "Recommended Common Variables". In connection with this it was decided to convene a sub-committee (Bowen, Cullen, Fogarty, Knap, Malone, Thompson) meeting in Boston, USA from 25-26 February 2002. This subcommittee was charged with finalizing the matrix-lists before the lists would be mailed to the panel members to be filled in. A graphical user interface would also be developed to facilitate data entry.

(iv) Re-draft Chapter 7 to address each subsystem (observations, data management, modelling), implementation mechanisms (including but limited to JCOMM), regional enhancement and their relevance to GOOS, capacity building, schedule for implementation, product development and marketing, evaluation and metrics, and oversight and coordination.

The changes will be made intersessionally. A draft plan will be completed around 1 June 2002 and then be send out for broad external review. The finalized plan will be presented at COOP IV in September 2002.

5. PARTNERSHIPS FOR IMPLEMENTATION

5.1 JCOMM

Johannes Guddal, Co-president of the WMO-IOC Joint Technical Committee for Oceanographic and Marine Meteorology (JCOMM) gave an update over JCOMM activates. Tony Knap has been nominated to be link to JCOMM data management committee concerning non-physical variables. In that context Savi Narayanan reminded that the JCOMM assembly had approved that JCOMM should move into the area of non-physical variables. The panel did express some concern about where COOP would be in the JCOMM structure and also that physical measurements may drive COOP/GOOS more than what is fair.

5.2 THE JCOMM ELECTRONIC BULLETIN AND THE GOOS PRODUCTS AND SERVICES BULLETIN

Johannes Guddal presented this item.

The JCOMM Electronic Bulletin (JEB) was originally an IGOSS asset developed and produced under the leadership of Professor Yves Tourre of Columbia University (http://iri.ldeo.columbia.edu/climate/monitoring/ipb/). JEB demonstrates global oceanographic products directed towards value adding users and with a particular application within seasonal forecasting. As such it demonstrates to 'outside users' that GOOS "climate" products are realistic and can find end-user applications. As such it is a GOOS 'outreach' element. In terms of JCOMM perspectives, it demonstrates "Implementation", and it may also contribute to Capacity Building. It also offers 'baseline' products for reference in cases where regional GOOS modelling activities can compare their modelling products with those from JEB, they can validate the qualities and decide how to improve their models accordingly. The JEB provides no feedback from actual end users.

The GOOS Products and Services Bulletin (GPSB) (http://ioc.unesco.org/gpsbulletin) was established by the GOOS Steering Committee and is governed by a voluntary editorial board. A set of "End-user scenarios" mirrors the philosophy of the bulletin. From 15 predefined end-user scenarios one seeks to get feedback from user constituencies on the need for and the application of different types of GOOS Products and Services. An-end user representative will describe how such products have come to benefit in his work situation, in planning and decision-making. She/he will reflect the positive and negative aspects of services/products delivered, the gaps identified and the needs for 'new' services not yet implemented. GPSB provides links to ongoing online products and services, and gives highlights of these.

The prominent task of GPSB is to maintain an active two-way communication between user communities and the planning and implementation activities of GOOS. The GPSB is operated by GPO, and relies on voluntary, non-paid contributions from members of the editorial board and whom they recruit to provide end-user feedbacks.

Both the JEB and GPSB face an uncertain future if sustainability is not considered soon. This would mean editorial management, financial resources and staff. The bulletins may be streamlined to better serve an advanced outreach role. A merger may also be considered.

The Panel recommended that the GPSB be continued under its own logo, as there clearly appears to be a need for GOOS outreach, particularly to the non-physical community.

5.3 OCEAN AND CLIMATE DATA (THE GOOS GLOBAL MODULE)

Neville Smith provided an update on the activities under the Ocean Observations Panel for Climate (OOPC). He also outlined some areas for collaboration between global and coastal modules of GOOS.

The OOPC has developed a strategy that recognizes multi-purpose objectives, ranging from the long-time scales of climate through to the shorter time scales of marine and ocean forecasts. Addressing a broad range of purposes with an integrated observing system delivers efficiency and robustness. All objectives are large-scale and generally global in nature, in contrast to those for COOP.

The implementation strategy has several components:

- assist in the creation of effective implementation mechanisms (for example, JCOMM);

- integrating and "frontier" pilot projects (for example, the Global Ocean Data Assimilation Experiment (GODAE) and *Argo*)
- focused activities (workshops, partnerships, working groups);
- exploiting international "movements" (for example, the 1997/98 El Niño and the UNFCCC COP and the Report on the Adequacy of Global Observing Systems);
- encouraging consensus – the OceanObs Conference.

GODAE: the Global Ocean Data Assimilation Experiment

The objective of GODAE is to develop a global system of observations, communications, modelling and assimilation, that will deliver regular, comprehensive information on the state of the oceans in a way that will promote and engender wide utility and availability of this resource for maximum benefit to society. The Strategic Plan for GODAE can be seen at http://www.bom.gov.au/GODAE/Strategic_Plan.pdf.

Models and data assimilation are central to the GODAE strategy. At least two of the potential application areas (coastal forecasting and ecosystem modelling) have strong links with COOP. The functional structure of GODAE (see Section 6 of the Plan) reflects this and also emphasizes the importance of data and information management, particularly for product serving. In the language of that Plan, the coastal module of GOOS could develop application centres in collaboration with GODAE in the areas of common interest.

GODAE is dedicated to developing a new generation of products and ocean services. The URLs at http://www.bom.gov.au/GODAE/godae_product_urls.htm provide several examples. Several other projects could benefit COOP, such as the Pilot Project to develop high-resolution SST products (http://www.bom.gov.au/GODAE/HiResSST/).

A GODAE Implementation Plan is due for completion by mid-2002 (aspects could be shared with the COOP modelling).

The *Argo* Pilot Project is progressing well (see http://www.argo.ucsd.edu/). The initial implementation is focused on N. Atlantic and N. Pacific. Around 500 floats were in the water at the end of 2001. Proposals for the coming three years suggest the seeding rate will reach around 750 per year, compared with the ideal of around 820 per year. The Argo Project is an excellent example of what can be achieved by imaginative "frontier" projects and strong leadership.

Other Initiatives of OOPC

The UNFCCC/GCOS Adequacy Report. The Global Climate Observing System is undertaking a review and assessment of the state of the climate observing system. This will be a major undertaking for 2002-2003, involving the IPCC.

Regional initiatives. For some regions (basins), it seems more effective to approach ocean observations on a broader front, embracing research requirements and/or the broader requirements of GOOS. This enables a broader constituency to be brought to the Table, as was done for the initial Indian Ocean Workshop. A follow-up Workshop is now being planned (November 2002). A similar approach is in its early stages for the South Atlantic. CLIVAR is taking the lead for the Southern ocean region.

Surface marine fields. Partnerships with JCOMM groups and with other expert groups have been used to enhance the quality of observations and to change the operational strategy. For

example, Voluntary-Observing-Ships (VOS) lines are now being developed as references and integrated with upper atmospheric and subsurface lines. Strong links are being established into numerical weather prediction groups. For surface waves and sea-ice JCOMM provides a substantial part of the leadership.

Global Ocean Time-series Observatory System. This project was initiated with the leadership of POGO and is one of important collaborative efforts with COOP (principally for open-ocean multi-disciplinary time series).

SOOP (Ship-of-Opportunity Programme). Efforts are being made to extend the SOOP to "new" observations such as pCO_2, using initiatives in Europe as elsewhere to “prove” the approach. As with time-series, there are clearly links to COOP. The move to “line mode” sampling also will provide additional value for COOP.

Remote sensing. Remote sensing requirements and implementation were covered in the Oceans Theme paper developed by the IGOS Partners. This paper represents a consensus view, in line with the conclusions of OceanObs. To the extent possible, the Theme Paper embraced likely requirements of COOP (e.g., ocean colour, where the IOCCG provides advice). GODAE takes the lead for the most part.

Carbon cycle. A paper on ocean carbon measurements has been drafted, led mainly by Scott Doney and Maria Hood. OOPC’s interests are mainly with the deep hydrographic elements. However, the paper also embraces some of the coastal issues. The Carbon Theme of the IGOS Partners provides some of the impetus for implementation.

Data and information management. This is likely to be the next big project, perhaps extended GOOS-wide (see http://www.bom.gov.au/OOPC/NVODS_WS/). There has been good progress on some basic elements (uniqueness, etc.). We will work with JCOMM and IODE (and CBS) and, perhaps win collaboration with PICES, by using biology as a test case.

In summary the main areas for interaction between OOPC and COOP would appear to be:

- GODAE
- Obvious strong links in modelling (Chapter 5 of COOP design plan)
- Pre-operational and operational coastal forecasts
- Evaluation of pilot products (e.g., N. Atlantic)
- Specific projects on coastal and/or ecosystems (e.g., PARADIGM, ToPaz)
- In development of ocean services products
- Fixed-point measurements, SOOP
- Multidisciplinary (Indian Ocean, South Atlantic, Southern Ocean)
- Other measurement networks
- GODAE Ocean current DAC
- Real time sea-level data
- SOOP for biological
- Autonomous floats for C-GOOS measurements
- Remote sensing, e.g. GHRSST and its DDS
- Data and Information Management
- Collaborate on biological issues (PICES July 2002)

5.4 THE ROLE OF INDICATORS IN INTEGRATED COASTAL MANAGEMENT

Robert Bowen informed that he would attend a workshop entitled "The Role of Indicators in Integrated Coastal Management" in Ottawa, Canada (29 April – 1 May 2002). This workshop is organized by the Government of Canada and IOC. The aims are to; (i) assess the state-of-the-art in the use of indicators to monitor and assess the effectiveness of coastal management efforts; (ii) review selected national and local case studies in the application of coastal management indicators; and (iii) develop a common framework and template for the selection and application of coastal management indicators in different contexts. The workshop is organized with lectures and breakout working groups devoted to (a) socioeconomic indicators, (b) environmental health indicators, and (c) governance indicators. More information about the workshop is available at: http://ioc.unesco.org/icam/activities_indicators.htm.

5.5 THE GLOBAL BURDEN OF HUMAN DISEASE FROM POLLUTION

Hillel Shuval presented some rough preliminary estimates of the Global Burden of Disease-GBD associated with swimming/bathing in wastewater polluted coastal waters, and eating raw or lightly steam shellfish harvested from such waters. These also included estimate of disease caused by biotoxins from tainted seafood, which may partially be caused by wastewater and other organic pollution of the marine environment. Until recently these human health effects, associated with marine pollution, have been considered to be primarily of a local nature, not normally included in the world agenda of marine scientists dealing with global marine pollution problems. The massive global scale of the problem can be visualized when one considers that the human body wastes, which carry the full spectrum of microbial pathogens of some 80% of the world population are discharged directly or indirectly into the marine coastal waters, much of it with little or no treatment. It is estimated that globally, foreign and local tourists together spend some two billion days annually at coastal recreational resorts and many are often exposed there to these wastewater polluted coastal waters. Annually some 800 million meals of potentially contaminated shellfish and other seafoods, harvested in polluted waters are consumed. It is estimated that globally there are some 200 million cases of gastrointestinal/respiratory/eye disease caused by swimming in wastewater-polluted waters annually. It is estimated that there are some four million cases of infectious hepatitis with some 40 thousand deaths and 40 thousand cases of long-term disability annually from consuming raw or lightly steamed shellfish harvested from polluted coast waters. In addition it is estimated that there are some 100,000 to 200,000 cases annually of intoxication from marine biotoxins with 20 thousand cases of death and 20 thousand cases of long-term disability. The total estimated impact of the human disease associated with land-based marine pollution may be about five million disability-adjusted life years (DALY's)/year, with an estimated economic loss of some 18 billion dollars per year. The massive global health impact and the economic loss associated with marine pollution is significant, with the impact being similar to the global burden of disease resulting from upper respiratory tract infections and intestinal nematodes. The findings of this study indicate that the very massive scope of these health impacts suggests that they add up to an issue of truly global magnitude, worthy of inclusion on the global agenda of marine pollution evaluation, prevention and control. The full report is available at http://ioc.unesco.org/goos/COOP-2/gdbfin_2.pdf.

5.6 POGO

A brief introduction to the Partnership for the Observation of the Global Ocean (POGO) had been provided by Shubha Sathyendranath at the second session of COOP in Trieste, Italy (6-8 June 2002; GOOS Report No. 111). As a continuation of this collaboration Tony Knap reported on the "Biology Meeting" which POGO convened in Dartington, England from 28-30 June 2001. This

meeting had been convened to explore the requirements for sustained, long-term, monitoring of marine biota and biological processes at the global scale, and to recommend step-wise and organized implementation of elements of such a system, through the POGO institutions. The full report from the meeting is available at:

http://www.oceanpartners.org/documents/Dartington_Report.pdf.

5.7 WORKSHOP ON REAL-TIME COASTAL OBSERVING SYSTEMS FOR ECOSYSTEM DYNAMICS AND HARMFUL ALGAL BLOOMS

John Cullen informed about the plans for major international workshop on real-time observation systems to be held in Villefranche-sur-Mer from 11-21 June 2003. There is a great deal of interest throughout the world in the installation of ocean observation systems to provide the data and knowledge needed to detect and forecast physical, chemical and biological changes in coastal and open-ocean ecosystems. Recent advances in instrumentation, communications and modelling capabilities have led to the design of prototype real-time observation and prediction systems for coastal ecosystems.

Through plenary lectures, contributed presentations, demonstrations and practical tutorials:

Review real-time and near real-time sensing systems applicable for observation, modelling and prediction of plankton dynamics in coastal waters, including HABs. Present the underlying theory and review the possibilities together with the current issues and limitations. Topics will include:

(a) Remote sensing of coastal waters;
(b) *In situ* optical measurements, (both passive and active);
(c) Automated methods for detection of plankton species or toxins;
(d) Integrated observation systems combining various kinds of detectors (optical, chemical, hydrodynamical), including moorings and autonomous vehicles;
(e) Continuous underway sampling systems (e.g., from ferries);
(f) Tools for characterizing distribution of plankton in relation to physical and chemical properties.

More through the plenary lectures and demonstrations than through the practical tutorials:

(g) Elaborate guidelines for the development of strategic and rational use of optical sensors for specific HABs problems
(h) Explore approaches for integrating data from various sensing systems to describe ecosystem processes in support of HAB research, monitoring and prediction (e.g., information systems)
(i) Review of prognostic models designed to use real-time observations of variables related to coastal ecosystem dynamics and HABs
(j) Introduction to and review of data assimilation techniques.

The panel strongly supported this workshop. More information about the workshop is available at: http://habwatch.org

5.8 THE COLOUR OF OCEAN DATA: A SYMPOSIUM ON OCEANOGRAPHIC DATA AND INFORMATION MANAGEMENT WITH SPECIAL ATTENTION TO BIOLOGICAL DATA

Savi Narayanan informed about this symposium to be held at The Palais des Congrès, Brussels, Belgium 25-27 November 2002. More information is available at http://www.vliz.be/en/activ/cod/cod.htm. This conference is part of the new efforts by the International Oceanographic Data and Information Exchange (IODE) of IOC to address management of non-physical data.

Neville Smith commented that the issue of data exchange and data management needed more than an incremental effort. He advocated for a larger scale effort that would more lead to a frontier approach. He listed several areas where he saw a need for improvements:

- data transmission (e.g. IRIDIUM capability)
- data standards and protocols
- data and data centre integration
- data circulation/distribution
- product circulation
- data assembly
- user interface wizards
- innovation in archives

He advocated taking a frontier approach on a small pilot project with non-physical data. These ideas are elaborated in the draft document *An Ocean Information Technology Project* to be presented as a background document to the fifth session of the GOOS Steering Committee (UNESCO, Paris, May 2002).

6. VENUE FOR COOP-IV

Cape Town, South Africa was suggested as a venue for COOP IV and it was left for the Co-chairman and the Technical Secretary to explore this suggestion.

7. CLOSING

In closing Tom Malone again thanked Mr. Bui Dinh Khuoc and the staff at MHC for their excellent assistance during the meeting.

ANNEX I

AGENDA FOR THE GOOS USERS' FORUM
(Third Session)

15 January 2002
Hotel Hanoi Horison Hotel
40 Cat Linh Street, Hanoi, Vietnam

1. Welcome and opening remarks. Thorkild Aarup, IOC.
2. Introduction to the meeting. Johannes Guddal. Co-president JCOMM.
3. Professor Dr. Bui Cong Que, Director, Oceanographic Institute of Hanoi.
4. Dr. Bui Nguyen Hong. Vice director, National Council for Typhoon and Flood Control.
5. Dr. Nguyen Viet Thi. National Centre for Hydrometeorological Forecasting.
6. Dr. Nguyen Minh Son. Department of Environment, Hanoi. PEMSEA.
7. Mr. Maarten Kuijper. Gulf of Thailand Project.
8. Dr. Yihang Jiang. UNEP East Asian Seas Regional Coordinating Unit.
9. Involving the offshore industry in GOOS. Johannes Guddal.
10. Summary discussion and proposed follow-ups. Discussion conducted by Johannes Guddal, report by Thorkild Aarup.

ANNEX II

AGENDA FOR THE COASTAL OCEAN OBSERVATIONS PANEL (Third Session)

16-18 January 2002

1. Plenary: Organization of the Meeting

1.1 Opening (IOC, Aarup)
1.2 Welcoming Remarks
(Dr. Nguyen Cong Thanh - Director General of Hydrometeorological Service of Vietnam)
1.3 Welcome Invited Experts (Malone)
1.4 Review and Adopt Agenda (Malone)

2. Plenary: Reports

2.1 Summary of Users' Forum (Knap)
2.2 Conference on Oceans and Coasts at Rio+10 (Malone)

3. Completion of the Integrated Strategic Design Plan for the Coastal Module of GOOS

3.1 Plenary
- 3.1.1 Organization of the Report (Malone)
- 3.1.2 Prologue and Introduction (Malone) [including Annex on Phenomena of Interest]
- 3.1.3 Applications: An Integrated Approach (Bowen, Knap)
- 3.1.4 Design Framework (Malone)
- 3.1.5 The Initial Subsystem for Observations (Cullen, Hall) (including annex on selection the common variables)
- 3.1.6 Combining Observations and Models (Thompson, Fogarty)
- 3.1.7 Data Management and Communications (Narayanan)
- 3.1.8 Developing an Operational System (Malone)
- 3.1.9 Group Discussion

3.2 Working Groups
- 3.2.1 Applications: An Integrated Approach (Bowen)
- 3.2.2 The Initial Subsystem for Observations (Cullen)
- 3.2.3 Combining Observations and Models (Thompson)
- 3.2.4 Data Management and Communications (Narayanan)
- 3.2.5 Developing an Operational System (Guddal)

3.3 Plenary: Results of Working Session 1 (WG Chair summaries and discussion)

4. Developing the Implementation Plan

4.1 Plenary: Background Information
- 4.1.1 Themes and Subgoals (Malone)
- 4.1.2 Forcings and Boundary Conditions of Change in Coastal Ecosystems
  - 4.1.2.1 GODAE, Argo and OOPC Requirements of COOP (Neville Smith)
  - 4.1.2.2 GTOS, ICM and the GPA for the Protection of the Marine Environment from Land-Based Activities (Bob Bowen)
  - 4.1.2.3 The Global Burden of Human Disease from Sewage Pollution (Hillel Shuval)

4.2 Selection of the Common Variables for the Global Backbone and of Generic Categories Requiring Regional Enhancements
  4.2.1 Plenary: Review procedure and organize Working Groups
  4.2.2 Working Groups complete matrices
  4.2.3 Plenary: Results of Matrix Integration
4.3 Plenary: Partnerships for Implementation
  4.3.1 COOP-POGO Partnership (Tony Knap)
  4.3.2 International Workshop on Real-Time Coastal Observing Systems (John Cullen)
  4.3.3 The Colour of Ocean Data (Savi Narayanan)
  4.3.4 Selecting and Promoting GOOS Pilot Projects: The OOPC Experience (Neville Smith)
  4.3.5 JCOMM: Its Mission and Ability to Oversee and Coordinate Implementation (Johannes Guddal)
4.4 Plenary: Next Steps (Malone and Knap)
  4.4.1 Formulate an intersession action plan
  4.4.2 Determine venue for COOP IV

ANNEX III

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ANNEX IV

PROBLEMS IN THE MARINE ENVIRONMENT AND RESOURCE MANAGEMENT IN VIETNAM

Prof. Bui Cong Que
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Introduction

With the rapid social-economic development in Vietnam, environment and resource management in the marine and coastal zone have become an important political issue. For many years the Vietnamese Government has paid much attention to this problem. In 1985 Vietnam launched the national strategy of environment protection. In 1991 a national plan for environment protection and sustainable development was produced. A number of important conventions and laws have been ratified by the Vietnamese Government in order to manage environment and resources such as the law of sea, the law of biodiversity, the law of oil and gas, the law of environment protection.

The Hanoi Institute of Oceanography together with Vietnamese scientists have performed many surveys and investigative projects for studying the conditions of the environment and resources in the Vietnam Sea areas and coastal zones, in order to contribute to the national strategy on environmental protection. These are: a survey for an assessment of environment in coastal zones of Vietnam (1994-1997, 1998-2000), a project for natural hazard zoning and prevention in coastal areas (1999-2001), a project for comprehensive investigation of the environment in the East Sea (1999-2001), a joint marine scientific research expedition between Vietnam and Philippines in the East Sea (1996-2000), a project to establish a national marine data bank (1996-2000) and a project to develop an atlas of natural conditions of the marine environment of the sea areas of Vietnam (2001-2004). The main projects above were developed in a large scale and required close and wide cooperation between our institute and other scientific organizations in Vietnam as well as all over the world.

The results from the projects are plentiful. The specialists, who are trained and experienced in professional skill, are one of the important ones. Along with the trained experts, a National Environment and Resource Information Center (NERIC) was established in our institute in 1997 and has continued to develop. The tasks of the NERIC are to collect, update, analyze and assess data and information of the marine environment and its resources, and to produce recommendations and resolutions to assist managers and decision markers for development activities.

The successful implementation of international cooperation projects between Australia and ASEAN countries for integrated Environment and resources management in Red River mouth and coastal zone of Khanh Hoa province (1997-1998) is one of the important results achieved by NERIC. For these areas NERIC has proposed a scientifically reliable petition in order to protect natural environment, resource exploration and sustainable development.

Some specific results on present conditions of environment and resources in the sea area and coastal zone of Vietnam are as follows:

- In the sea area and coastal zone of Vietnam exists a system of more than 2,700 islands. The islands are distributed near the shoreline as in the northeast region or at rather long distance

from the shoreline as in the southeast region, including the Hoang Sa (Paracel) and the Truong Sa (Spratly) archipelagos. The total area of the islands is 1,600 km^2. There are two distinguished estuary deltas in the coastal zone of Vietnam: the Red River, located in the North, with total area of 17,000 km^2, and the Mekong in the South with total area of 59,000 km^2. These are regions of highest population, with major agricultural development in Vietnam.

- The Vietnamese sea area and coastal zone of Vietnam have abundant water resources, which includes seawater, brackish, and fresh water. A great source of rainwater is poured into a system of about 2,500 rivers and 390,00 ha of lake area. There is also a big source of ground water in the Red River and Mekong deltas and along the whole coastal zone of Vietnam.

- Based on the hydrological features, the sea area and coastal zone of Vietnam can be divided into three regions; the Bac bo (Tonkin) Gulf, Central Vietnam and South Vietnam. Each region has different seawater salinity, turbidity and seasonal variation. Nine upwelling regions in the sea area of Central Vietnam strongly affect component and temperature of seawater at different depths. In the northern and southern sea areas, the hydrological regime is strongly influenced by the systems of big rivers such as the Red River and the Mekong River. Tidal regime and tidal currents in the sea area of Vietnam are rather complicated and differential. The maximum tidal amplitude reaches to 3.5 m, and the highest tidal levels in different regions compared with the zero value at Hon Dau station vary from 1.5 m to 2 m.

- Oil, gas and other minerals have been investigated, explored and exploited by Vietnam and foreign companies in the continental shelf and sea areas during the last 30 years. Up to now, oil and gas had been found in the Cuu Long, Nam Con Son, Malay basins and Hanoi trough. A big oil field, which had been exploited since 1986, is Bach Ho. Some recently exploited areas are Dai Hung, Dragon and others. Oil production in 2001 will reach more 13 million tons, while the total oil production of Vietnam up until now has reached 100 million tons. Results of oil and gas investigations show big potential in Cuu Long, Nam Con Son, Malay, Phu Khanh basins and the Red River trough. Resources of Tu Chinh, Truong Sa and Hoang Sa basins are being estimated. The oil reserves estimated in Cuu Long, Nam Con Son basins and Red River trough are more than two billion tons each.

- In Vietnam, there is a high biodiversity with more than 1,200 plant species, 75 animal species, 2,500 fish species and 800 bird species, of which a considerable amount are marine and coastal ones. There are 13 principal ecosystems in the coastal zone of Vietnam: agrosystem, aquaculture system, estuaries, lagoon, deltas, beaches, mangroves and nipa, sea grass beds, coral reefs, upwelling areas, islands, near-shore and off-shore waters. The ecosystems are distributed in different sea and coastal areas with very abundant and complicated ecological and environmental features.

- The sea area and coastal zone of Vietnam have more than 2,000 fish species, 300 scleractinian coral and thousands of flora species. There are approximately 13-fish species of high economic value in the coastal zone of Vietnam. Fishing and aquatic yield in the coastal zone is very high, accounting for 90% of the country's fish and aqua-species production. Fish species distribution in the coastal zone is of a seasonal character.

- Estuary ecosystems are widely developed in the coastal zone of Quang Ninh, Hai Phong, and several northern provinces. In the South, the estuary of Saigon Dong Nai River is characterized by a rich biodiversity, which supports development of fish, shrimp and crab species.

- Lagoons are mainly distributed along the coastal zone of Central Vietnam. There are large lagoons in Lang Co, Tam Giang, with surface areas ranging from 1,500 ha to 21,000 ha. In these lagoons exist over 165 species of phytoplankton, 54 macroalgae species, 200 plankton species and 33 benthic species. There are 144 fish species but these are mainly fresh water types.

- Mangroves cover an area of about 250,000 ha, 60% of which is located in the southern part of the country, particularly in the Mekong estuary.

- Coral reefs can be found in all watered areas in northern, central and southern parts of Vietnam. In Bac bo gulf (North Vietnam) exist mainly fringing reefs, with short and low reefs, while in the southern part exist fringing and barrier reefs and in Truong Sa sea area-atoll and platform reefs.

- There are more than 600 algae species in the sea of Vietnam, which are distributed from the north to the south of the country.

- Facing the threat of biodiversity degradation due to environment pollution impact and over exploitation, the Vietnamese Government has established a number of National Protected Areas in order to protect from human penetration, destruction and over exploitation. The Marine National Protected Areas are: Ha Long (Quang Ninh province), Cat Ba (Hai phong province) and in islands such as Hon Mun (Khanh Hoa province), Con Dao (Ba Ria province) and Phu Quoc (Kien Giang province). Marine resources are being degraded and destroyed due to unplanned exploitation and pollution from various sources. Fish resources are rapidly decreasing due to the fishing activities in the sea and estuary areas. At the present time, there are more than 60,000 motors and hundreds of thousands of fishing boats using wind or human power. Destructive fishing techniques such as the use of fishnets (small size), high electric currents and blasting are all still common and have seriously affected the marine biodiversity and environment.

- Coral reefs in the Vietnam Sea are being degraded and their biodiversity is rapidly declining. The ecological balance of many coral reefs is disrupted. Many coral reefs are damaged due to blast fishing, or being exploited for building materials and tourism products.

- Mangroves play an important role in the economy of Vietnam. Mangroves are heavily damaged in the coastal zone and estuaries of Vietnam due to shrimp farming and agriculture development. Millions of hectares of mangroves have been destroyed because of herbicide spraying with more than 500,000 ha of mangroves damaged due to shrimp farming. At present there are only about 250,000 ha of mangroves left in the whole coastal zone of Vietnam.

- The problem of pollution is quite serious in the sea and coastal zone of Vietnam due to economic development activities as well as upstream deforestation. Most of the pollution is caused by the use of pesticides and fertilizers in agriculture, which result in toxins in the water, killing fish and declining marine biodiversity.

- Increases in industrial activities (more than 10% pa) causes heavy metal pollution. Chemicals, pesticides, fertilizers, metals, rubbers, glass, porcelain, etc., cause discharges of wastewater in the rivers, which in turn carry heavy metals and toxins to the sea. The concentration of heavy metals in the sea areas near big cities and industrial zones reaches 0.03-0.05 mg/l. In Vung Tau, the proportion of Zinc in seawater is five times higher than the standard level. Toxic

chemicals such as cadmium, cobalt, nickel, copper, arsenic and mercury have been found in the seawater and the concentration of each exceeds the standard level.

- Pollution by city sewage is becoming more and more serious. The majority of Vietnam's big cities are located in the coastal zones or on big riverbanks. From the rivers the waste to be transferred to the sea. Urbanization increases the threat of pollution caused by big city sewage and wastewater. Waste may transport many organic and inorganic toxins to the sea, impact on the environment, destroy many biological species and cause human disease.

- Along with development of the oil-gas industry and marine transport activities many oil spill incidents have occurred during recent years, which cause serious oil pollution in several regions of Vietnam. One of the spills was over 1,700 tons of diesel oil by a Singapore tanker *Neptune* in Cat Lai port (Saigon river) in October 1994, which caused the losses of a value of $40 million. Up to now, a number of oil spills cases with different scale and losses have been occurring in the seas of Vietnam.

- Salinity intrusion from the sea landward is a big problem in the coastal zones and estuaries. During the dry season, fresh water in the rivers reduces, and saline water from the sea enters the main rivers and creeks under the effect of the tides. In the Mekong delta, saline water enters 40 km upstream, while in the Red River delta, saline water enters 25-30 km upstream. Salinity intrusion strongly affects agriculture production, decreases land fertility, increases the acidity and degrades many fish species.

- Various kinds of natural hazards have taken place in the coastal zone of Vietnam causing damage and losses to people and agriculture as well as industrial production. Typical phenomena are typhoon and storm surges. On average every year there are 5-10 storms hitting land areas from the East Vietnam sea, spreading along the Vietnam coast, destroying houses, crops and industrial structures. In addition, sea water level rises with amplitude of 2.5-3 m, flooding the cities, villages, paddy fields, roads, etc., and causing adverse impacts.

- Floods are also caused by upstream deforestation, which leads to overflows in rivers downstream. The situation is quite serious in the Mekong delta, where the flood season lasts for several months each year, obstructing production and causing severe losses to the economy.

- Erosion and sedimentation are also rather frequent natural hazards observed along the coastal zone of Vietnam, considerably changing the coastline, affecting production, and polluting the environment. Up to 650 km of coastline is often affected by erosion. There are 243 coastline segments eroded, of which 69 are 1 km long, 61 are more than *5* km long. There are more than 60 segments eroded at a rate of 120-40 m/year. In some places such as the Red River and Mekong estuaries sedimentation reduces the flow from rivers to sea and therefore increases the possibility of flood in the rain season.

- In review, from the foregoing investigative results one can clearly see the important role of the investigation in managing and protecting the environment and marine resources. Our aim in the short and long term is to continuously extend and improve the investigative quality so as to satisfy real requirements in this relation.

The main tasks that are proposed to us in the field of environmental and resources investigation in the sea area and coastal zone are as follows:

- To organize observations and effective investigations in the open offshore areas that are lying in difficult and complicated physical conditions as the Truong Sa archipelago in the central area of Eastern Sea and Gulf of Thailand.

- To extend the network and increase the scale of observations and measurements in such a large area where the available survey data are not sufficient and detailed enough for determination of significant characteristics of environment and resources.

- To improve and enhance the scale and quality of the monitoring network for the marine environment and its resources to allow for more effective management of the marine and coastal zone environment which have been degrading due to development.

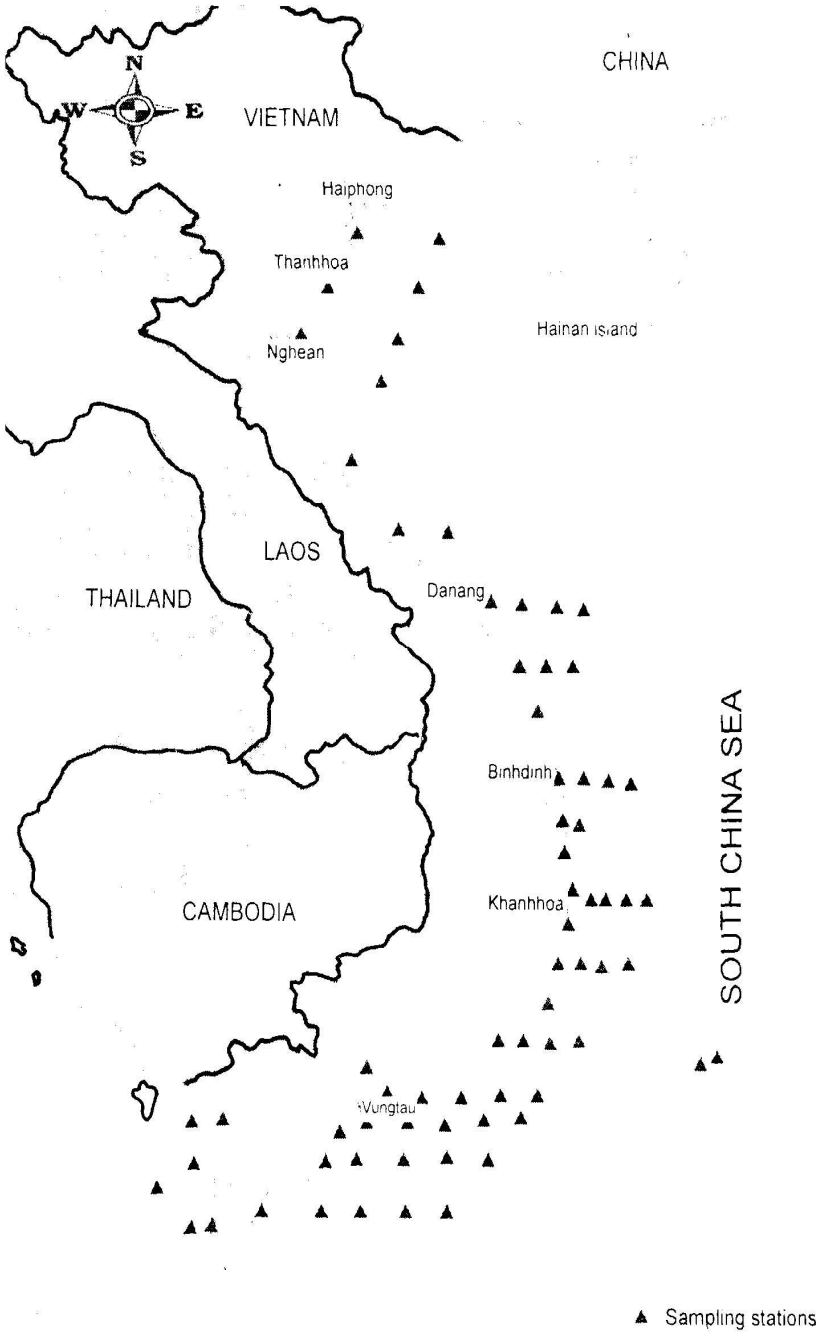
- To improve and modernize the technical base for the field investigation, monitoring networking and environment assessment together with special training for experts, as well as developing and using new technologies and methods in this domain.

- To enhance and further develop scientific cooperation between countries and scientific organizations in the region and all over the world to improve the investigative technology, the quality of environment control and assessment, exchange data, information and to share experience in the field of environment and resources protection and sustainable development.

APPENDICES

Some results of determination of water quality in Khanhhoa coastal zone (after Nguyen Tac An et al. – 2000).

Maps and tables on next pages complement this paper (Annex IV, p. 6-10).



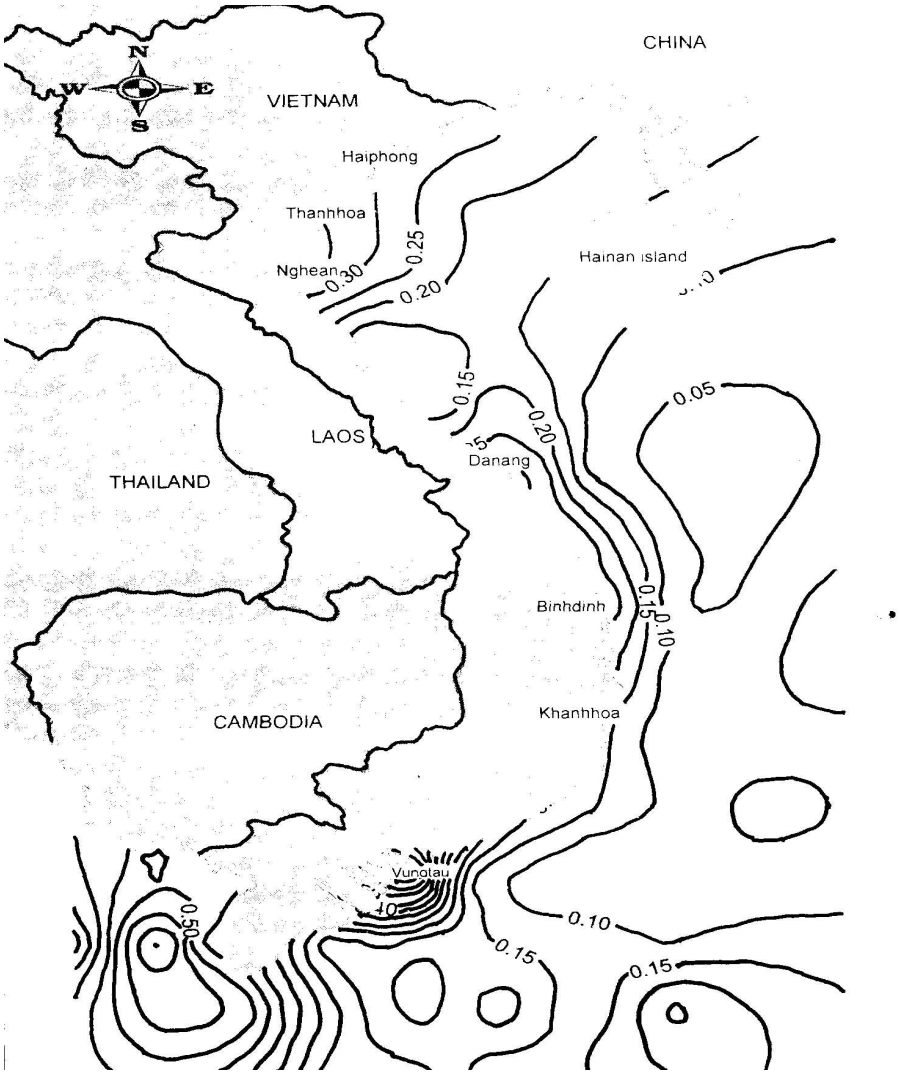
Map of sampling stations in Vietnamese waters (1979-1999)

AREAS	PARAMETERS	MONTHS											
		JAN.	FEB.	MAR.	APR.	MAY	JUN.	JULY	AGU.	SEPT.	OCT.	NOV.	DEC.
3/2 POOLS (YEAR 1986)	P	166	214	344	367	158	644	276	440	302	160	146	563
	B	1.9	2.5	2.8	3.4	1.8	4.7	2.8	3.4	2.8	1.6	1.8	4.1
	CA	2.37	3.16	2.80	3.67	2.19	4.40	3.27	3.30	3.16	1.89	2.29	3.76
	AC	70	68	123	100	72	144	85	132	98	85	64	150
CUABE (YEAR 1986)	P	166	266	332	474	251	618	482	573	464	233	140	463
	B	1.9	2.5	2.7	3.4	2.5	4.8	3.8	4.5	4.0	2.3	1.6	3.8
	CA	2.51	2.86	2.7	3.2	2.81	4.73	3.8	4.47	4.22	2.62	2.11	3.98
	AC	66	93	123	148	90	130	127	128	110	89	66	116

AREAS	PARAMETERS	YEAR 1979									YEAR 1980	
		APRIL	MAY	JUN.	JULY	AGU.	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.
NHAPHU	P	247	207	91	216	279	83	-	350	492	213	480
	B	0.74	10.8	1.33	2.92	1.08	8.64	15.0	-	4.57	5.21	1.84
	CA	1.03	1.03	1.87	4.08	1.50	6.1			1.30	1.40	2.58
	AC	240	159	49	53	186	14	-	-	378	152	186
CAUDA	P	71.4	57.1	18.5	38.6	52.9	67.1	85.7	407.1	161.4	24.08	-
	B	0.43	0.21	0.17	0.51	0.09	0.11	1.01	1.51	0.60	0.70	-
	CA	0.61	0.29	0.50	-	-	-	1.41	2.50	1.01	-	-
	AC	117	197	37	-	-	-	61	163	160	-	-

Long. - Lat.	P (mgC.m^{-3}.day^{-1})	Chlorophyll (mg.m^{-3})			AC (mgC.mgchl-a^{-1} day^{-1})
		a	b	c	
4°5'-106°05'7	0.31	0.222	0.029	0.174	1.396
9°39'-108°32'	0.24	0.164	0.048	0.263	1.463
10°15'5-107°05'3	1.65	1.24	0.180	0.950	1.331
9°52'-107°00	1.1	0.542	0.103	0.555	2.029
9°51'-107°00	1.6	0.741	0.131	0.711	1.159
9°45'-107°09	0.98	0.434	0.061	0.406	2.258
8°47'-107°01	0.13	0.099		0.128	1.313
9°04'-108°44	0.07	0.081	0.015	0.115	0.864
9°51'-107°01'3	3.1	0.729	0.127	0.684	4.252
13°24'-110°050'7	0.07	0.082	0.202	0.446	0.854
17°40'-116°25	0.08	0.045			0.842
19°35'-119°15'	0.25	0.115	0.006	0.034	2.174
Average	*0.80 ±0.94*	*0.37±0.37*	*0.09±0.07*	*0.41±0.29*	*1.66±0.95*
Max.	*3.10*	*1.24*	*0.20*	*0.95*	*4.25*
Min.	*0.07*	*0.05*	*0.01*	*0.03*	*0.84*

Distribution of Chlorophyll and Primary production in offshore



Map of Chlorophyll a distribution in Vietnamese water (mg/m3)

Elements	Unit	Mean concentration		Critical value	Mean pollution coefficience	
		Dry season	Rainy season		Dry season	Rainy season
TSS	mg/l	28.3	47.1	50*	0.57	0.94
NH3-N*	µg/l	13.6	45.2	500*	0.03	0.09
Nitrate-N	µg/l	89.5	126	100**	0.89	1.26
Phosphate-P	µg/l	3.8	5.6	15**	0.25	0.37
Fe	µg/l	348	867	100*	3.48	8.67
Mn	µg/l	10.9	39.8	100*	0.11	0.39
Zn	µg/l	22.8	24.9	10 *	2.28	2.49
Cu	µg/l	7.4	8.3	10 *	0.74	0.83
Pb	µg/l	1.0	1.2	50 *	0.02	0.02
As	µg/l	22.9	15.7	10 *	2.29	1.57

Mean pollution coefficient of some elements (Nhaphu lagoon)

Elements	Unit	Mean concentration		Critical value	Mean pollution coefficience	
		Dry season	Rainy season		Dry season	Rainy season
TSS	mg/l	17.0	30.4	50*	0.34	0.61
NH3-N	µg/l	22.2	0.2	500*	0.04	0.00
Nitrate-N	µg/l	64.7	75.2	100**	0.65	0.75
Phosphate-P	µg/l	4.8	5.8	15**	0.32	0.39
Fe	µg/l	304	701	100*	3.04	7.01
Mn	µg/l	9.1	24.1	100*	0.09	0.24
Zn	µg/l	27.9	27.5	10*	2.79	2.75
Cu	µg/l	8.0	7.8	10*	0.80	0.78
Pb	µg/l	1.1	1.3	50*	0.02	0.02
As	µg/l	12.6	17.2	10*	1.26	1.72

Mean pollution coefficient of some elements (Binhcang bay)

Elements	Unit	Mean concentration		Critical value	Mean pollution efficience	
		Dry season	Rainy season		Dry season	Rainy season
TSS	mg/l	19	34	50*	0.38	0.68
DO	mg/l	6.44	6.28	5*	0.78	0.80
P04-P	mg/l	21.2	8.9	15**	1.41	0.59
N03-N	µg/l	290	464	100**	2.90	4.64
Fe	µg/l	169	330	100*	1.69	3.30
Mn	µg/l	14.2	17.0	100*	0.14	0.17
Zn	µg/l	17.9	6.7	10*	1.79	0.67
Cu	µg/l	66	8.3	10*	0.83	0.83
Pb	µg/l	2.6	5.6	50*	0.05	0.11

* Vietnamese Fishery Water Standard

** Chinese Fishery Water Standard (Guao Shenquan et al.,1991)

Mean pollution coefficient of some elements (Nhatrang bay)

Area	Value	Org.C (µg/l)	Org.n (µg/l)	P Total (µg/l)	Fe (µg/l)	Mn (µg/l)	Zn (µg/l)	Cu (µg/l)	Pb (µg/l)	As (µg/l)
Vanphong -Bengoi Bay	Min	1020	1133	774	12680	442	2.06	1.15	0.30	-
	Max	13600	1660	1030	16100	494	3.89	4.29	0.48	-
	Mean	9200	755	610	6000	366	0.55	0.21	0.12	-
Nhaphu-Binheang Bay	Min	8200	415	119	11200	-	0.45	1.60	0.01	1.34
	Max	20700	870	397	40400	-	4.51	15.20	0.86	6.14
	Mean	15000	632	224	27400	-	1.63	5.45	0.22	3.76
Nhatrang	Min	500	36	18	13000	81	1.7	4.6	0.1	2.3
	Max	26000	848	248	26000	320	12.1	13.5	1.3	7.6
	Mean	8056	440	133	18083	166	5.1	8.2	0.4	5.1
Camranh Bay	Min	2250	110	10	550	10.5	3.0	4.4	0.08	1.5
	Max	20600	852	280	11800	355.3	59.5	20.1	1.02	16.5
	Mean	10833	453	133	5417	156.7	18.8	1.0	0.39	4.2

Contents of organic substances & heavy metals in sediments (Camranh bay)

ANNEX V

THE INTEGRATED, STRATEGIC DESIGN PLAN FOR THE COASTAL OCEAN OBSERVATIONS COMPONENT OF THE GLOBAL OCEAN OBSERVING SYSTEM

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ANNEX VI

LIST OF ACRONYMS

ASEAN	Association of Southeast Asian Nations
CBS	Commission for Basic Systems (WMO)
C-GOOS	Coastal Panel of GOOS
COBSEA	Coordinating Body on the Seas of East Asia
COP	Conference of Parties
COOP	Coastal Ocean Observations Panel
DAC	Data Assembly Center
EAS/RCU	East Asian Seas Regional Coordinating Unit
FAO	UN Food and Agricultural Organization
GCOS	Global Climate Observing System
GEF	Global Environmental Facility
GHRSST	GODAE High Resolution Sea Surface Temperature Project
GLOBEC	Global Ocean Ecosystem Dynamics
GODAE	Global Ocean Data Assimilation Experiment
GOOS	Global Ocean Observing System
GPO	GOOS Project Office
GPSB	GOOS Products and Services Bulletin
GSC	GOOS Steering Committee
GTOS	Global Terrestrial Observing System
HAB	Harmful Algal Bloom
HOTO	Health of the Oceans
ICM	Integrated Coastal Management
ICRAN	International Coral Reef Action Network
ICSU	International Council for Science
IGBP	International Geosphere - Biosphere Programme
IGOS	Integrated Global Observing Strategy
IGOSS	Integrated Global Ocean Services System
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Ocean Data and Information Exchange Programme
IPCC	Intergovernmental Panel on Climate Change
JCOMM	Joint WMO-IOC Technical Commission for Oceanography and Marine Meteorology
JEB	JCOMM Electronic Bulletin
NERIC	National Environment and Resource Information Centre (Vietnam)
NOAA	National Oceanic and Atmospheric Administration (USA)
OOPC	Ocean Observations Panel for Climate
PEMSEA	Partnerships in Environmental Management for the Seas of East Asia

PICES	North Pacific Marine Science Organization
POGO	Partnership for Observation of the Global Ocean
SEAPOL	Southeast Asian Programme in Ocean Law, Policy and Management
SEA START RC	Southeast Asia START Global Change Regional Centre
Sea-WiFS	Sea-viewing Wide Field-of-view Sensor
SOOP	Ship-of-Opportunity Programme
START	Global change SysTem for Analysis, Research and Training
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Cultural and Scientific Organization
WESTPAC	IOC Sub-commission for the Western Pacific
WMO	World Meteorological Organization

In this Series, entitled

Reports of Meetings of Experts and Equivalent Bodies, which was initiated in 1984 and which is published in English only, unless otherwise specified, the reports of the following meetings have already been issued:

1. Third Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans
2. Fourth Meeting of the Central Editorial Board for the Geological/Geophysical Atlases of the Atlantic and Pacific Oceans S. Fourth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' ***(Also printed in Spanish)***
4. First Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
5. First Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
6. First Session of the Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
7. First Session of the Joint CCOP(SOPAC)-IOC Working Group on South Pacific Tectonics and Resources
8. First Session of the IODE Group of Experts on Marine Information Management
9. Tenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies in East Asian Tectonics and Resources
10. Sixth Session of the IOC-UNEP Group of Experts on Methods, Standards and Intercalibration
11. First Session of the IOC Consultative Group on Ocean Mapping ***(Also printed in French and Spanish)***
12. Joint 100-WMO Meeting for Implementation of IGOSS XBT Ships-of-Opportunity Programmes
13. Second Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
14. Third Session of the Group of Experts on Format Development
15. Eleventh Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
16. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
17. Seventh Session of the IOC-UNEP Group of Experts on Methods, Standards and lntercalibration
18. Second Session of the IOC Group of Experts on Effects of Pollutants
19. Primera Reunión del Comité Editorial de la COI para la Carta Batimétrica lnternacional del Mar Caribe y Parte del Océano Pacífico frente a Centroamérica ***(Spanish only)***
20. Third Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
21. Twelfth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of South-East Asian Tectonics and Resources
22. Second Session of the IODE Group of Experts on Marine Information Management
23. First Session of the IOC Group of Experts on Marine Geology and Geophysics in the Western Pacific
24. Second Session of the IOC-UN(OETB) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources ***(Also printed in French and Spanish)***
25. Third Session of the IOC Group of Experts on Effects of Pollutants
26. Eighth Session of the IOC-UNEP Group of Experts on Methods, Standards and lntercalibration
27. Eleventh Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans ***(Also printed in French)***
28. Second Session of the IOC-FAO Guiding Group of Experts on the Programme of Ocean Science in Relation to Living Resources
29. First Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
30. First Session of the IOCARIBE Group of Experts on Recruitment in Tropical Coastal Demersal Communities ***(Also printed in Spanish)***
31. Second IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
32. Thirteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asia Tectonics and Resources
33. Second Session of the IOC Task Team on the Global Sea-Level Observing System
34. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and Overlay Sheets
35. Fourth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
36. First Consultative Meeting on RNODCs and Climate Data Services
37. Second Joint IOC-WMO Meeting of Experts on IGOSS-IODE Data Flow
38. Fourth Session of the Joint CCOP/SOPAC-IOC Working Group on South Pacific Tectonics and Resources
39. Fourth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
40. Fourteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
41. Third Session of the IOC Consultative Group on Ocean Mapping
42. Sixth Session of the Joint IOC-WMO-CCPS Working Group on the Investigations of 'El Niño' (***Also printed in Spanish)***
43. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
44. Third Session of the IOC-UN(OALOS) Guiding Group of Experts on the Programme of Ocean Science in Relation to Non-Living Resources
45. Ninth Session of the IOC-UNEP Group of Experts on Methods, Standards and lntercalibration
46. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
47. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
48. Twelfth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
49. Fifteenth Session of the Joint CCOP-IOC Working Group on Post-IDOE Studies of East Asian Tectonics and Resources
50. Third Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
51. First Session of the IOC Group of Experts on the Global Sea-Level Observing System
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53. First Session of the IOC Editorial Board for the International Chart of the Central Eastern Atlantic ***(Also printed in French)***
54. Third Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico ***(Also printed in Spanish)***
55. Fifth Session of the IOC-UNEP-IMO Group of Experts on Effects of Pollutants
56. Second Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean
57. First Meeting of the IOC *ad hoc* Group of Experts on Ocean Mapping in the WESTPAC Area
58. Fourth Session of the IOC Consultative Group on Ocean Mapping

59. Second Session of the IOC-WMO/IGOSS Group of Experts on Operations and Technical Applications
60. Second Session of the IOC Group of Experts on the Global Sea-Level Observing System
61. UNEP-IOC-WMO Meeting of Experts on Long-Term Global Monitoring System of Coastal and Near-Shore Phenomena Related to Climate Change
62. Third Session of the IOC-FAO Group of Experts on the Programme of Ocean Science in Relation to Living Resources
63. Second Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
64. Joint Meeting of the Group of Experts on Pollutants and the Group of Experts on Methods, Standards and Intercalibration
65. First Meeting of the Working Group on Oceanographic Co-operation in the ROPME Sea Area
66. Fifth Session of the Editorial Board for the International Bathymetric and its Geological/Geophysical Series
67. Thirteenth Session of the IOC-IHO Joint Guiding Committee for the General Bathymetric Chart of the Oceans ***(Also printed in French)***
68. International Meeting of Scientific and Technical Experts on Climate Change and Oceans
69. UNEP-IOC-WMO-IUCN Meeting of Experts on a Long-Term Global Monitoring System
70. Fourth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
71. ROPME-IOC Meeting of the Steering Committee on Oceanographic Co-operation in the ROPME Sea Area
72. Seventh Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño' ***(Spanish only)***
73. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico ***(Also printed in Spanish)***
74. UNEP-IOC-ASPEI Global Task Team on the Implications of Climate Change on Coral Reefs
75. Third Session of the IODE Group of Experts on Marine Information Management
76. Fifth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
77. ROPME-IOC Meeting of the Steering Committee for the Integrated Project Plan for the Coastal and Marine Environment of the ROPME Sea Area
78. Third Session of the IOC Group of Experts on the Global Sea-level Observing System
79. Third Session of the IOC-IAEA-UNEP Group of Experts on Standards and Reference Materials
80. Fourteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans
81. Fifth Joint IOG-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
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84. Fourth Session of the IODE Group of Experts on Marine Information Management
85. Sixth Session of the IOC Editorial Board for the International Bathymetric chart of the Mediterranean and its Geological/Geophysical Series
86. Fourth Session of the Joint IOC-JGOFS Panel on Carbon Dioxide
87. First Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Pacific
88. Eighth Session of the JSC Ocean Observing System Development Panel
89. Ninth Session of the JSC Ocean Observing System Development Panel
90. Sixth Session of the IODE Group of Experts on Technical Aspects of Data Exchange
91. First Session of the IOC-FAO Group of Experts on OSLR for the IOCINCWIO Region
92. Fifth Session of the Joint IOC-JGOFS CO, Advisory Panel Meeting
93. Tenth Session of the JSC Ocean Observing System Development Panel
94. First Session of the Joint CMM-IGOSS-IODE Sub-group on Ocean Satellites and Remote Sensing
95. Third Session of the IOC Editorial Board for the International Chart of the Western Indian Ocean
96. Fourth Session of the IOC Group of Experts on the Global Sea Level Observing System
97. Joint Meeting of GEMSI and GEEP Core Groups
98. First Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
99. Second International Meeting of Scientific and Technical Experts on Climate Change and the Oceans
100. First Meeting of the Officers of the Editorial Board for the International Bathymetric Chart of the Western Pacific
101. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico
102. Second Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
103. Fifteenth Session of the Joint IOC-IHO Committee for the General Bathymetric Chart of the Oceans
104. Fifth Session of the IOC Consultative Group on Ocean Mapping
105. Fifth Session of the IODE Group of Experts on Marine Information Management
106. IOC-NOAA *Ad hoc* Consultation on Marine Biodiversity
107. Sixth Joint IOC-WMO Meeting for Implementation of IGOSS XBT Ship-of-Opportunity Programmes
108. Third Session of the Health of the Oceans (HOTO) Panel of the Joint Scientific and Technical Committee for GLOSS
109. Second Session of the Strategy Subcommittee (SSC) of the IOC-WMO-UNEP Intergovernmental Committee for the Global Ocean Observing System
110. Third Session of the Joint Scientific and Technical Committee for Global Ocean Observing System
111. First Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate
112. Sixth Session of the Joint IOC-JGOFS C02 Advisory Panel Meeting
113. First Meeting of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS)
114. Eighth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of "El Niño" ***(Spanish only)***
115. Second Session of the IOC Editorial Board of the International Bathymetric Chart of the Central Eastern Atlantic ***(Also printed in French)***
116. Tenth Session of the Officers Committee for the Joint IOC-IHO General Bathymetric Chart of the Oceans (GEBCO), USA, 1996
117. IOC Group of Experts on the Global Sea Level Observing System (GLOSS), Fifth Session, USA, 1997
118. Joint Scientific Technical Committee for Global Ocean Observing System (J-GOOS), Fourth Session, USA, 1997
199 First Session of the Joint 100-WMO IGOSS Ship-of-Opportunity Programme Implementation Panel, South Africa, 1997
120. Report of Ocean Climate Time-Series Workshop, Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate, USA, 1997

121. IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional Global Ocean Observing System (NEAR-GOOS), Second Session, Thailand, 1997

122. First Session of the IOC-IUCN-NOAA *Ad hoc* Consultative Meeting on Large Marine Ecosystems (LME), France, 1997

123. Second Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), South Africa, 1997

124. Sixth Session of the IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico, Colombia, 1996 ***(also printed in Spanish)***

125. Seventh Session of the IODE Group of Experts on Technical Aspects of Data Exchange, Ireland, 1997

126. IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), First Session, France, 1997

127. Second Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 1998

128. Sixth Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1997

129. Sixth Session of the Tropical Atmosphere - Ocean Array (TAO) Implementation Panel, United Kingdom, 1997

130. First Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 1998

131. Fourth Session of the Health of the Oceans (HOTO) Panel of the Global Ocean Observing System (GOOS), Singapore, 1997

132. Sixteenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), United Kingdom, 1997

133. First Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1998

134. Fourth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IOC/EB-IBCWIO-IW3), South Africa, 1997

135. Third Session of the Joint GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC), France, 1998

136. Seventh Session of the Joint IOC-JGOFS C02 Advisory Panel Meeting, Germany, 1997

137. Implementation of Global Ocean Observations for GOOS/GCOS, First Session, Australia, 1998

138. Implementation of Global Ocean Observations for GOOS/GCOS, Second Session, France, 1998

139. Second Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Brazil, 1998

140. Third Session of IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), China, 1998

141. Ninth Session of the Joint IOC-WMO-CPPS Working Group on the Investigations of 'El Niño', Ecuador, 1998 ***(Spanish only)***

142. Seventh Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Croatia, 1998

143. Seventh Session of the Tropical Atmosphere-Ocean Array (TAO) Implementation Panel, Abidjan, Côte d'Ivoire, 1998

144. Sixth Session of the IODE Group of Experts on Marine Information Management (GEMIM), USA, 1999

145. Second Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), China, 1999

146. Third Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Ghana, 1999

147. Fourth Session of the GCOS-GOOS-WCRP Ocean Observations Panel for Climate (OOPC); Fourth Session of the WCRP CLIVAR Upper Ocean Panel (UOP); Special Joint Session of OOPC and UOP, USA, 1999

148. Second Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), France, 1999

149. Eighth Session of the Joint IOC-JGOFS CO2 Advisory Panel Meeting, Japan, 1999

150. Fourth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Japan, 1999

151. Seventh Session of the IOC Consultative Group on Ocean Mapping (CGOM), Monaco, 1999

152. Sixth Session of the IOC Group of Experts on the Global Sea level Observing System (GLOSS), France, 1999

153. Seventeenth Session of the Joint IOC-IHO Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO), Canada, 1999

154. Comité Editorial de la COI para la Carta Batimétrica Internacional del Mar Caribe y el Golfo de Mexico (IBCCA), Septima Reunión, Mexico, 1998

IOC Editorial Board for the International Bathymetric Chart of the Caribbean Sea and the Gulf of Mexico (IBCCA), Seventh Session, Mexico, 1998

155. Initial Global Ocean Observing System (GOOS) Commitments Meeting, IOC-WMO-UNEP-ICSU/Impl-III/3, France, 1999

156. First Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Venezuela, 1999 ***(also printed in Spanish and French)***

157. Fourth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), China, 1999

158. Eighth Session of the IOC Editorial Board for the International Bathymetric Chart of the Mediterranean and its Geological/Geophysical Series, Russian Federation, 1999

159. Third Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS), Chile, 1999

160. Fourth Session of the IOC-WMO-UNEP-ICSU-FAO Living Marine Resources Panel of the Global Ocean Observing System (GOOS). Hawaii, 2000

161. Eighth Session of the IODE Group of Experts on Technical Aspects of Data Exchange, USA, 2000

162. Third Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LME), France, 2000

163. Fifth Session of the IOC-WMO-UNEP-ICSU Coastal Panel of the Global Ocean Observing System (GOOS), Poland, 2000

164. Third Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System (GOOS), France, 2000

165. Second Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, Cuba, 2000 ***(also printed in Spanish and French)***

166. First Session of the Coastal Ocean Observations Panel, Costa Rica, 2000

167. First GOOS Users' Forum, 2000

168. Seventh Session of the Group of Experts on the Global Sea Level Observing System, Honolulu, 2001

169. First Session of the Advisory Body of Experts on the Law of the Sea (ABE-LOS), France, 2001 ***(also printed in French)***

170. Fourth Session of the IOC-WMO-UNEP-ICSU Steering Committee of the Global Ocean Observing System, Chile, 2001

171. First Session of the IOC-SCOR Ocean CO_2 Advisory Panel, France, 2000

172. *Cancelled*

173. Third Session of the *ad hoc* Advisory Group for IOCARIBE-GOOS, USA, 2001 ***(also printed in Spanish and French)***

174. Second Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Italy, 2001

175. Second Session of the Black Sea GOOS Workshop, Georgia, 2001

176. Fifth Session of the IOC/WESTPAC Co-ordinating Committee for the North-East Asian Regional – Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2000

177. Second Session of the Advisory Body of Experts on the Law of the Sea (IOC/ABE-LOS), Morocco, 2002 ***(also printed in French)***

178. Third Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, Vietnam, 2002

179. Fourth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), France, 2002

180. Second Session of the IOC-SCOR Ocean CO_2 Advisory Panel, Honolulu, Hawaii, U.S.A, 2002 ***(electronic copy only)***

181. IOC Workshop on the Establishment of SEAGOOS in the Wider Southeast Asian Region, Seoul, Republic of Korea, 2001 (SEAGOOS preparatory workshop) ***(electronic copy only)***

182. Third Session of the GOOS Users' Forum and Coastal Ocean Observations Panel, Vietnam, 2002

183. Fourth Session of the IOC-IUCN-NOAA Consultative Meeting on Large Marine Ecosystems (LMEs), France, 2002

184. Seventh Session of the IODE Group of Experts on Marine Information Management (GEMIM), France, 2002 ***(electronic copy only)***

185. Sixth Session of IOC/WESTPAC Coordinating Committee for the North-East Asian Regional - Global Ocean Observing System (NEAR-GOOS), Republic of Korea, 2001

186. First Session of the Global Ocean Observing System (GOOS) Capacity Building Panel, Switzerland, 2002 ***(electronic copy only)***

187. Fourth Session of the ad hoc Advisory Group for IOCARIBE-GOOS, 2002, Mexico ***(also printed in French and Spanish)***

188. Fifth Session of the IOC Editorial Board for the International Bathymetric Chart of the Western Indian Ocean (IBCWIO), Mauritius, 2000

189. Third session of the Editorial Board for the International Bathymetric Chart of the Western Pacific, Chine, 2000

190. Third Session of the Coastal Ocean Observations Panel and GOOS Users' Forum, 2002, Vietnam