

Intergovernmental Oceanographic Commission

Workshop Report No. 140



IOC Workshop on GOOS Capacity Building for the Mediterranean Region

Valletta, Malta
26-29 November 1997

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UNESCO

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**REPORT OF THE GOOS CAPACITY BUILDING WORKSHOP
FOR THE MEDITERRANEAN REGION
26-29th November 1997, Valletta, Malta**

1. INTRODUCTION

The GOOS Capacity Building Workshop for the Mediterranean Region was convened in Valletta, Malta, during 26-29 November 1997. The purpose of the Workshop was to inform the Mediterranean countries about the Global Ocean Observing System (GOOS), and to identify and discuss capacity building needs and priorities and development of GOOS in the Mediterranean. Participants were invited from all Mediterranean countries and from international organisations active in the region. A list of participants is given in Annex I.

The meeting was sponsored by the Intergovernmental Oceanographic Commission (IOC) and the United Nations Environment Programme (UNEP) and organized by the IOC and the Malta Council for Science & Technology. Other sponsors included EU/MAST, The Netherlands Geosciences Foundation (GOA), the Malta Ministry of Foreign Affairs and the Environment, the Malta Ministry of Education and National Culture and the Bank of Valletta International Ltd. The agenda is included in Annex II. The meeting was chaired by Dr. Jan H. Stel (GOA), who was assisted by Mr. William Erb (IOC) in facilitating the meeting.

Mr. Aldo Drago (Malta Council for Science & Technology) welcomed the participants to Malta. He described the vulnerability of the Mediterranean attributable to heavy exploitation and improper practices which may lead to irreversible damages in the basin. Most Mediterranean countries lack the human resources, the financial support and often the necessary infrastructures necessary to keep pace with the northern Mediterranean countries in the marine fields. He stressed that a sustainable exploitation strategy needs to be developed for the Mediterranean which will also provide a platform for (i) the provision of Mediterranean-wide operational oceanographic services, (ii) the setting up of environmental contingency plans, with the related supporting infrastructures for preparedness, and (iii) enabling all Mediterranean countries to respect international marine obligations and codes of practice.

Dr. Stel welcomed the participants on behalf of the IOC. In his speech he stressed the importance of awareness creation in oceanography issues for informing the general public. The text of his speech is given in Annex III.

2. PRESENTATION OF GOOS

2.1 GOOS

A presentation on GOOS was provided by the IOC Senior Advisor Mr. William Erb. He described the basic aspects of GOOS as they relate to the Mediterranean region, acknowledging that a number of the participants were likely to be already well-informed concerning GOOS. The major objectives of GOOS are:

- (i) The monitoring, assessment and prediction of environmental and climate changes.
- (ii) The production and exchange of data and data products required by nations for assessing ocean resources, protecting the marine environment, managing the coastal zone and for other economic applications.
- (iii) Fostering research towards understanding, modelling and prediction of the ocean and its role in climate and environmental changes.

GOOS will capitalize on the availability of scientific data and information; transforming it into products and services beneficial to governments, industry and the general public. Present and future systematic, routine, and high quality observation systems will comprise the GOOS system. Participants will include national organisations and institutes. GOOS will utilize the successful results of various scientific initiatives such as the Tropical Ocean Global Atmosphere (TOGA) project, which has now become a GOOS activity identified as TAO (Tropical Atmosphere and Ocean Observing System); the array that monitors El Niño.

Many new GOOS activities have been developed in 1997. These include: the North-East Asian Regional GOOS (NEARGOOS) pilot project, EuroGOOS Pilot Projects, NOAA GOOS Centre, Western Indian Ocean Marine Applications Project (WIOMAP), South East Asian GOOS (SEAGOOS) and the Global Data Assimilation Experiment (GODAE).

GOOS is a global project supported by governments but it is implemented nationally and regionally according to a set of principles to which all participants adhere. The concept is based on contributing to the system and the entitlement to extract from the system the contributions of others. There is no one model for how GOOS should be developed by a region, all present regional GOOS projects are different. Individual countries are free to participate in GOOS as they might wish as long as they adhere to the GOOS principles. The system is directed by the GOOS Project Office based at the IOC Secretariat in Paris, which receives its direction from the GOOS international structure that is responsible to the GOOS intergovernmental sponsors - IOC, WMO, UNEP and ICSU. GOOS members comprise the managing intergovernmental committees, the main two being the Intergovernmental GOOS (I- GOOS) Committee and the GOOS Steering Committee (GSC).

The focus of GOOS is on climate, coastal areas, health of the ocean, living resources and marine meteorological and oceanographic services. Panels either have been or will be convened to develop plans required in each of these areas for developing GOOS. The climate panel is the most advanced and panels for the coastal areas and living resources will be initiated in 1998. A region may participate in one or all of these areas depending on its needs, interests and requirements.

Those wishing to learn more about GOOS should read the many GOOS documents including: the "Strategic Plan", the "GOOS Principles" and "The Approach to GOOS". The IOC world-wide-web includes the text of these and other pertinent documents and information about GOOS. See the GOOS Homepage (<http://www.unesco.org/ioc/>).

2.2 COST-BENEFIT ANALYSIS FOR GOOS IN THE MEDITERRANEAN

Cost-benefit analysis was introduced by Dr. N. Flemming. Cost-Benefit Analysis (CBA) is a highly technical financial analysis through time, supported by detailed figures on discounted values of a wide range of costs and benefits related to a project. The procedure is expensive because of the complete data required. Such data are very seldom available for marine activities, and more informal methods usually have to be applied. CBA has been favorably applied to an assessment of the benefits of ENSO forecasting to agriculture in the southern USA, wave research and forecasting in the southern North Sea, the construction of the Thames Barrage and the implementation of the SeaWatch system.

EuroGOOS has developed a sophisticated survey method which is used to identify the customer community for GOOS products; the applications and purposes for which they need the data; and the variables and data products which they require. This information for each country is combined with analysis of the proportion of GNP derived from marine industries and services. This provides an approximate method to estimate national benefits from GOOS. Surveys have been conducted, but the statistics have not yet been completed, in Greece, Italy, Spain, the Netherlands, UK and Denmark.

For developing countries, the benefits of GOOS can be obtained by utilizing regional model data and forecasts. This requires a minimum investment in equipment to access and distribute data and forecasts to users, which will produce benefits quickly. Each country should assess the industries and services which are most important to it, and use locally acceptable methods to distribute data and forecasts. When individual and institutional users of regional GOOS data have become familiar with the benefits of using the data, it will be practical to consider further investment in additional observing systems, beyond those already supported for traditional reasons. Typically, the marine industries and services contribute between 3-5% of GNP for a coastal state. GOOS can add significantly to the efficiency, safety and productivity of these activities. Additional benefits arise from the use of marine data to improve and extend seasonal and inter-annual forecasts of weather and climate over the adjacent land masses.

2.3 LEGO FOR CAPACITY BUILDING

Dr. Stel introduced the *'Lego for Capacity Building'* concept. He said that the major policy pulls for the development of marine science and technology in the next century are (i) the implementation of UNCED's programme of actions listed under 'Agenda 21' and (ii) UNCLOS's various provisions reflected in a number of articles on the rights and obligations of countries. These relate among others to the exploration and exploitation of marine resources in Exclusive Economic Zones (EEZ). The costs to implement Rio's actions is an estimated US \$ 120 billion per year. This is two times the present official development aid (ODA) from the member countries of the Organisation for Economic Co-operation and Development, OECD. Since 1970, the ODA effort of the OECD has more or less remained at the same level of some 0.3% of GNP, instead of the UN accepted target of 0.75% in 1970. The major funding mechanism for implementing UNCED requirements is the Global Environment Facility (GEF), a joint program of the World Bank, UNEP, and UNDP. The first phase of GEF (1992-95) was funded with some US \$ 1.6 billion. For the second, restructured phase US \$ 2 billion have been committed by 26 countries, including eight developing ones.

No clear-cut procedures for the development and strengthening of a marine research capability exist. A number of elements can, however, be identified at different levels. These are: (I) human resources or the level of the individual scientist (microlevel), (ii) the necessary institutions (mesolevel) and (iii) an enabling national environment which is willing to support and sustain a marine research activity (macrolevel). These levels must be seen in relation to each other and as expressions of a single research system.

- (i) On the micro-level, the following capabilities and requirements are important:
 - a) The capacity to formulate a project and to carry out the entire project cycle (including transferring the results to the public at large, policy makers and politicians).
 - b) Appropriate qualifications through further academic training (MSc. and PhD).
 - c) Motivation, and the opportunity to undertake operational oceanographic activities, including research.
 - d) External contacts (national and international), networks, and membership in professional associations.
 - e) Access to information (libraries, databases, etc.) and equipment.
- (ii) At the level of institutions, capacity is needed for:
 - a) The development of policy; the development and management of projects and programs (priority-setting, coordination, monitoring, and the publication and dissemination of results to users).
 - b) The acquisition and management of funds.
 - c) The training of staff.
 - d) The provision of adequate incentives and working conditions (time, financial resources, salaries, libraries, laboratories, equipment, funds for travel, etc.).
 - e) A network of external contacts, which provide links to other operational research centers, funding agencies, voluntary organisations, business, government bodies etc.
 - f) Monitoring and evaluation of projects and programs.
- (iii) An 'enabling national environment' concerns such aspects as:
 - a) Commitments at the national level to a policy and a set of measures aimed at promoting and maintaining a marine capacity, including adequate and sustained funding of institutions, infrastructure and programs.
 - b) Mechanisms for steering marine activities towards topics that are of relevance to the economic, social, cultural and political development of society, and possibilities for various groups to articulate their interests.
 - c) Links between basic and applied research, policy, and practise (involvement of research users in prioritising, implementing and disseminating research).
 - d) A professional environment, including formal associations, standards, mobility, incentives, and a research tradition.

The partnership approach is based upon the mutual interest (learning by doing) of the scientific communities of the partners in the industrialised and southern countries. As part of a long-term (10 years) bi- or multilateral commitment to joint scientific research programmes, capacity building activities are an intrinsic part of partnership programmes. Funds for the scientific component of the programmes should be granted by relevant national science foundations. Funding for the capacity building component is sought through national and international ODA organisations as well as sources such as the European Union, World Bank, Asian Development Bank, African Development Bank, GEF etc. Partnership programmes form a flexible instrument to integrate capacity building activities at the individual, institutional, national and regional level. Within a

partnership donors can integrate their activities by 'adopting' an institution or country. The linking with science foundations guarantees the transfer of high quality products.

The Seawatch system offers one potential aid to capacity building in relation to GOOS. Seawatch is an on-line, of-the-shelf environmental monitoring and surveillance system developed to provide an operational information system for the management of regional seas. It consists of the following modules: data acquisition; data storage; analysis and presentation; environmental modelling and forecasting; distribution of data; forecasts and user relevant information. The data acquisition module includes a network of moored marine environmental data collection buoys. All data and results from the various models, are collected in a processing centre where the results are quality checked, and then used for monitoring and forecasting purposes. This centre could be compared with a processing centre in a weather bureau. Seawatch forecasts and environmental data are distributed to clients such as: public authorities, aquaculture/fish farming, commercial fishing, tourist industry, research institutes, navy and coastguards. A cost-benefit analysis of the Seawatch system performed by the OECD confirmed that it provided recognisable benefits

2.4 EuroGOOS

The European Association for the Global Ocean Observing System (EuroGOOS) exists to maximize the benefits to Europe from operational oceanography within the framework of GOOS. EuroGOOS member agencies are already deeply committed to conducting operational oceanography, and delivering products to customers. Extensive customer search has been carried out, and EuroGOOS has identified both the customer community and the products which they need. The scale of the business generated in operational oceanography could be of the order of 5,000 jobs, with a turnover of the order of 500 million Ecu per year.

EuroGOOS was established in 1994, based on a Memorandum of Understanding (MOU), which was signed by European institutions interested in the development of operational oceanographic activities in the seas of Europe. The members are now 26 agencies from 15 countries. The EuroGOOS Plan, published in 1997, builds on the "Strategy for EuroGOOS" published in 1996. The Plan was approved by the first EuroGOOS Conference which was organized in The Hague, the Netherlands, in October 1996. The proceedings of the Conference will be published in December 1997 by Elsevier, in its Oceanography Series. EuroGOOS has established six regional task teams to devise the following projects: Atlantic, Arctic, Baltic, Mediterranean, North West Shelf, Global, and two underpinning programs on capacity building in developing countries and generic support in strategic sectors (gridded bathymetry, ferry instruments, data packages, Mediterranean economics etc.)

These projects are being designed to demonstrate the potential collaboration between agencies for creating operational services in European coastal and ocean areas.

The aims of EuroGOOS are to:

- (i) Assess the economic and social benefits to Europe from forecasting marine and coastal conditions and the marine contribution to climate forecasting.
- (ii) Prioritise the benefits to Europe from operational oceanography.
- (iii) Promote the development of technological, computer, and science-based industries which will advance European operational oceanography for predicting the state of the ocean.
- (iv) Establish a concerted European approach to the planning and implementation of the Global Ocean Observing System (GOOS).
- (v) Ensure routine collaboration between European national and multi-national agencies to obtain maximum economic and social benefit from operational oceanography.

2.5 THE MEDITERRANEAN FORECASTING SYSTEM (MFS)

Dr. Nadia Pinardi explained that a Mediterranean Forecasting System (MFS), Science and Strategy Plan has been formulated in the past two years by the EuroGOOS Mediterranean Regional Task Team. The Plan was built upon four scientific workshops and meetings during 1996 and 1997, including the EuroGOOS Project Forum in September 1997.

The general aims of MFS are to explore and quantify the potential predictability of ecosystem fluctuations at the level of primary producers from the overall basin scale to the coastal/shelf areas and for time scales of weeks to months. In order to achieve these goals MFS has formulated the elements of the observing system and the modelling components that are required for such predictions.

MFS will be implemented through three phases within some ten years. They are:

- (i) First Pilot Phase: deployment of elements of the automatic observing system (VOS - Voluntary Observing Ship), production of near real time ocean forecasts at basin scale, implementation of nesting strategies for hydrodynamic models, and validation of ecosystem modelling in the coastal areas.
- (ii) Second Pilot Phase: expansion of the automatic observing system (VOS - Voluntary Observing Ship) to innovative technologies; production of near real time short term forecasts in the coastal areas; development of coupled ocean-atmosphere models for long range ocean forecasts; validation of three-dimensional ecosystem modelling and development of ecosystem model nesting.
- (iii) Pre-Operational Phase: transition of the observing network to international and national agencies, evaluation of observing system performance and update, and production of delayed mode primary producers ecosystem forecasts in the Mediterranean coastal areas.

A Mediterranean Forecasting System Pilot Project encompassing European countries (including all the northern Mediterranean countries) plus Cyprus, Malta, Israel and Egypt has been initiated to accomplish the first phase of the MFS.

2.6 REMOTE SENSING AS A TOOL FOR OPERATIONAL OCEANOGRAPHY

Dr. Vittorio Barale introduced Remote Sensing (RS), which has become an important component of environmental marine science and operations in Europe. The application of RS-techniques allows the assessment of various marine parameters, including: (i) the nature and concentration of water constituents and planktonic agents in particular; (ii) the temperature of surface water, tracing major dynamical features of the upper layers in the sea; (iii) the surface roughness and topography from which the wind, wave, eddy and current fields can be explored.

In addition, RS-data provide the means to bridge local, regional and basin-scale observations, placing *in situ* measurements into a broader environmental perspective and assessing their time variability over periods ranging from days to seasons and years. The integration of RS-derived information in any marine observation system will be made possible, in the next few years, by a score of quasi-operational missions currently under development by the major space agencies.

2.7 THE MEDITERRANEAN ACTION PLAN

The Mediterranean Action Plan was introduced by Mr. Gabriel Gabrielides. MEDPOL, the scientific and technical component of the Mediterranean Action Plan was initiated in 1975. Its first phase concentrated on the upgrading of technical capabilities at the institutions in the region. This would enable them to undertake marine pollution work giving emphasis to the analysis of chemical contaminants (heavy metals, halogenated hydrocarbons) in biota. In parallel, a data quality assurance program was initiated through the IAEA laboratory in Monaco. This program includes training of personnel, maintenance of equipment, intercomparison exercises, provision of reference materials, preparation of analytical reference methods, etc. The major achievement of MEDPOL Phase II was to set up and maintain national monitoring programs in the Mediterranean countries.

MEDPOL Phase III places emphasis on pollution control through the implementation of the land-based sources protocol without neglecting the assessment component, which focusses on trend and compliance monitoring. Trend monitoring is essential in assessing the effectiveness of the pollution control measures taken

by countries, while compliance monitoring is required to control the implementation of regulations. A new activity is monitoring the biological effects of pollutants using biomarkers. Loads will continue to be monitored. For the implementation of all the above activities, assistance will be provided to the participating countries when requested.

3. PRESENTATION BY PARTICIPATING COUNTRIES

3.1 CROATIA

Dr. Mira Morovic presented an overview of marine science activities in Croatia in which no official activities in relation to GOOS exist. There is no national ocean observing agency exclusively in charge of oceanographic measurements, but activities which could be closely related to GOOS exist. Oceanographic measurements are performed by the Institute of Oceanography and Fisheries in Split and Dubrovnik, the Centers for Marine Research in Rovinj and Zagreb, and the State Hydrographic Institute in Split. Most of the measurements by research institutes are continuations of long-term research and monitoring programs, established years ago at a number of stations and transects in the open sea and coastal areas. Measurements of physical, chemical, biological, geological and fisheries parameters are performed at least seasonally and at some stations monthly.

Plans are underway by the Croatian government to fund a new monitoring project, the "systematic ecosystem monitoring as a base for sustainable development". This project will include all major research institutions, universities, the meteorological service, environmental protection agencies, etc. The project will consist of four phases including: ecosystem monitoring, resources management & bio-diversity protection, monitoring of unusual phenomena and development of tools and technologies necessary for the project.

Ecosystem monitoring will meet GOOS requirements as it will monitor the following parameters: pollution from land and sea sources; sanitary quality of beaches; influence of aquaculture activities; pollution and ecosystem changes. For implementation of this project, new people trained in oceanography should be employed and new equipment purchased.

Regarding sea-truth measurements as a basis of GOOS, Croatia is able to meet the GOOS objectives in terms of systematic, long-term and relevant measurements. Regarding data availability, the intention is to make the data available on-line via InterNet, at least to the research community in Croatia and to other participants.

3.2 CYPRUS

Dr. George Zodiatis introduced the relevant activities of Cyprus. It is well known that the eastern Mediterranean is one of the major routes for transporting oil in Europe. The risk associated with heavy ship traffic indicates the need for efforts in organizing and preparing response to accidental marine pollution. Accidental or natural hazards may both affect the quality of the life for the coastal population and the marine living resources. Most of these hazards are now satisfactorily described by numerical oceanographic models. The strong interest to predict the behavior of the marine system under certain anthropogenic stress mandates the need for oceanographic models to serve as a tool for decision-making.

The Department of Fisheries, the leading institution for marine research and marine environmental activities in Cyprus, in co-operation with other bodies from neighboring countries such as Israel and Egypt, recently established a Subregional Contingency Plan for Response to major marine pollution incidents in the Levantine Basin (an EU-LIFE funded program).

One of the response capabilities for such environmental activities is the application of operational numerical modelling for the prediction of the fate of pollutants in the Levantine Basin. The oceanographic knowledge of the water circulation is of vital importance in order to forecast and predict properly the dispersion and the behavior of oil slicks. Until recently the sea area of Cyprus Basin-Hecataeus Ridge was poorly investigated. To obtain vital information, the Cyprus Basin Oceanography (CYBO) project was implemented by the Laboratory of Physical Oceanography (LPO-FD) in 1995.

LPO-FD participates in the EuroGOOS Mediterranean Forecasting System project in order to: (i) obtain XBT data from the Limassol-Alexandria transect and, (ii) participate in numerical flow modelling in the coastal and deep sea areas of the Cyprus Basin-Hecataeus Ridge.

There is new growing interest in oceanographic information from an increasing number of organizations related to planning, construction, management and control of marine aquaculture, desalination plants, pipelaying, marine tourism, maritime rescue, etc. This has stimulated an effort to establish the Cyprus National Oceanographic Data Center (NODC) with the support of the IODE. The LPO also participates in the MEDAR/MEDATLAS (an IOC project) for management of oceanographic data (a MAST proposal).

Remote sensing infra-red data for the eastern Mediterranean Sea are obtained on a regular basis for every oceanographic cruise of the CYBO project. During 1998, a ground NOAA-AVHRR receiving station will be established at LPO in close cooperation with the Center of Remote Sensing and Information. This remote sensing information will strengthen the efforts to provide operational SST images.

3.3 FRANCE

Professor Michel Glass introduced the relevant activities in France, stating that GOOS activities are assessed and decided by an inter-institutional steering committee composed of the heads of the major French agencies interested in oceanography, including:

CNES	:	French Space Agency.
IFREMER	:	Agency doing research related to the exploitation of the sea and also running the oceanographic fleet.
INSU/CNRS	:	Agency doing pure research and funding academic work in universities.
IFRTP	:	Polar Institute.
ORSTOM	:	Agency doing research in overseas territories and with developing countries.
SHOM	:	Research Centre of the Navy, also providing bathymetric charts.
METEO-FRANCE	:	French Meteorology Agency.

Some projects have been adopted:

- (i) The construction with the USA of an operational altimetric satellite, JASON.
- (ii) The initial phase of MERCATOR, the objective of which is to build an ocean model with $1/6^\circ \times 1/6^\circ$ mesh and data assimilation in real time. The project will be widened to a European or worldwide scale (GODAE). Some other operational activities already exist, such as the French water quality monitoring system, meteo-oceanic services and long-series data acquisition in marine stations (three at the Mediterranean seaside in Banyuls, Marseilles, and Villefranche sur Mer).

3.4 GREECE

The GOOS-related activities in Greece were introduced by Dr. Christos C. Tziavos. The National Centre for Marine Research (NCMR) is a governmental institution that provides comprehensive and technical support to the public on all aspects of the marine and freshwater environments. The NCMR works closely with various organizations and institutions in developing research projects focussing on environmental and sustainable resource exploitation issues within the Mediterranean Region including:

MATER	:	Aegean Sea. Biochemical fluxes and processes.
MEDATLAS	:	Mediterranean Atlas.
MEDRIF	:	An integrated investigation of the fluid flow regime of the Mediterranean Ridge.
METROMED	:	Dynamic and Modelization of the matter transfer in coastal environments.
PELAGOS	:	Hydrodynamic and Biogeochemical processes in the Strait of the Cretan Arc.

The NCMR also participates in the open sea Marine Pollution Program (Aegean, Cretan and Ionian Seas) launched in 1983 in relation to MEDPOL. Developed under the guidelines of the MEDPOL/UNEP program, it concentrates on the monitoring of chemical, biological and physical parameters of the open waters around Greece. Chemical parameters include the measurement of nutrients and pH, heavy metals in water, sediment and biological organisms, petroleum hydrocarbons in water and sediment and organochlorines in fish. Physical parameters include T,S,O meteorological data and currents. The biological component of the program involves the study of zoo-and phytoplankton.

Since 1995, NCMR is member of EuroGOOS and participates in all meetings and working groups as well as in the development of the MFS proposal. In 1996 NCMR, in order to develop national GOOS activities, organized a meeting with all the technical and academic institutions in Greece, which established a National Committee for GOOS (GreekGOOS).

Considerable capacity building is expected to derive from the national operational project POSEIDON (Marine Environmental Monitoring Forecasting and Information System for Greek Waters), which aims to enhance environmental surveillance, protect marine ecosystems, respond to environmental disasters and provide real-time data to decision-makers. This objective will be achieved by real-time meteorological and oceanographic observations, data management and evaluation, and data information distribution and associated forecasting services.

3.5 ISRAEL

Dr. Dov Rosen introduced the GOOS related activities in Israel. An Israeli GOOS National Committee is under establishment. Present meteo-oceanographic and marine activities are conducted through the following ministries and their subordinate bodies: Infrastructure [Israel Oceanographic Limnological Research (IOLR), Geological Survey of Israel, Geophysical Institute, Israel Electric Corporation], Environment, Interior, Transport (Ports & Railways Authority), Meteorological Service, Tourism, and Education (7 universities).

IOLR is the governmental body responsible for gathering, analysis, archiving and dissemination of meteo-oceanographic data and other marine data and also for providing advice to governmental bodies on utilization of marine resources and environmental problems. IOLR departments include: marine geology, physical oceanography, chemical oceanography, marine biology, marine biology, mariculture. It has instrumentation and laboratories for maintenance and operation of stations gathering waves, currents, sea-level, water quality, monitoring of the sea environment (physical, chemical and pollution), bathymetry, sediment transport, and the following modelling and monitoring capabilities: deep ocean 3 dimensional model - via Princeton model; deep ocean measurements by sea-going research vessel Shikmona; ship-mounted Doppler current meter; Datasonics "Chirp" sub-bottom multi-frequency profiler; navigation equipment and software using DGPS near-shore monitoring vessels, etc.; WAM model calibration and adjustment for the Eastern Mediterranean; GLOSS station No. 80 (Hadera) and near real-time data distribution through the ISRAMAR software package.

Major Israeli interests are:

- (i) Coastal protection and development.
- (ii) Mariculture in open sea.
- (iii) Assessment of environmental impacts due to pollution.
- (iv) Climatic change and sea-level rise - monitoring and long term changes assessment.

GOOS related projects which are underway include:

- (i) POM for the eastern Mediterranean, also directed towards seasonal forecasting of precipitations.
- (ii) WAM for the eastern Mediterranean, to be provided through the Internet after calibration and validation is completed.
- (iii) Long-term sea level and land movements changes.
- (iv) Providing ISRAMAR to MedGLOSS for implementation in other countries, including know-how experience.
- (v) Participation in a number of international / European programmes e.g. CAMPS, REESAC, MED-POL, etc.

Additional updated information on IOLR activities is available from the internet: <http://www.ocean.org>. The ISRAMAR data presentation module is available via ftp from: [ocean.org.il](ftp://ocean.org.il) password: ISRAMAR; user: ISRAMAR. The WAM forecasts in EM will be provided daily through the internet within 6 - 12 months.

3.6 LEBANON

Dr. Hratch Kouyoumjian introduced the GOOS related capabilities in Lebanon. Most of the marine activities regarding monitoring and research are centered around the National Center for Marine Sciences (NCSM) of the National Council for Scientific Research. Parallel and related activities take place within other institutions; however, coordination could be improved. There is deep appreciation and willingness at NCSM to participate in GOOS, and the decision rests with NCSM. The following activities have been already implemented:

- (i) Rehabilitation and relocation of NCSM.
- (ii) Participation in regional and bi-lateral activities with GOOS implementation as an outcome.

- (iii) Coordination of monitoring activities.
- (iv) Activities targeting the public at large in order to focus attention on the coast and the sea.

Full participation, however, needs to address several issues for which international support complements national efforts:

- (i) Detachments of scientists from the EU to Lebanon on a long-term basis in order to strengthen phased integration and assure continuity.
- (ii) Technical assistance in quality control.

The needs in capacity building must be perceived as an issue of mutual interest in order to highlight the benefits of operational oceanography to decision-makers in the country.

3.7 MALTA

In order to meet the demands of operational oceanography in Malta, a National GOOS Committee composed of all local agencies and entities with an interest or direct activity in operational oceanography has been established. The members of the Committee come from:

- (i) The Malta Council for Science and Technology (MCST), which is also the national lead agency for GOOS; physical oceanographic measurements are mainly carried out by the Physical Oceanography Unit within the MCST.
- (ii) The University of Malta with main activities related to marine biological studies.
- (iii) The Centre on Insular and Coastal Ocean Dynamics with regional activities on marine risk assessments.
- (iv) The Coastal Management Co. Ltd (CMC) of the Malta Freeport that is responsible for a wave monitoring program in coastal waters.
- (v) The Planning Directorate which has established the Malta Structure Plan and is responsible for coastal zone mapping and for planning development on the islands.
- (vi) The Malta Maritime Authority which controls all port and shipping activities.
- (vii) The Pollution Control Co-ordinating Unit (PCCU) of the Environmental Protection Department which is responsible to monitor the coastal sea against marine pollution especially from oil, and to control and combat pollution incidents.
- (viii) The Oil Division which is responsible for oil exploration and is a depository for marine seismic data.

Although developments in the marine field in Malta have been significant over the past decade, the country still faces a situation with scarce human and infrastructural resources in this field. The basic support that is indispensable for the marine research and monitoring operations in all sea-related activities and coastal development programs is unfortunately not yet properly in place. The financial and institutional needs are too high to be sustained by local funding. There is also a general lack of human and analytical resources even at the university level. In total there are only six doctorates involved in marine-related activities. Capacity building should be pursued through specific efforts in the area of human resource training. In particular the University of Malta needs to widen its spectrum of courses. It should aim to provide a basis for human resource building and for the training of personnel in marine science, coastal management and coastal engineering. Present initiatives taken by its various faculties, institutes as well as the Foundation for International Studies should be better coordinated and further developed to ensure cost-effectiveness and complementarity.

Improved cooperation between the various agencies listed above is necessary in order to develop and implement a comprehensive strategy for marine and coastal resources management and development. Initiatives in the past have been excessively project-oriented and disconnected. Coordination on a national scale is necessary in order to synergise activities and avoid duplication.

The establishment of a National Marine Science Centre is considered to be a necessary step in this direction. Efforts are currently underway to establish this Centre through capital investment from the Italo-Maltese Financial Protocol. The Centre is planned to consist of specialised laboratories in the various marine fields and will provide laboratory and field based facilities to the: University, Department of Fisheries, Environment Protection Department, Planning Authority, Maritime Authority, private industry and other sectors. This will facilitate a sound integrated management of the ocean space under national jurisdiction. The Centre also aims to be a national depository of oceanographic data and information.

3.8 MOROCCO

The GOOS related activities in Morocco were presented by Prof. Maria Snoussi. Several departments and institutions are involved in coastal and marine activities, including:

- (i) Ministry of Fisheries and Merchant Navy through IHRH (National Institute of Fisheries).
- (ii) Ministry of Public Works through: Directorate of National Meteorology, Directorate of Ports and the Laboratory of Studies and Experiments (LPEE).
- (iii) Ministry of Environment through the National Observatory of Environment.
- (iv) Ministry of Higher Education and Research Science through Universities and Institutes.

Regarding the GOOS Modules, the following activities are presently conducted:

- (i) Monitoring of migration of fish stocks.
- (ii) Monitoring of land-based sources, and toxic contaminants.
- (iii) Monitoring of water and beach quality.
- (iv) Monitoring and forecasting of seasonal and inter annual climate.
- (v) Forecasting coastal erosion and dredging operations.
- (vi) Improving modelling and numerical forecasts.

In order to enable full benefits and to participate in the implementation of MedGOOS, operational management of GOOS components will require close collaboration between different national bodies, and close interaction with the marine user community. There is a need to establish a National GOOS Committee which will be responsible for defining the national needs, provide an internal network and infrastructure and identify resource requirements. Finally, human capacity building is needed mainly in the field of physical oceanography, remote sensing, data assimilation and numerical modelling. A detailed overview is given in Annex IV.

3.9 SPAIN

The activities related to GOOS in Spain were introduced by Mr. Ruiz de Elvira. These activities are mainly conducted by three institutions, although universities and the Spanish research council carry out some small scale oceanographic research.

The Instituto Espanol de Oceanografia (IEO) is a subdirectorate of the General Directorate for Fisheries of the Agriculture Ministerium. It has a central site in Madrid and several sites at the coast. It has 6 vessels and carries out routine sectional measurements. IOE has several tide gauges and a tidal data base from the start of the century that is being digitized and quality controlled with the assistance of Clima Maritimo.

The CEDEX develops intensive studies in coastal management and harbour design.

The Navy has a hydrographic institute charged with coastal bathymetry and a large oceanographic research vessel used mainly for Antarctic research. It is chartered occasionally to the Spanish research agency for oceanographic missions.

Puertos del Estado is an umbrella agency charged with coordinating the operation of 26 Spanish harbors. It maintains a series of instruments for this purpose including:

- (i) Waverider buoys (20) measuring scalar properties of the waves (height and period). (Time series starting variously from 1985 through 1990).
- (ii) Wavescan buoys (2) measuring spectral properties of the waves, and some meteorological parameters (from 1990).
- (iii) OCEANOR buoys (5) measuring meteorological, wave and oceanographic parameters (time series starting from 1997).
- (iv) OCEANOR buoys (4) to be moored during 1998.
- (v) Navigational radars (4) measuring operationally wave spectra and some data on the wind (time series starting from 1994).
- (vi) Acoustical tide gauges (14) (time series starting from 1992).
- (vii) Coastal meteorological stations (30) (time series starting from 1997).

The data is collected at least hourly. All the data is subjected to very strict quality control procedures and stored in a data base. This data base contains the analyses of the diurnal wave and wind forecasts, as well as other oceanographic information. The web site is: <http://www.puertos.es>. Clima Maritimo has developed wave forecast and propagation models, mesoscale meteorological models, 3-D baroclinic oceanographic models, and the statistical techniques for data analysis and assimilation.

3.10 TURKEY

The GOOS related activities in Turkey were introduced by Prof. Umit Unluata. GOOS planning mechanisms in Turkey are in the process of being formalized. A pilot project carried out under the IOC Black Sea Regional Committee has set-up the foundations for the development of GOOS activities in this basin. Two science plans related to the marine meteorological and oceanographic services and the climate/health of the ocean modules of GOOS have been prepared. For the Mediterranean, a structured GOOS development is in preparation.

The National Oceanographic Research Programme, administered and supported by the Turkish Scientific and Technical Research Council (TUBITAK), was redesigned in 1997 to provide the scientific research necessary for the development of the predictive models and the systematic observation systems needed in operational oceanography within Turkey.

The responsible agencies for marine-related activities in Turkey include TUBITAK, Ministry of Environment, Under Secretariat for Marine Affairs, Ministry of Agriculture (Fisheries) and the Naval Hydrographic Office. Marine research activities are notably carried out by universities, notably by the Middle East University, Eylul University and the Istanbul University.

3.11 ITALY

An overview of GOOS related activities in Italy was given by Dr. Sylvana Vallerga. The GOOS-Italy Working Group has been established by the EuroGOOS Member Agencies (CNR and ENEA). The GOOS-Italy members are, for CNR: Vallerga, Pinardi, Dallaporta; for ENEA: Dalla Costa, Manzella and Artale. The objectives of the Working Group are to promote GOOS awareness and to move from the agency level to the government level. Operational oceanography is not yet ready to be implemented in the Mediterranean, consequently no operational agency is identified in Italy. The plan for 1998 is to organize a national information-day on EuroGOOS and GOOS and to open GOOS-Italy membership to other agencies. The establishment of MedGOOS should be developed at basin level.

The ministries and agencies involved in the study for the protection and management of the sea are:

- (i) Ministry for University and Scientific and Technical Research, through ISMARE-CNR and CONISMA (Universities).
- (ii) Ministry of Industry, through ENEA.
- (iii) Ministry of Environment, through Ispettorato Centrale Difesa Mare.
- (iv) Ministry of Transport, through the Coast Guard.
- (v) Servizi Tecnici dello Stato, directly under the Prime Minister.

Dr. Vallerga reported that the present framework V document of the European Commission (COM.97 553 final) on the specific programs includes GOOS related activities.

4. WORKING GROUPS

4.1 INTRODUCTION

The chairman tabled a proposal concerning the membership of the two working groups. The aim of the working group on the feasibility of Med-GOOS, chaired by Dr. Umit Unluata, was to discuss and define steps for the establishment of a regional GOOS body for the Mediterranean in the next two years. The objective of the working group on capacity building, chaired by Prof. Michel Glass, was to assess the needs and requirements for capacity building in the region, and to define a series of do-able pilot projects for the next two years. To facilitate interactions between the two working groups plenary meetings were organised on a regular basis. The membership of the working groups is given in Annex I. The reports of the working groups are given below.

4.2 WORKING GROUP ON THE FEASIBILITY OF MEDGOOS

4.2.1 Recommendations

The WG recommends that a Mediterranean regional GOOS (MedGOOS) be established to promote operational oceanography through the Global Ocean Observing System (GOOS).

MedGOOS will promote the technical implementation of GOOS in the Mediterranean region on all the appropriate time and space scales, as required, to meet the economic, social and environmental needs of Mediterranean coastal and island states and the climate prediction of the adjacent continents.

MedGOOS will promote Pilot Projects involving research in order to develop certain aspects of operational oceanography in the Mediterranean. The Mediterranean Forecasting System Project developed within EuroGOOS and the MedGLOSS Pilot Project are of high interest.

MedGOOS should promote the establishment of National GOOS Committees in order to:

- (i) Increase awareness of GOOS at the national level.
- (ii) Foster support for MedGOOS Projects.
- (iii) Identify existing and potential agencies interested in participating in MedGOOS.
- (iv) Ensure the circulation of MedGOOS information nationally.
- (v) Communicate and interact with other GOOS bodies.
- (vi) Conduct relevant surveys concerning needs, requirements and benefits within each country.

4.2.2 MedGOOS Steering Group

A preparatory MedGOOS Steering Group (MSG) should be established to prepare the documentation and agreements needed to establish MedGOOS. The MSG will serve until such time as a permanent Steering Committee is formed and it will strive to work in close cooperation with the GOOS Project Office (GPO). MSG should initially be composed of all the interested countries (one per country) participating in the Malta Workshop and will be open to any other interested Mediterranean country.

An Executive Board will be formed to organise and coordinate the work of the MSG. The board will consist of six persons, who are members of the MSG, nominated by the MSG (see para.4.5). It will address the tasks identified below. The work of the Board will be reviewed by the MSG.

The MSG will:

- (i) Be the driving force behind the establishment of MedGOOS.
- (ii) Identify the GOOS Capacity Building needs of participating countries.
- (iii) Follow-up the recommendations of the Malta Workshop as appropriate.
- (iv) Advise all the interested parties on the general development of MedGOOS.
- (v) Draft a MedGOOS Strategy document which reflects the economic, social and environmental protection needs of the region and establishes the strategy for planning and implementing GOOS. This document should take into account the EuroGOOS Strategy and Plan document, the GOOS Principles document, etc., and it will be circulated to all potential MedGOOS participants. It should also be presented for

information to the I-GOOS Committee. A preliminary version of the strategy should be available by November 1998, the International Year of the Ocean.

- (vi) Prepare a Memorandum of Understanding (MOU) which would form the basis for cooperation of all interested members in the MedGOOS activity. The MOU should be drafted by February 1998 and widely disseminated, and hopefully finalized during 1998.
- (vii) Recommend scientific and technical activities which support the MedGOOS implementation.
- (viii) Oversee the establishment of a MedGOOS network for data and information exchange.
- (ix) Identify organizations in the Mediterranean region that could contribute to MedGOOS and initiate contacts with them.
- (x) Promote and disseminate the MedGOOS information to the public at large.

4.2.3 Membership of MedGOOS

All countries bordering the Mediterranean Sea shall be entitled to have members within MedGOOS, whether at the level of member state, agency or institution level. The membership requirements will be further clarified by the MedGOOS MOU and the strategy document; however, the Malta Workshop suggests utilizing the EuroGOOS membership requirements as a model.

4.2.4 Additional Recommendations

The WG recommends that immediate action be taken regarding GOOS implementation in the Mediterranean area for the purpose of:

- (i) Promoting the transfer of existing marine operational capabilities to operational services in the Mediterranean area particularly for wave forecasting (harbor authorities, national environmental protection agencies, etc.).
- (ii) Developing cooperation with IODE, EU-Mast and EU Environment and Climate Projects and National Oceanographic Data Centers for data archiving and dissemination relevant to the Mediterranean region.
- (iii) Producing guidelines for near real time data collection and exchange in the Mediterranean region.
- (iv) Identifying the means and guaranteeing the availability of fully processed satellite data in near real time for the Mediterranean region.

4.2.5 Relationship to Other Bodies

MedGOOS development will be enhanced if collaboration and linkages are established with other bodies involved in or interested in GOOS. This will result in maximization of limited resources, non duplication and improved coordination. The sharing of information and joint planning with such bodies will result in improved services and products to governments, industry and the public sector. The strategy plan of MedGOOS should therefore identify the appropriate linkages and/or collaboration with other organizations, projects and activities.

4.3 WORKING GROUP ON GOOS CAPACITY BUILDING IN THE MEDITERRANEAN

The Group identified the Mediterranean Sea as a special case with its own particular needs and its specific characteristics and problems. The Mediterranean is a heavily traversed marine transportation basin, an overfished sea with high biodiversity, an over-exploited tourist venue and a densely urbanized and industrialized coast. Also, the Mediterranean Sea is bordered by a mosaic of different cultures, and countries with different socio-economic development levels and technological capacities but with available human resources to address the future implementation of GOOS.

The needs of the various countries as well as the applications of GOOS in the various parts of the basin must be evaluated in order to establish common denominators and prioritize actions.

Existing initiatives and regional frameworks in the Mediterranean were identified by the participants as potentially supportive to GOOS. Also, it was agreed that GOOS should be built on existing national structures. The modelling and forecasting activities necessary for operational oceanography will benefit from existing measuring and monitoring activities in the Mediterranean. The achievements of EuroGOOS will be used as a basis for the development of effective capacity building measures.

The Group noted that capacity building for GOOS needs to take several forms:

- (i) Building GOOS awareness at the national level of what benefits can be derived by each country, informing decision-makers by presenting successful case studies and applications ubiquitously relevant to the Mediterranean (e.g., beach erosion, marine pollution, marine impact assessment of coastal development and exploitation, eutrophication, etc.).
- (ii) Training new professionals for operational oceanography including measuring and monitoring, maintenance and calibration of instruments, collection and transmission of data, management of data and generation of value-added products that address the needs of society.

The Group identified a list of initial capacity building actions that need to be considered in a phased approach to GOOS, these are:

- (i) Two GOOS fora were recommended to promote awareness in the Mediterranean region. These fora will be used to address decision makers, experts, mass media, funding agencies and the private sector. The main goal of these fora will be to focus on the specificity of GOOS, to highlight the socio-economic benefits that can be derived from GOOS and to present GOOS as a solution to critical marine environmental and climatological issues in the Mediterranean. These fora could take place during the Fall of 1998, possibly in Lebanon and Morocco. The Executive Board of MedGOOS could take the lead in preparing the activity.
- (ii) A capacity building scheme for the basin must be formulated including :
 - a) Long-term secondments of qualified personnel to those countries expressing a need for full integration into GOOS.
 - b) Using existing mechanisms for bi-lateral and/or subregional cooperation between institutes in order to promote GOOS.
- (iii) A small GOOS Capacity Building Working Group should be included in the MedGOOS Strategy Plan to:
 - a) Implement GOOS Capacity Building in the region.
 - b) Provide advice on capacity building opportunities and activities available within the entire GOOS community.
 - c) Improve cohesion in the Mediterranean region by promoting compatible and comparable measurements and networks throughout the Mediterranean region.

4.4 OUTCOME

The working group agreed that the best way for initiating capacity building is to propose small immediately do-able projects that eventually will be extended in the region. Therefore, a format is proposed for developing projects as elements of GOOS.

The project proposals should include :

- (i) A precise description of the project.
- (ii) The potential users of the anticipated products and services generated by the project.
- (iii) The immediate actions to be undertaken to begin the project.

The Group noted that 3 projects are presently being prepared for submission to potential donors. These three projects are:

(i) ***Morocco-Spain***

Morocco and Spain share some stretches of the ocean. The Alboran gyre in the Western Mediterranean, the Strait of Gibraltar and the Atlantic Sea at the latitude of the Canary Islands are waters common to both countries.

Morocco aims to install two oceanographic buoys, one in the Atlantic, to monitor mainly the upwelling intensity there, and at the same time as many other oceanic parameters as possible; the other buoy in or near Gibraltar Strait.

If funded, Morocco will dedicate three persons to gather and quality control the data, and to understand, prepare and adapt the Spanish Clima Maritimo wave, sea level and oceanographic 3-D models to Moroccan bathymetry.

The final aim is to collect and exchange data with Clima Maritimo to run a forecast model. Data and model results will be used in a common databank for oceanographic information. This process of cooperation is a contribution to the development of MedGOOS.

(ii) ***France-Italy-Lebanon*** agreement on the long-term secondment of personnel for concerted action in data collection and interpretation (waves, currents) in relation to coastal erosion.

Dr. S. Vallerga agreed to identify experts responding to the needs of the Lebanon partner and will consider the secondment of a person to Lebanon.

(iii) ***Malta-Italy*** agreement in support to the establishment of a Marine Centre in Malta with activities in operational oceanography. A draft memorandum of understanding has been agreed between Malta and the International Marine Centre of Oristano and the IMGA - CNR of Bologna respectively. The responsible scientists are Silvana Vallerga for the IMC, Nadia Pinardi for IMGA-CNR and Aldo Drago for Malta. An essential step for the implementation of the agreement is capacity building provided by the Italian institutions to the Malta partners. Training of personnel and bi-lateral projects were identified as an essential starting point.

4.5 CONCLUSIONS

The draft reports of the working groups were discussed and approved. The chairman proposed the following membership of the interim Executive Board:

- Chairperson: Dr. Silvana Vallerga (Italy)
- Members: Membership by Egypt will be explored by Dr. Stel.
Prof. Michel Glass (France)
Dr. Christos C. Tziavos (Greece)
Dr. Aldo Drago (Malta)
Prof. Maria Snoussi (Morocco)
Prof. Umit Unluata (Turkey)

This proposal was accepted. The interim Executive Board met after the workshop.

5. CLOSURE

The workshop was officially closed by Dr. Rena Balzan, chairperson of the Malta Council for Science and Technology. She thanked the participants for their hard work in developing the Global Ocean Observing System (GOOS) in the Mediterranean Sea region. In her view, tremendous progress was made by the workshop.

Dr. Jan Stel thanked the Government of Malta and the various sponsors for their support of the workshop. Everyone involved made the workshop participants especially welcome which contributed to the

excellent atmosphere and spirit of cooperation that prevailed throughout the week. The support secretarial staff provided by the Malta Council for Science and Technology worked especially hard in preparing the report and appreciation was expressed for their support.

ANNEX I

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Annex II

ANNEX II**AGENDA****Wednesday 26 November 1997**

- Morning : Arrival of participants.
 12:00 - 14:00 : Opening Lunch.
 14:00 - 14:30 : Opening Session.
 Speech by Hon. Min. of Foreign Affairs and the Environment.
 Speech by Dr. J. H. Stel on behalf of the IOC.
 Presentation of GOOS.
 14:40 - 15:10 : GOOS - Mr William Erb.
 15:00 - 15:30 : Cost-Benefit analysis - Dr. N.C. Flemming.
 15:30 - 16:00 : Capacity Building - Dr. J. H. Stel.
 16:00 - 16:30 : Tea.
 16:30 - 17:00 : EuroGOOS - Dr. Silvana Vallerga.
 17:00 - 17:30 : The Mediterranean Forecasting System - Dr. Nadia Pinardi.
 17:30 - 18:00 : Remote Sensing as a tool for operational oceanography - Dr. Vittorio Barale.
 18:00 - 18:30 : Discussion how to proceed and establishing working groups on Capacity building and the development of a regional GOOS for the Mediterranean - Dr. J.H. Stel.
- Event : Guided tour: Dinner for participants and Mdina (Host: Bank of Valetta International Limited).

Thursday 27 November 1997

- 09:00 - 10:40 : Presentations by participants.
 10:40 - 11:00 : Coffee.
 11:00 - 12:15 : Presentations by participants.
 12:15 - 12:30 : Presentations by MAP/UNEP.
 12:30 - 13:30 : Lunch.
 13:30 - 14:00 : Plenary.
 14:00 - 17:30 : Meeting Working Groups.
 17:30 - 18:00 : Plenary.
- Evening : It is suggested that the working groups continue their work for one or two hours that evening.
- Event : Reception for participants with some Maltese guests at Belleview, Mellieha. (Host: Ministry of Education & National Culture).

Friday 28 November 1997

- 09:00 - 12:00 : Meetings Working Groups.
 12:00 - 13:00 : Plenary.
 13:00 - 14:00 : Lunch.
 14:00 - 15:30 : Writing reports.
 15:30 - 17:45 : Meeting Working Groups.
 17:45 - 18:45 : Plenary.
- Evening : If necessary Working Group meetings go on during the evening.
- Event : Reception at the San Gorg Corinthia Palace hotel. (Host: Ministry of Foreign Affairs & the Environment).

Saturday 29 November 1997

- 09:00 - 10:30 : Writing of Report.
 10:30 - 11:00 : Coffee.
 11:00 - 13:00 : Plenary.
 13:00 : Closure by Chairperson Malta Council of Science and Technology.

ANNEX III

Speech by Dr. Jan H. Stel, Director of the Netherlands Geosciences Foundation and Chairman of the GOOS Capacity Building Workshop at Malta, November 26 - 29, 1997

Some weeks ago you could hear on the news that the pathfinder at Mars stopped transmitting information to the Earth. That simple fact was news and was covered by all media. Half a year ago you could have found at the internet a forecast of the present El Niño in the Pacific. At that time, however, this was not seen as news by the media or as something of general interest by the public at large. However, some three months ago the forest fires in Indonesia turned into havoc. This was shown on among other CNN. Then El Niño and its economic and social consequences had become news.

The United Nations have identified 1998 as the International *Year of the Ocean*. Through this initiative, which was proposed by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, one hopes to create awareness about the ocean with the public at large and about the role the ocean plays in our daily lives. Hopefully these activities, together with a dedicated Ocean Expo in Lisbon next year, will facilitate that ocean issues will be taken more seriously by governments, like the one in Indonesia, and the general public. By this the economic loss and human misery due to the El Niño "disaster" might be mitigated.

Every morning we see a weather forecast on the television. We take this for granted, as we take the cost to collect the underlying data and information as well as the "translation" of the information into easy to understand presentation in the media, for granted. Most people do not realise how complex the data gathering system through the global World Weather Watch system is. Most people are not aware of the costs of the data and information exchange system of the lower part of the "Ocean of Air", which we call the atmosphere. Why don't we have such a system for the "Ocean of water"?

I think that is mainly due to the fact that we live at the bottom of the "Ocean of Air", which is some 50 kilometers deep. The phenomenon which we call weather only are expressions of processes taking place in the lower 9 to 10 kilometers of this ocean. When we would have been fishes instead of land animals, we would certainly have developed a world weather observing system for the upper part of the ocean instead of the lower part of the atmosphere! Yet, it is the establishment of the Global Ocean Observing System (GOOS) that brings us together at Malta, where we will discuss a global ocean "weather" watch system. Many people, scientists, operators of coastal monitoring systems, policy makers and politicians think that time has come to create a monitoring network for the collection and exchange of ocean data and information. For many countries and especially developing ones, the emphasis will however be on the newly obtained Exclusive Economic Zone (EEZ). GOOS data will be used for climate forecasting as well as for a better understanding of the ocean and an improved and more efficient sustainable use and management of the marine resources.

I just mentioned the EEZ; a present of the UN to coastal states through the new Law of the Sea which became into force in November 1994. Since that time coastal states have ownership of at least 200 miles. Again it is important that the general public be well informed about what is happening during the exploration and exploitation of national Ocean Space areas. Again I want to stress the importance of the *Year of the Ocean* as an instrument to reach the public. An interesting initiative is the OCEAN98 initiative, a NGO activity supported by the IOC, WMO and UNEP in which awareness creation and education of young people is united in an attractive package. I think that the development and implementation of GOOS, its regional bodies such as EuroGOOS, NEARGOOS, SEAGOOS and hopefully in the near future MedGOOS, should use the *Year of the Ocean* activities to advocate the concepts, benefits and implementation steps on a national, regional and global scale for GOOS.

Why are we doing this? Why are we trying to build GOOS at all? Why are we discussing the next days here at Malta issues such as capacity building, awareness creation, EuroGOOS, cost-benefit analysis, regional co-operation etc.? I think that we do this because we are convinced of the need and reality of GOOS, because we have the vision that GOOS might make the future of next generations brighter. Hopefully GOOS will help them just as we do that today with "disasters" such as hurricanes in the Ocean of Air, to cope with the effects of a natural phenomenon which we call El Niño. GOOS might help us to understand expressions of processes in the life supporting system of our Planet.

I wish you a successful workshop.

ANNEX IV

Detached Country Presentations

1. MARINE ACTIVITIES RELATED TO GOOS IN MOROCCO

1.1 PRESENTATION

Moroccan Marine activities were at first focused on the Atlantic coast. Since a few years and following some agreements between Europe and Morocco, the Mediterranean coast is becoming a priority for economic development. The value of marine resources to the northern part of the country is enormous, ranging from primary fishing industry, tourism, transport and trade. The weakness of monitoring activities on this side of Moroccan coastal waters indicates an underestimation of this value.

Some of the priorities for developments in marine sector are: fisheries and aquaculture; coastal zone management; tourism; port development; the capacities available for the implementation of GOOS programmes in Morocco are limited. Although some of the elements are in place, an operational framework of a national GOOS Committee is required. The following activities are carried out in relation to the GOOS Modules:

1.1.1 Marine Living Resources: fisheries & aquaculture

The relevant lead institution is the National Institute for Fisheries (INRH). The mission of INRH is to ensure the effective protection and sustainable use of the living marine resources and ecosystems by conducting the following projects:

- (i) Assessment and control of MLR.
 - Climatic variability in relation with MLR (Fishing/Climate Programme).
 - Spatial-temporal variability of up-wellings using satellite imagery.
 - Hydrodynamics in coastal ecosystems such lagoons, estuaries etc.
- (ii) Improvement of fishing Technology.
- (iii) Socio-economics of fishing.
- (iv) Marine Pollution.
 - Heavy metals & pesticides in coastal & marine biota (Med Pol Programme).
 - Red Tides, Toxic Algal Blooms, oils spills, etc.
- (v) Aquaculture & mariculture, with studies on evaluation of geographic locations and sites.
- (vi) Marine Biodiversity with special attention to the protection of Monk-Seals.

1.1.2 Climate Monitoring Assessment and Prediction

The relevant lead agency is the Directorate of National Meteorology (DNM). The activities of DNM involve 3 major fields:

- (i) Meteorological Operations: The activity of this division consists of meteorological assistance to maritime activities. In coordination with other national bodies, four stations for observations and maritime information have been set up at the Atlantic coast. The installation of two stations at the Mediterranean coast (Nador & Al Hoceima), and the improvement of the Tangier's station are in progress. DNM is equipped with a powerful computer and a station with high resolution reception (HRPT). Furthermore, the technical level of analysis reception and satellite imagery recently reached in the DNM constitute an important asset to improve forecasts. A numerical Forecast Development Project was started in 1991. The model is called «ALADIN» (a product of multilateral cooperation between France, Morocco and some Eastern European countries).

- (ii) **Climatology:** The source of all data used in climatology comprises both the synoptic network and the climatological stations network which includes more than 700 points spread all over the country.
- (iii) **Meteorology:** applied to the economy. Some economic sectors constantly require meteorological data and their activities are closely linked to prevailing weather and climatic conditions. As the permanent concern of enterprises working in these economic sectors is to improve and develop their products and activities, the Division of Applied and General Climatology has created services likely to meet their needs.

The requirements for the regional network to be fully operational are:

- Installation, repairs, maintenance and levelling of gauges.
- Data Management: archiving, dissemination and usage.

1.1.3 Health of the Ocean

The lead institutions are Observatoire National de l'Environnement du Maroc (ONEM), Centre d'Etudes et de Recherches de l'Environnement et de la Pollution (CEREP) and the National Institute for Fisheries (INRH).

The main objectives are:

- (i) Sustained monitoring of coastal environment, in order to develop sound management approaches and cleanup strategies.
- (ii) Elaboration of norms and standards.
- (iii) Awareness & Education.

1.1.4 Coastal Module and Marine Services

The coastal area consists of a wide to narrow continental shelf, estuaries, lagoons, bays, dunes, coastal plains and wetlands. The pressures of development and utilisation of the coastal area are increasing, particularly from industrial, urban and tourist perspectives. Management in this area is then critical. The present activities focus on port dredging which is carried out by ODEP. The growing development in the size of the ships and the ever growing sea traffic, increasingly requires costly dredging operations, modern technology and deep and appropriate know-how. The scientific knowledge and monitoring of oceanographic parameters such as tides, swell, currents is basically needed.

The main objective of the OEDP is to improve operating conditions and service quality in ports, in order to increase output and make best use of available infrastructure and facilities.

- (i) Restoration of eroded beaches specially at the seaside resorts.
- (ii) Management of wastes.
- (iii) Methods of improved planning.

1.1.5 Education & Research at Universities & Institutes

There are eleven Universities in Morocco. Each of them comprises three faculties. The Faculties of Science comprises five departments being: biology, geology, physics, chemistry and mathematics. These Universities undertake education and research in marine biology, environmental and ecological studies, geological, chemical and physical oceanography, including numerical modelling, remote sensing and GIS. However, many of them suffer from a lack of facilities and skilled personnel to analyses and interpret the data, even to make use of end-products. Although jointly these universities more or less cover the whole spectrum of marine research, the effectiveness of the diverse activities would increase if there were more cooperation and coordination.

The notable lack of programmes dealing with marine activities is mainly due to marine science being dispersed over a number of university departments and as the activities are not sufficiently co-ordinated, the total result is less effective.

1.2 CAPACITY BUILDING FOR GOOS: DEVELOPMENTAL NEEDS AND REQUIREMENTS

1.2.1 At a National level:

In order to enable full benefits and to participate in the implementation of GOOS in the Mediterranean Sea operational management of components of GOOS will require close collaboration between different national bodies, and close interaction with the marine user community. There is a need to establish a national GOOS committee which will be responsible in defining the national needs, providing an internal network and infrastructure, and identifying resource requirements. Many of the institutions involved in marine activities are under different supervising ministries or government authorities. The weakness in this structure is the lack of coordination and integration of the fragmented research efforts.

In Morocco, whereas fisheries capabilities have been significantly developed over the past few years, development of a capacity for physical oceanography, marine meteorological research and intergrated coastal management has been lagged behind. This is because unlike fisheries, the benefits of oceanographic research are not immediately obvious. A programme to strengthen the capability of institutions should include: the training of technicians, and the development of a capability to repair and maintain oceanographic equipment.

1.2.2 At a regional level:

Substantial training, education and mutual assistance efforts and technology transfer initiatives should be launched to enable all countries in the Mediterranean Basin to participate in GOOS and to interpret and apply the resulting data, end-products and information. It is essential that scientists and technicians are encouraged to carry out monitoring and assessment programmes related to GOOS through assistance, guidance and logistic support from more experienced institutions in the developed countries. For optimizing the use of available funds, expertise and equipment, it is possible, with this type of regional network, to create not only a pool of scientists working in marine science but also a pool of laboratories and field equipment. This approach suggests that the need to create individual centres in each country is lower than the need to create regional centres.

In this context, it is proposed that EuroGOOS could develop a cooperative programme and offer equipment and training facilities.

The participation and contribution of Morocco in regional programmes has been modest due to the difficulties and constraints it faces, such as a lack of trained young scientists and technicians, a lack of equipment and inadequate funding for routine sampling and analysis. In addition, it is noted that like most African countries, there is a lack of political will on the part of government to fund studies, acquisition of equipment and data collection in general.

Morocco has faced a lot of problems due to underestimation of benefits of operational oceanography. With implementation of GOOS, improved coastal forecasting information is expected to be of benefit to public and private activities in the coastal zone.

1.2.3 The potential benefits which Morocco can derive from GOOS:

- (i) Fisheries: The most important benefit for this economic sector will be a better understanding of the natural and anthropogenic factors that affect fish stocks and their variability, by improving models of water variation, upwelling variability, pollution transport etc.
- (ii) Coastal Operations: Such as post building and management, coastal protection. GOOS can help engineers to choose the most adequate and sustained design which will lead to reduced dredging operations and a better protection of beaches against erosion.
- (iii) Meteorological forecasting will produce benefits in improved seasonal and inter-annual forecasts which will create a statistical basis for improved management of agriculture and water supplies. Furthermore, improved offshore weather forecasts and sea state forecasts are important for maritime transport and routine operation of merchant vessels.

- (iv) Public Health and Safety at Sea cannot work without accurate and continuous information about the state of the sea which is necessary to:
- a) ensure safety in merchant vessels and small traditional fishing boats;
 - b) prevent catastrophic events such as: accidental spills of oil and chemicals, toxic algae and blooms, red tides.

All these risks could be reduced if we fully adopt the concept of GOOS.

II. MARINE ACTIVITIES RELATED TO GOOS IN MALTA

Physical oceanographic measurements are mainly carried out by the physical oceanography unit at the Malta Council for S&T. The unit avails of basic marine equipment for studies in the coastal areas and can provide advanced data processing facilities and related services such as with regard to the study of coastal hydrodynamics, water column structure, shelf processes and climate change. The initial activities of the unit in 1993/4 focussed on several data collection campaigns aimed to study the phenomenology of the sea currents and water column structure in the NW coastal area of Malta. Meteo-marine stations were also set up at Ramla tal-Bir and Mellieha Bay respectively and are currently collecting densely spaced time series of the relevant parameters. The unit has also established co-operation with renowned oceanographic centres in the Mediterranean and notably with centres in Bologna, Oristano, Trieste and Mazara del Vallo in Italy. The unit is already participating in several international programmes such as MedGLOSS which aims to establish a network for the monitoring of sea level in the Mediterranean. The unit is a member of the EuroGOOS Mediterranean Task Team and participating in a very important research proposal on ocean forecasting. The unit is also involved in an IOC project (MEDAR/MEDATLAS) aimed to enhance data management in the Mediterranean and to update climatologies in the basin.

The main centre of scientific and technological research is the University of Malta. The Department of Biology of the University of Malta has achieved a remarkable level of excellence in marine biology. The key research efforts in the field of fisheries include: marine fish-farming technology particularly hatchery techniques and diseases of farmed fish and environmental impact of aquaculture. Most of these activities are undertaken at the National Aquaculture Centre.

Other main areas of research and specialisation within the Biology Department include: marine ecotoxicology and pollution studies, environmental risk assessment and management, application of remote sensing for environmental monitoring.

These studies are mainly carried out within the framework of international projects including the MAP-UNEP, MEDSPA, EU-AVICENNE and the Italo-Maltese Financial Protocol.

The Biology Department is also involved in research on:

- biology, ecology and phenomenology of seagrasses (in particular *Posidonia oceanica*) in cooperation with University of Aix-en-Provence (France);
- I. general phytobenthos in collaboration with the University of Catania.

The Biology Department undertakes studies on shore and shallow water marine benthos, faunistics of the Maltese Islands particularly with reference to biogeography, and the human impact on Mediterranean small island ecosystems. One main project is BIOMAERL which is an EU-funded project that is being undertaken by a consortium of research center and aims to study maerl biodiversity, functional structure and anthropogenic impacts.

New areas of study of the Department concern:

- cetacean biology dealing with the scientific aspects of dolphin stranding and monitoring of dolphin populations in local waters;
- II. genetic population and conservation of coastal and offshore marine populations.

The PCCU of the Environment Protection Department is mainly geared to combat oil spills. It however participates in the MEDPOL Programme and is involved in the monitoring of coastal water quality.

The only non-governmental agency that undertakes oceanographic measurements in Malta is the Coastal Management Co. Ltd (CMC) of the Malta Freeport. CMC have been conducting a wave monitoring programme since 1992. Two wave buoys are utilised to determine the wave characteristics in the open sea on an hourly basis, 7 days a week. Two pressure gauges are utilised to measure wave heights inside Marsaxlokk Harbour. All the four instruments are equipped with an on-line radio link to a base station.

ANNEX V

LIST OF ACRONYMS

CEOS	Committee on Earth Observation Satellites
CMM	Commission for Marine Meteorology (WMO)
DBCP	Data Buoy Co-operation Panel (WMO-IOC)
DIMS	Data and Information Management System (id.)
ECMWF	European Centre for Medium-Range Weather Forecasts
ENSO	<i>El-Niño</i> - Southern Oscillation
EuroGOOS	European GOOS
GCOS	Global Climate Observing System
GEF	Global Environment Facility (World Bank-UNEP-UNDP)
GESAMP	Group of Experts on the Scientific Aspects of Marine Environment Protection (IMO-FAO-UNESCO/IOC-WMO-WHO-IAEA-UN-UNEP)
GLOSS	Global Sea-level Observing System
GODAE	Global Ocean Data Assimilation Experiment (GOOS)
GOOS	Global Ocean Observing System
GOSSP	Global Observing Systems Space Panel (G3OS)
GPO	GOOS Project Office (formerly GSO)
GSC	GOOS Steering Committee
GTOS	Global Terrestrial Observing System
GTS	Global Telecommunication System (WWW)
GTSP	Global Temperature-Salinity Pilot Project / Profile Programme
HOTO	Health of the Oceans (module of GOOS)
I-GOOS	Intergovernmental Committee for GOOS
ICSU	International Council of Scientific Unions [CIUS]
IGOS	Integrated Global Observing Strategy (GCOS, GOOS and GTOS)
IGOSS	Integrated Global Ocean Services System
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Oceanographic Data and Information Exchange (IOC)
IPCC	Intergovernmental Panel on Climate Change (WMO-UNEP)
J-DIMP	Joint Data and Information Management Panel
J-GOOS	Joint Scientific and Technical Committee for GOOS
LMR	Living Marine Resources (module of GOOS)
NEAR-GOOS	North-East Asian Regional GOOS
NOAA	National Oceanic and Atmospheric Administration (USA)
OECD	Organisation for Economic Co-operation and Development
OOPC	Ocean Observations Panel for Climate
OOSDP	Ocean Observing System Development Panel (old)
PC	Personal Computer
SOOP	Ship-of-Opportunity Programme
SOPAC	South Pacific Applied Geoscience Commission
SSC	Scientific Steering Group
TAG	Trans-Atlantic Geophysical Traverse (USA-former USSR)
TAO	Tropical Atmosphere Ocean Array
TEMA	Training, Education and Mutual Assistance (IOC)
TOGA	Tropical Ocean and Global Atmosphere (WCRP)
UNCED	United Nations Conference on Environment and Development (Brazil, 1992)
UNEP	United Nations Environment Programme
VOS	Voluntary Observing Ship (WMO)
WCRP	World Climate Research Programme [PMRC]
WESTPAC	IOC Sub-commission for the Western Pacific
WMO	World Meteorological Organization (UN) [OMM]
WOCE	World Ocean Circulation Experiment