

**Summary Proceedings of  
IOGOOS Workshop  
&  
Third Annual Meeting (IOGOOS-III)**

Bali, Indonesia  
August 9 – 12, 2005

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## **1. Introduction:**

The IOGOOS Workshop and 3<sup>rd</sup> Annual Meeting (IOGOOS–III) was hosted by the Agency for the Assessment & Application of Technology (BPPT), Indonesia at the Kuta Paradiso Hotel in Bali, Indonesia during August 9 – 12, 2005. IOGOOS III was organized jointly by the IOGOOS Secretariat, IOC Perth Regional Programme Office and BPPT, Indonesia. About 80 participants from 15 countries and IOC participated in the deliberations of IOGOOS III. The list of participants is attached as Annexure I.

The agenda of IOGOOS III is attached as Annexure II. An important element of IOGOOS III was a High-level meeting held on August 11, 2005 to review the Indian Ocean Panel for Climate (IOP) implementation plan. This meeting was attended by nine high-level participants/representatives from eight countries.

## **2. Opening of IOGOOS III**

Opening IOGOOS III, Dr. Freddy Numberi, Hon. Minister for Marine Affairs and Fisheries of Indonesia stated that IOGOOS has taken up the challenge to implement an ocean observing system in the Indian Ocean and also basin-scale pilot projects. He briefly recalled the history of oceanographic activities in Indonesia and its recent initiatives in developing the Indian Ocean Tsunami Warning and Mitigation System (IOTWS). He stressed that IOGOOS III needs to address the requirements of capacity building for operational oceanography. He announced with pleasure, the launch of the Indonesian node of GOOS, InaGOOS and then signed the InaGOOS declaration. His statement is attached as Annexure III.

Welcoming participants, Mr. Jana Anggadiredja, Deputy Chairman of BPPT, informed that three institutions related to marine affairs in Indonesia have expressed interest to participate IOGOOS activities.

In his opening remarks, Dr. Radhakrishnan, Chairman of IOGOOS recalled the evolution and growth of IOGOOS since its formal launch at Mauritius in November 2002, and acknowledged the contributions made by several individuals and institutions to bring it up as one of the best GOOS regional alliances (GRA) with 19 members from 12 countries in the region and two associate members. . He informed the meeting that the IOP had made excellent progress in preparing a draft implementation plan for ocean observations in the Indian Ocean for climate. He stressed that the coastal GOOS pilot projects have to be evolved into concrete proposals in conformance with the IOC's Coastal GOOS implementation plan. He suggested that IOGOOS has a major role to play in the tsunami warning arrangements for the Indian Ocean region.

Mr. William Erb, Head of IOC Perth Regional Programme Office in his opening remarks, appreciated the efforts of Mr. Harry Ganoo and Mr. Kamal Tennakoon, for organizing the earlier IOGOOS meetings at Mauritius and Sri Lanka in 2002 and 2004 respectively. He also expressed appreciation for Dr.

Harsh K Gupta for his efforts during the formative stages of IOGOOS, and for Dr. K Radhakrishnan and Mr. Srinivasa Kumar for the effective management of the IOGOOS Secretariat. Further, he appreciated the efforts of Dr. Gary Meyers and members of IOP for drafting the IOP implementation plan. He informed that the tsunami tragedy of Boxing Day had directed the attention of everyone and affected the progress of some of the IOGOOS pilot projects. He also informed the meeting on the setting up of the secretariat for ICG-IOTWS at the IOC Perth Regional Programme Office with support from Australia. Further, he recognized the efforts of Indonesia in setting up Indonesian GOOS (InaGOOS), which is Indonesia's new mechanism for coordinating GOOS activities nationally. The statement made by Mr. Erb is attached as Annexure IV.

Dr. Jan Sopaheluwakan, Deputy Chairman for Earth Sciences, LIPI, Indonesia welcomed all the participants to the meeting and briefed them on InaGOOS, which is a collaborative effort between all the agencies in Indonesia involved in marine operations and research. He informed that the new InaGOOS will have strong interactions and collaboration with the IOGOOS.

### **3. Plenary Session-1: IOGOOS Science Workshop**

**Chair: Dr. Gary Meyers and Mr. William Erb**

The science workshop had invited presentations from four eminent speakers viz. Dr. John Keesing of the Strategic Research Fund for the Marine Environment (SRFME), Dr. Yu Weidong of the Second Institute of Oceanography, China, Prof. Mervyn John Lynch of the University of Curtin and Dr. Jan Sopaheluwakan of LIPI, Indonesia.

Dr. John Keesing gave an overview of multi-disciplinary research on the coastal marine environment in South East Indian Ocean and further briefed on two of the large multi-disciplinary core projects of SRFME viz. Coastal Ecosystems and Biodiversity Core Project, Marine Environmental Modelling Core Project.

Dr. Yu Weidong made a presentation entitled "Towards Modelling the Climate with Coupled Atmospheric General Circulation Model (AGCM) - Ocean Surface Wave-OGCM and its preliminary results". Modelling studies conducted by him indicate that coupling AGCM with OGCM has improved considerably the simulation of upper ocean thermal structure. The description of atmospheric pressure fields has also improved significantly after coupling AGCM with OGCM. Results also indicated that ocean surface waves contribute significantly to the output of the models.

Prof. Mervyn John Lynch presented the emerging scenario on "Ocean Remote Sensing. He provided the details of various satellite data products that are available on line and free of cost. Bandwidth requirements are high in order to download huge data sets and data management tools are necessary to archive the data. Remote sensing delivers numerous physical & biological products for the oceans such as SST, GHRSSST, insolation, chlorophyll-a, Coloured dissolved organic matter (CDOM), sediments, sea surface winds, thermal

fronts, fresh-salt water interfaces. He indicated that hyper-spectral remote sensing data can be used effectively to study coastal habitats but need extensive field study to initially identify the signatures. He informed that GOOS reports, GOOS documentation on remote sensing capacity building, data management's reports and other training courses provide guidelines for an IOGOOS remote sensing strategy. IOGOOS pilot projects need to identify the type of remote sensing products that are required for the projects.

Dr. Jan Sopaheluwakan made a presentation on the establishment of the Indonesian GOOS [InaGOOS]. He stressed the importance of the seas around Indonesia due to the strong influence of Monsoon, Indian Ocean Dipole Mode (IODM) and El Nino. The Indonesian through-flow is a complex phenomenon that is being studied through projects such as INSTANT. Upwelling and sinking processes are being studied in relation to Monsoon and the El Nino event. He stated that Indonesia is using remote sensing data operationally for the identification of fishing grounds. He also listed the imperatives for the formation of InaGOOS and provided the list of marine institutions in Indonesia that are a part of InaGOOS. He reiterated that the effective role of InaGOOS will enhance the regional alliances like IOGOOS and SEAGOOS.

During the discussion that followed, Mr. William Erb stated that InGOOS could be used by the IOGOOS members as a model for development of national GOOS organizations elsewhere. He suggested that the list of participants in InaGOOS could be provided to IOGOOS Secretariat so that they could be loaded onto the IOGOOS website.

#### **4. Plenary Session-2: Progress Reports from IOGOOS Working Groups**

**Chair: Dr. Mitrasen Bhikajee**

Progress reports on (a) Indian Ocean Panel on Climate, (b) Remote Sensing Capacity Building strategy, (c) Penaeid Prawn Pilot Project, (d) Coastal Ecosystems Pilot projects and (e) Coastal Erosion Pilot Project were presented by the respective Action Coordinators viz. Dr. Gary Meyers, Prof. Mervyn Lynch, Prof. A.T Forbes, Dr Greg Wagner and Dr. N. Wikramanayake respectively. Progress reports of the Coastal GOOS Working groups are attached as Annexure V

#### **5. IOGOOS Officers' Meeting**

On the afternoon of August 9, 2005, the IOGOOS Officers met and:

- a) reviewed and finalized the agenda for the High level meeting of August 11, 2005,
- b) reviewed the status of action items of IOGOOS II and the follow up as given in the report from the Secretariat,
- c) noted that many of the Members were seriously engaged in evolving the Early Warning arrangements in the aftermath of the Indian Ocean Tsunami disaster of December 26, 2004,

- d) recognized the need to be pursue more vigorously the IOGOOS tasks assigned to the Members and the Secretariat,
- e) recommended the imperative for the Officers to take up responsibility for follow up of actions and pro-active actions, including designating them as focal points for specific areas including research,
- f) reiterated the need to deploy and sustain two full time persons at the Secretariat as promised by the host agency, , to assist Secretary, IOGOOS, to carry out the tasks assigned to the Secretariat,
- g) appointed Mr. Mitrasen Bhikajee, an Officer of IOGOOS to scrutinize the accounts and financial statements of IOGOOS for the period April 1,2004 to March 31, 2005,
- h) agreed to the induction of (i) Agency for the Assessment and Application of Technology (BPPT), Indonesia, (ii) Indonesian Institute of Science (LIPI) and Department of Marine Affairs and Fisheries, Indonesia as IOGOOS Members and Mercator as an Associate Member,
- i) reviewed the reports of the Sub-committees appointed by IOGOOS II to evolve (a) guidelines for funding of participants for IOGOOS annual meetings and (ii) detailed procedure for election of Chair and Officers and Officers including their tenure,
- j) arrived at an understanding that participation to IOGOOS meetings and workshops shall be open for the designated representative(s) of its Members/Associate members or by invitation from the Secretariat,
- k) provided guidelines to the Secretariat for preparation of budget for the forthcoming year,
- l) reviewed the membership dues for 2003-04 and 2004-05, and advised to remind all by fax and further recommended that (i) membership would cease if the dues is for more than 2 years (ii) however they could continue to participate as Observers,
- m) considered the possible involvement of IOGOOS in various upcoming meetings.

## **6. Round Table Discussion 1 : “What IOGOOS can contribute to IOTWS”**

Mr. William Erb initiated the discussion by providing an overview of the latest developments on Indian Ocean Tsunami Warning System (IOTWS). He noted that IOTWS was an outcome of the meetings organized by IOC at Paris and Mauritius during March and April 2005. The Paris meeting recommended establishment of an ICG IOTWS with IOC as the secretariat. The system will be a fully coordinated network of national systems. National assessment teams set up by IOC are visiting countries in the region that have requested assessments and the teams are assessing the capability of the countries to

contribute to the warning system. They are also assessing the capacity building needs of the countries.

The 23<sup>rd</sup> Assembly of the IOC passed Resolution XXIII-12, which recommended the establishing of the ICG-IOTWS in Perth and outlined the terms of the reference of the ICG. The first meeting of ICG-IOTWS was held at Perth during August 3-5, 2005, and resulted in the formation of technical working groups addressing various aspects of tsunami warning such as seismic activities, communication, warning centers, sea level networks, data & information management, modelling, etc. A second ICG meeting is planned in early December 2005, in Hyderabad that will address the capacity building needs of the countries and also will bring together donors. It will also have a one or two day workshop on Tsunami Modelling.

He then made a presentation addressing a proposed strategy revision of IOGOOS. The initial IOGOOS strategy was written in 2000 and was adopted by IOGOOS in 2002. The tsunami disaster has suggested that a revision to the strategy might be appropriate to consider new responsibilities that may be taken up by IOGOOS. The likelihood of storm surge, tropical cyclones, droughts and flooding in the Indian Ocean region are far greater than that of tsunamis. He suggested that awareness building and education will be far more expensive and time consuming than building the warning/observing system itself and that IOGOOS should be able to help with capacity building. The possible role of IOGOOS in supporting the Indian Ocean tsunami warning system has been mentioned by high-level UN officials including Mr. Koffi Annan and Mr. Matsura.

Within the IOC, tsunamis, GLOSS and IODE are a part of the GOOS program. Operation of ships to deploy service and maintain arrays, management of communications, data and logistics are all critical elements of an effective Tsunami Warning System. Maintenance and calibration of the sea level network could be supported by IOGOOS. Considering the terms of reference within IOC Assembly Resolution XXIII/12 those that are related to IOGOOS are (a) Sea level and other data at near real-time and information required for the interoperability of IOTWS (b) To promote implementation of relevant Capacity Building and (c) To promote IOTWS in a multi-hazard framework

IOGOOS will need strengthening if it is to take on additional IOTWS tasks. Full time staff for the secretariat is a critical need even without the IOTWS tasks. The downside considerations for IOGOOS taking on IOTWS are (a) IOGOOS is operational oceanography whereas IOTWS is a 24x7 warning system and the communities involved are somewhat different and (b) the IOGOOS Secretariat has neither the funding nor staff to take on these additional tasks. The upside considerations include (a) a moderately developed communication network, and an active community, as well as, (b) the IOGOOS Secretariat is also the heart of Indian TWS and there already is some capability.

Mr. Francois Gérard, I-GOOS Chair, noted that Tsunami is a part of GOOS and that the GOOS also deals with operational services. He strongly supported

the view that the Indian Ocean system has to be a multi-hazard system. IOTWS has to be developed in overall coherence to GOOS principles. We also need to take cognizance of the presence and potential of JCOMM. GOOS and its GRAs have to pass on their requirements to such experts groups to benefit from them. He also said that modelling is an important component of disaster warnings. He also indicated that inundation activities related to hazard mitigation are coastal problems and have to be developed in coherence with the Coastal GOOS Projects. In essence, observation, modelling and inundations activities that are being set up for the Indian Ocean have to be developed in coherence with the overall GOOS objectives.

Mr. William Erb commented that, within GOOS there is generally no formal view so far on the tsunami activities. This will be the first such attempt. Activities will be presented to JCOMM for their views. The coastal projects of IOGOOS are also related to the activities.

Prof. Mervyn Lynch requested William Erb to elaborate on the capacity building activities, budget, etc. Mr. Erb elaborated that this will be discussed thoroughly at the ICG meeting in Hyderabad in December 2005. Inputs are expected from the report of the national assessment teams.

Prof. Mervyn Lynch suggested that people should look at assessing the impact of tsunami on coastal ecosystems using remote sensing inputs and simple tools should be made available through appropriate capacity building initiatives. Dr. Greg Wagner clarified that the Coastal GOOS pilot project could be expanded to study such impacts.

Dr. Neville Smith clarified that there are several working groups that are going to be created within the ICG. One of them is a sea-level group that will address primarily the tsunami. The system that is being set up as part of the tsunami will satisfy the requirements of operational oceanography. The IOGOOS/IOP requirements for sea-level gauges could be communicated to the ICG sub-group so that some of these gauges could act as climate sites. Bottom pressure moorings are being set up by many countries in the next 6 months for tsunami warning. The technology does not have any overlap with other observing programs. These are critical systems that need to be used only for the tsunami activities and will not probably have onboard any other extra sensors. Probably the tsunami and the climate moorings could be co-located closely so that logistics of maintenance will be simplified. As far as modelling is concerned, modelling of tsunamis and storm surges has many commonalities; but for the purpose of tsunami, operational models have to be put in place immediately using data from seismic sensors and sea level sensors. Risk assessment and vulnerability for tsunamis and storm surge have several aspects in common. Bathymetry is also a commonality and accurate coastal bathymetry data are not available. IOGOOS could probably help in this area. Operationally, there will be 5 centres that will generate warnings and communicate to the focal points from 25 countries. The ICG/IOTWS will coordinate the warnings from these centers under a single protocol to preclude confusion from several warnings.



Dr Gary Meyers informed that climate and tsunami requirements for tide gauges have commonalities; however, there is a conflict between the real-time data reception for tsunami vs. the long –term observations that are required for climate. On deep-sea moorings, Dr Meyers agrees with Dr Smith that though sensor packages are different, logistics could be simplified through cooperation.

Dr. Radhakrishnan elaborated that the capabilities and expertise set up as part of IOGOOS could be fruitfully used for IOTWS.

**It was decided to constitute a Sessional Working Group, under the chairmanship of Dr. Neville Smith to deliberate further and to come up with specific recommendations to the Plenary.**

## **7. Round Table Discussion 2: “Implementation of Coastal GOOS”**

Dr. Neville Smith initiated the discussion concerning implementation of Coastal GOOS projects within IOGOOS. The COOP Implementation Strategy for the Coastal Module of GOOS is the relevant document for guiding this process. COOP has identified certain physical variables that need to be measured mandatorily in the coastal regions. To progress, it is important to identify the capabilities that can be effectively delivered by the GRA’s in the coastal regions and also make sure that there is an appropriate mechanism within JCOMM to oversee the development.

The coastal pilot projects being considered by the GRA’s should be developed as part of the overall coastal GOOS. An important role of I-GOOS is to facilitate the implementation of GOOS plans through national, regional and global initiatives, using mechanisms such as JCOMM and the GRA’s and by supporting and promoting pilot projects aimed at delivering additional capacity to GOOS. The GSC recommended the implementation of the following pilot projects as an effective means to enable development of the coastal module:

- a) MILAC – (This project is important if we are talking of a multi-hazard framework).
- b) Global methods for developing, evaluating and improving ocean colour products in the coastal zone (IOGOOS remote sensing strategy should also address this aspect).
- c) Coupling shelf and deep ocean models (IOGOOS does not have a group working in this area, but this needs to be addressed in light of its importance to the tsunami warning).
- d) Coastal ocean data assimilation experiment. (This will include coastal ocean prediction – physical system, ecosystem modelling, impacts and others).

Each of these projects is described in the COOP Implementation Strategy for the Coastal Module of GOOS. Tom Malone indicated at Paris that he is

willing to consider the Indian Ocean as the platform for launching few pilot projects.

It is thus advisable to identify a few projects and tune them to match with the COOP plan. We should look forward to work on these initiatives and discuss the final plan in a workshop that could be planned in the next six months along with the neighbouring GRA's. IOGOOS should seek expressions of interest from members and from other GRA's for participating in the above projects.

In connection with the IOC Capacity Building Programme and its GOOS components, Dr. Ehrlich Desa intends to run an intensive workshop on ocean modelling and IOGOOS should communicate its requirements to him.

**It was decided to constitute a Sessional Working Group, under the chairmanship of Dr. John Keesing to deliberate further and to come up with specific recommendations to the Plenary.**

## **8. Round Table Discussion 3 “Remote Sensing Applications”**

Dr. K. Radhakrishnan and Prof. Mervyn Lynch initiated the discussion. Dr. Radhakrishnan briefly described the importance of remote sensing and indicated that the USA, Europe and India have major remote sensing programmes that cover the Indian Ocean. He gave an example of fisheries as a case where remote sensing data is being used for an operational purpose. Remote sensing data could also be used to provide inputs for coastal land use, shoreline changes, etc. He suggested that the IOGOOS website should have a page on remote sensing data availability, tools, etc. He gave an overview of the training programme offered by CSSTE-AP and Indian Institute of Remote Sensing.

Prof. Lynch identified the different physical (SST, Currents, etc) and biological products (Ocean Colour) that could be derived from satellite data. Derived parameters such as currents (from sequential data) and productivity are also important parameters. Shallow water bathymetry and benthic cover can also be derived from satellite data.

With respect to the capacity building activities of IOGOOS, it was suggested that workshops be held that address the need for remote sensing in IOGOOS pilot projects. Participants should be able to use the techniques for the progressing their projects. The IOCCG and POGO also provide training programmes.

**It was decided to constitute a Sessional Working Group, under the chairmanship of Dr. Radhakrishnan and Prof. Mervyn Lynch to deliberate further and to come up with specific recommendations to the Plenary.**

## **9. Plenary Session 3: Technical Presentations**

### **9.1. TRITON Mooring Array**

Dr. Yoshifumi Kuroda of JAMSTEC presented an overview of the TRITON projects and their future plan for moorings in the Indian Ocean. The data from two moorings in the eastern tropical Indian Ocean, which have been deployed as a pilot study since October 2001, demonstrated how they are useful for climate studies in terms of air-sea interaction and subsurface oceanic changes. He also reported that there is continuous vandalism of buoys and warned that it is the major problem for maintaining and constructing the surface mooring array. He thanked BPPT, Indonesia for their cooperation in implementation of the TRITON project. Based on the success of this pilot study, the Japanese government is going to support the development of a small size surface mooring for enabling usage the small size vessels in Indian Ocean rim countries and contribute to the basin wide mooring array planned at the Indian Ocean Panel. They are going to deploy at three locations in the eastern Indian Ocean by a five-year GEOSS promoting fund cooperated with IOGOOS countries

## **9.2 Overview of Whale Shark Research, Conservation, Management and Tourism in Indian Ocean and a proposal for an IOGOOS Pilot Project for enhanced cooperation in Indian Ocean**

Dr. John Keesing provided an overview of outcomes of the 1<sup>st</sup> International Whale Shark Conference. He presented an overview of whale shark research activities in the Indian Ocean countries and presented a case for possible future focus / objectives for an IOGOOS whale shark project. IOGOOS could play an oversight/coordination role, host regional meetings, and encourage countries to provide needed funding support.

## **9.3 POGO Activity in the Indian Ocean**

On behalf of POGO, Dr. Gary Meyers briefed the meeting on the mission of POGO and the need for partnerships. He provided details on the POGO-IOC-SCOR fellowship programme, Nippon Foundation – POGO Visiting Professorship Programme, post tsunami activities of POGO Members, biodiversity workshops, news & information group. The upcoming meeting of POGO will be in Hyderabad in January 2006 and will focus on the post-tsunami activities. The meeting suggested that the IOGOOS Secretariat send a letter to POGO thanking them for their support of CB activities in the Indian Ocean

## **9.4 Presentation on the Activities of MERCATOR: Dr. Francois Gerard**

Mercator Ocean is a consortium of six French Agencies (CNES, CNRS, IFREMER, IRD, Météo-France and SHOM), three of them (IFREMER, IRD, Météo-France) having operational and research activities in La Reunion. Initiated in 1995, the Mercator project has the objective to develop a capability in ocean monitoring and forecasting, using space and in situ observations, to support research, civil services, defense activities and the marine economic sector.

At the end of 2005, Mercator Ocean will operate a comprehensive ocean forecast system assimilating space and in situ data. The Atlantic Ocean and the Mediterranean ( $1/15^\circ$  resolution) are covered together with the world Ocean ( $1/4^\circ$  resolution). Mercator Ocean is recognized internationally. It has contributed to the GODAE project and is one of the lead partners of the European projects related to the development of operational oceanography under the framework of GMES (Global monitoring for Environment and Security), a European Union contribution to GEOSS. Detailed information can be found on <http://www.mercator-ocean.eu.org>.

Today, Mercator Ocean ensures a variety of services towards the user communities, which are of interest for IOGOOS.

- a) access to expertised ocean forecast bulletins (fields with quality indicators and assessment) through the unique web portal indicated above. It will be of full use for IOGOOS when the global  $1/4^\circ$  forecast suite will be operational, after October 2005, the following step will be, at the horizon of 2008, the operation of the global eddy resolving European model at  $1/12^\circ$  resolution;
- b) expertise advice upon user request for some specific activities (routing, pollution, coastal projects, planning of oceanographic cruises, etc...);
- c) calibration and validation of ocean observation projects, from space, and in situ. This capacity will be offered to IOGOOS in support of the deployment of the observing system presented by Gary Meyers;
- d) availability of tools for operational oceanography (packaged model configurations, coupling tools, etc). It is under development and could be offered to IOGOOS;
- e) contribution to capacity building and public awareness activities in the domain of ocean monitoring and forecasting. For example, pending the availability of funding support, a visiting scientist could be hosted to work on the Indian Ocean problems.

In 2006 Mercator Ocean will move from R&D projects to an Operational long-lead activity. It will be the Operator running the European global model and conducting activities over some European shelves. But it also has the will and objective to co-operate outside Europe, as a follow-on to its GODAE activities. It is for this reason that Mercator Ocean wishes to join IOGOOS while the Indian Ocean observing system is being implemented. Finally, through Mercator Ocean, IOGOOS will also link with French agencies active over the Indian Ocean.

### **9.5 Presentation on Regional LOICZ: Dr. Nalin Wikramanayake**

Dr. Nalin Wikramanayake made a brief presentation on Regional LOICZ nodes and potential collaboration with IOGOOS.

### **9.6 Presentation on Activities of SEAGOOS & Potential Collaboration with IOGOOS: Dr. Somkiat Khokiattiwong**

Dr. Somkiat briefed the meeting on the development of SEAGOOS and the main projects viz. (i) Climate and tropical cyclones; (ii) Coastal dynamics and pollution; (iii) Ecosystems and fisheries. Department of Marine and Coastal Resources, Thailand is the host for SEAGOOS. Three pilot projects are being pursued by SEAGOOS viz. (i) Real-Time Sea Level Observing System for SEAGOOS Region; (ii) Development of New Generation Sea Surface Temperature (NGSST) products in the SEAGOOS region; and (iii) Creation of an Expert System for Hazard and Risk Modeling in the SEAGOOS area. The last two projects were supported by Dr. Hiroshi Kawamura (Center for Atmospheric and Ocean Studies) and WAPMERR (World Agency of Planetary Monitoring and Earthquake Risk Reduction) respectively.

## **10. Parallel Session of the Working Groups**

The following three Sessional working groups formed during the Round Table discussions met as break-out groups and deliberated on various issues.

- a) Working Group on “What IOGOOS can contribute to IOTWS”, chaired by Dr. Neville Smith
- b) Working Group on “Implementation of Coastal GOOS”, chaired by Dr. John Keesing
- c) Working Group on “Remote Sensing Applications”, co-chaired by Dr. Radhakrishnan and Prof. Mervyn Lynch

## **11. Plenary Session 4: Presentation of Summary Report by Sessional Working Groups**

### **11.1 Summary Report from Sessional Working Group on “What IOGOOS can contribute to IOTWS”**

The Working Group deliberated on Sea level measurements, Deep-sea moorings, Ocean modeling, Vulnerability and risk studies, The multi-hazard framework (global, ocean-related), and Communication to the ICG/IOTWS. The detailed report of the Working Group is attached as Annexure VI.

The following are the major recommendations:

**The Sea Level Observing System:** IOGOOS person should be nominated to join the ad hoc sea level working group established by ICG-1 under the leadership of Dr B. Kilonsky.

**The deep-sea mooring network:** The IOGOOS to identify an individual familiar with the rationale and plan for the IOP network should join the IOTWS mooring discussion group.

**Ocean modeling:** IOGOOS to ensure that several people from IOGOOS agencies, with knowledge of IOGOOS and its work beyond tsunamis, participate in the Hyderabad Ocean modeling Workshop (12-13 Dec 2005).

**Vulnerability and Risk Assessment:** IOGOOS could commit to provide a better characterization of other hazards such as sea level changes arising from climate and climate change; intra-seasonal/tropical cyclone events including both direct (wind, flooding) and indirect (storm surge) effects; coral bleaching; and the vulnerability of the ocean environment (reefs, ecosystems, etc.).

**The multi-hazard framework:** IOGOOS should participate in the planned workshop (1<sup>st</sup> quarter of 2006), with the areas touched on in 6 to be the main topics of the paper

**Communication to ICG:** This discussion should form the basis of a communication from IOGOOS to the ICG Chair and Officers, emphasizing to keep communication lines open and to ensure the ICG Secretariat and IOGOOS Office work closely together.

## **11.2 Summary Report from Sessional Working Group on “Implementation of Coastal GOOS”**

The Working Group recalled that three Coastal Pilot Projects dealing with Penaeid Prawns, Monitoring Coastal Erosion, Monitoring Keystone Coastal Ecosystems were formulated during IOGOOS I in Mauritius 2002. These projects were further planned and progressed between IOGOOS II and IOGOOS III. Further, a project on IO cooperation on whale shark migration and its links to oceanography was also proposed at IOGOOS III. It was also reported to the IOGOOS III meeting that the COOP Implementation Strategy for the Coastal Module of GOOS had been adopted by IOGOOS. This provided the opportunity to consider the fit of the current and proposed pilot projects to the COOP Implementation Strategy for the Coastal Module of GOOS and to evaluate if there were other projects or activities that might be proposed consistent with these. The detailed deliberations of the Working Group is attached as Annexure VII. Important recommendations/action items are as follows:

**11.2.1. Penaeid Prawn Pilot Project:** The Penaeid Prawn Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS. The foundation of the web site for this project has been constructed with an emphasis on graphics and user friendliness as it is intended to be accessed as a general source of information and used not only by researchers in the field. It is expected, pending adequate funding, that the bulk of the website details will be completed by the end of 2005 and the site hosted by the IOGOOS secretariat by mid-2006 in advance of the IOGOOS IV meeting.

**11.2.2. Coastal Erosion Pilot Project:** The Coastal Erosion Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS. In order to progress the pilot project a number of important steps were identified as follows:

- a) Gauge interest in this project at WIOMSA Meeting – beginning September 2005.
- b) Poster/written Information provided to WIOMSA – Dr. Wikramanayake to develop flyer/poster to be sent from IOGOOS and provide to Dr. Bhikajee to deliver.
- c) Workshop proposed, follow up to UNEP Workshop, these may be regional depending on level of interest – March 2006.
- d) Workshop(s) would require funding (IOGOOS/ IOC/ UNEP).
- e) Seek support from IOGOOS to promote projects for funding by member countries (nominate relevant agency, funding source). Important to identify government support before committing funding to that countries participation in workshop).
- f) Seek to integrate post-tsunami monitoring of shoreline recovery into the proposal development process.

These outputs would be used to develop a detailed proposal for the pilot project in time for IOGOOS IV.

**11.2.3. Coastal Ecosystems Pilot Project:** The Coastal Ecosystems Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS. In order to progress the Coastal Pilot Project the following steps

were identified leading up to a project planning and capacity building workshop.

- a) Hold preliminary discussions at WIOMSA Symposium—early Sept 2005
- b) Hold project planning workshop on 16 –20 February, University of Dar es Salaam (re-evaluate venue). The overall objective of this workshop will be to finalize the project proposal for submission to donors and discuss details of how to implement the project.
- c) Country Implementation Plans (Lead Implementing Institutions/individuals responsible, collaborating institutions,
- d) Identify funding sources for the project – CoML, IOC, POGO
- e) Establish links to other projects.
- f) Seek support from IOGOOS to promote projects for funding by member countries (they should need to nominate relevant agency, funding source) important to do this before committing funding to that countries participation in workshop).

By IOGOOS IV it is planned to report that the project proposal, including all country plans, is finalised and approaches made to international and national donors.

**11.2.4. Enhanced Cooperation in Observations on Whale Sharks in the Indian Ocean:** The project, proposed by Dr. John Keesing aims at enhanced cooperation in observation of whale sharks in the Indian Ocean. This project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS and has relevance to the Coastal Ocean Data Assimilation Experiment (CODAE). The following tasks have been identified to be carried out to pursue this initiative:

- a) Affirm the commitment of individuals in the Indian Ocean region to a cooperative regional approach in the form of an IOGOOS Coastal Project – Dr Keesing to contact interested individuals/organisations in each country (these already identified for the countries identified above (and invite additional contacts to be put forward by other countries) September 2005.
- b) Determine the interest/relevance/links to COOP Implementation Strategy for the Coastal Module of GOOS



– Dr Keesing to discuss with the IOGOOS Secretariat and IOC Perth Office the best way to do this.

- c) If there is sufficient agreement and commitment among individuals in the Indian Ocean, then a proposal will be developed to hold a workshop in 2006 to bring together all existing observations and make firm plans to finalise the development of and plan implementation of the project plan. Support and sponsorship for the workshop would need to be sought from a variety of sources.

A report on activities would be made at IOGOOS IV. The next International Whale Shark Conference will be held in Mexico in 2007. It is expected a paper on IOGOOS sponsored activities and a review of activities in the Indian Ocean would be presented at that meeting.

**11.2.5. Timor Sea Deep Ocean to Continental Shelf Model Demonstration Proposal:** This project proposed by Dr. Ray Steedman aims to examine the feasibility of demonstrating the coupling of the deep ocean operational model Bluelink with a shelf model. This project is consistent with the Coupling Shelf and Deep Ocean Models strategy of the COOP Implementation Strategy for the Coastal Module of GOOS.

### **11.3 Summary Report from Sessional Working Group on “Remote Sensing Applications”, chaired by Dr. K. Radhakrishnan & Prof. Merv Lynch**

The group identified satellite missions that provide valuable sources of data for IOGOOS, parameters of interest for IOGOOS, Remote Sensing capabilities in the region as well as capacity building opportunities. The detailed report of the Working group is placed as Annexure VIII

The following recommendations/action items were identified by the Working Group:

#### **11.3.1 Short Duration Training Programs proposed are as follows:**

At least two or three short-duration training programmes are proposed to be conducted during 2006. IOGOOS Secretariat to follow up on the following prospects.

- a) India, Hyderabad 2006: “Ocean Colour Applications” (Funding: IOCCG / POGO-SCOR-IOC)
- b) India, Ahmedabad 2006: “Physical Oceanographic Parameters” (Funding: POGO-SCOR-IOC)

- c) India, Dehradun 2006: “Coastal Remote Sensing and GIS” (Funding: IOCCG / POGO-SCOR-IOC)
- d) Thailand, Bangkok 2006: “Coastal Remote Sensing and GIS” (Funding: IOCCG / POGO-SCOR-IOC)

**11.3.2 One long duration training program:** Proposed to be held at CSSTE: Asia-Pacific, Dehradun

**11.3.3 Web site:** IOGOOS web site to host ocean remote sensing tutor. Content generation and case studies to be done by volunteers and IOGOOS Secretariat. The site could provide links to sources of Remote Sensing data (IOCCG, CEOS, PODAAC, NDC etc).

**11.3.4 Expert Faculty sponsored to Country/Institution:** For on-the-job training, it was suggested that a programme be worked out where the trainer visits the trainees. Sponsorship could be requested from the Nippon Foundation / POGO.

## **12 High-level Meeting to review the Indian Ocean Panel implementation plan for sustained observations:**

Mr. William Erb welcomed participants to the high-level meeting. Dr. Radhakrishnan chaired the Meeting and gave his opening remarks. The CLIVAR/GOOS Indian Ocean Panel (IOP, Chair Gary Meyers) is a group of experts in ocean-climate science and observing systems, formed in response to a recommendation from the first meeting of IOGOOS (Mauritius, 2002). The Panel has met face to face twice (Pune, India, 2004; Hobart, Australia, 2005), but works primarily between sessions by email and internet. The Panel’s plan for IOGOOS is reported on the web site of the International CLIVAR Project Office at <http://www.clivar.org/organization/indian/IOOS/obs.html> . The Panel has published a Report entitled, “The Role of the Indian Ocean in the Climate System—an implementation plan for sustained observations.” The final draft of the Report was presented to the high level participants for review and comment. The Report is in two parts: Part 1 is a review of what is known about the Indian Ocean’s role in climate variation and the research issues that can be resolved with better data, as well as the potential uses of data by operational oceanography. Part 2 presents technical details of the implementation for each of the commonly used types of instrumentation.

The following four presentations based on the IOP Report were made in the plenary session.

### **12.1 Weather and Intra seasonal Variability-Predictability and managing impacts:**

This topic was presented by Dr. Gary Meyers on behalf of Dr. Peter Webster. The presentation covered model-simulation of Madden-Julien Oscillation (MJO) and Monsoon Intraseasonal Oscillation (MISO) as well as data-based diagnostic studies of MJO and MISO. The focus

was on the processes in the ocean associated with these phenomena. A statistical scheme to predict rainfall due to MJO and ISO was compared to results from a coupled model. The conclusion indicated that planned observations are required for the accurate simulation of such events, and as an initial condition to improve their prediction. In particular, the continuous measurements from an array of moorings is needed to capture the fast time-scale of MJO and MISO.

## **12.2 Role of the Ocean in Climate Variability & Change**

Prof. Friedrich Schott presented this topic. He presented the relation between large scale (>1000 km) patterns of SST and rainfall to demonstrate the Indian Ocean impacts on the atmosphere. The focus was on subsurface ocean thermal structure and currents associated with the SST patterns, implying predictability associated with the oceanic memory and propagation of remote forcing. He showed the high correlation between SST and rainfall in Africa and Indonesia associated with the Indian Ocean Dipole (IOD). The thermocline ridge in the southwestern Indian Ocean and related mixed layer structure, are associated with the probability of cyclones forming in the region. He also identified the role of Ekman transports and circulation patterns for the southwest (summer) monsoon and for the winter monsoon. Accurate simulation of seasonal-to-interannual cycles in the ocean by coupled models is required before we can hope to use climate models for prediction of climate variability and change. The Indian Ocean observing system is needed to identify the ocean-processes and initialize prediction models.

## **12.3 Operational Oceanography:**

This topic was presented by Dr. Neville Smith. He elaborated on the need for sustained and systematic observing systems in the Indian Ocean in order to make operational ocean nowcasts, hindcasts and predictions. The products of operational oceanography will be used in a wide range of marine activities, including fisheries, transport, off shore industries (e.g. oil and gas) and tourism. Accurate, high-resolution winds, oceanic data, flux measurements, coastal topographies and other data are required to enable operational oceanography. He listed the critical issues for operational oceanography such as sustainability of satellite measurements (Scatterometer, Microwave SST, Altimeter and Ocean Colour) and rapid easily accessible dissemination of observational data, as well as operational products. He elaborated on the need for Global High Resolution SST and stressed that IOGOOS should put in efforts to have such a product for the Indian Ocean.

As an example of the products of operational oceanography that are available now, he summarized the Australian BLUELink Project. <http://www.marine.csiro.au/bluelink/exproducts/index.htm>. The applications include coastal predictions and marine ecosystems, short-range ocean prediction, seasonal-to-interannual prediction, Reanalysis

and Research. He concluded that operational ocean prediction has a future in its own right and a sustained ocean observing system is required to realize the potential benefits of operational oceanography.

#### 12.4 The Integrated Observing System

Dr. Gary Meyers presented an overview of the design for an Indian Ocean Observing System. It is integrated in the sense (a) that it makes use of all the available types of instrumentation that can be deployed in the ocean for long periods of time, (b) it provides data for a wide range of parameters relevant to the physical and biological state of the ocean and (c) it observes all the relevant time-scales of variability from intraseasonal to multi-decadal. The high level objective of the observing system is to observe, describe, understand, model and predict: seasonal monsoon variation with related intraseasonal variability; the interactions among monsoon—El Nino Southern Oscillation—Indian Ocean Dipole; and the multidecadal warming trends and natural variation.

**Moorings:** An array of moorings to measure ocean temperature, salinity, currents, weather variables and other parameters is required to measure the basin-scale variations associated with the above objective, in particular the fast variability associated with MJO and MISO. The first design of the array was based on observational studies and the experience of researchers. Modelling studies were conducted to confirm that the sites for the moorings were adequate and to identify gaps. Three types of moorings will be deployed: TAO and mini-triton to measure the upper ocean temperature, salinity and surface weather; upward looking ADCP's along the equator where geostrophy does not hold and flux reference sites where additional weather data will be collected to estimate surface heat and fresh water fluxes for calibration of satellite estimates. The moored buoy array will provide all data in real-time using Argos. During October to November 2004, PMEL-NOAA and NIO deployed 5 moorings in the central equatorial Indian Ocean in the locations of the design. JAMSTEC has maintained three moorings at locations in the eastern Indian Ocean since 2000. The Indian Ocean Moored Buoy Data Assembly Centre (DAC) has been set up that is modelled after TAO/TRITON and PIRATA. PMEL & JAMSTEC are initial contributors with PMEL hosting the site now with a possibility of having a mirror site outside US at INCOIS.

**Argo Floats:** The full implementation of the Argo Program in the Indian Ocean is essential to achieve the goals of understanding and prediction at all time scales, particularly interannual to multidecadal scales. Possible strategies for alternative Argo sampling have been discussed and it was decided to follow the standard 10 day sampling since it would give maximum life time for the float. The areas of weak sampling as well as areas of divergence need to be covered well. INCOIS is going to proactively announce opportunities to deploy floats getting the details of research cruises planned in the Indian

Ocean. About 120 deployments are required per annum to maintain the Argo array.

**XBT:** The panel identified the lines to be covered and prioritized them following a set of considerations. The high priority lines recommended for more frequent sampling include- IX 01, 08, 09N/1X-10E, IX-12, IX15/IX21, IX22, PX-02 and IX-14. The coverage in the WIO is poor and hence a workshop is being arranged in October at NIO to improve this.

**Drifters:** The panel feels that 5degx5deg sampling needs to be maintained. Needs full implementation and reseeded of northern areas.

- 12.5 Data management – Progress and shortfall:** CSIRO and APDRC have compiled and carefully edited all the available subsurface temperature data for the Indian Ocean collected during the 20<sup>th</sup> century. Though data from various instruments at various centres are available, what is missing is a one-stop shop for research. INCOIS and APDRC have the capability to do this. IOP recommended that they together prepare a joint plan for Indian Ocean data management and dissemination, optimizing the great capability available in these agencies. Capacity building in all the nations around the Indian Ocean rim needs to be addressed through ODINCINDIO.

The major issues that have to be resolved to fully establish the mooring array include: Ship time (180 days per year), Fishing Vandalism, Operational Funding, International Coordination, System Integration (e.g. commonalities with multi-hazard warning system), Data management. In the mean time, incremental steps to develop the Indian Ocean observing system will be made through national and bilateral arrangements coordinated through the Indian Ocean Panel.

## **12.6 Comments/Presentation by High-level Participants**

### **Dr. Neville Smith – Australia**

Dr. Neville Smith read out the following statement on behalf of the Director of Bureau of Meteorology.

“On behalf of the Director of the Bureau of Meteorology, I would like to thank the organizers of this Meeting for the opportunity to comment on the Implementation Plan and its importance to our work.

First we extend our thanks and congratulations to the Indian Ocean Panel and to Gary Meyers in particular, for the fine work and tremendous effort that has gone into getting the plan to this point. The scientific basis is strong and the engagement of Indian Ocean scientists in the process is to be commended.

In a general sense, Australia attaches great importance to the Indian Ocean region for Global and regional weather prediction; Tropical cyclone and other extreme weather prediction; Studies and prediction of intraseasonal variability such as the MJO; Emerging operational ocean analysis and prediction systems; Seasonal to interannual climate prediction; and Monitoring and understanding climate change.

For the Bureau of Meteorology, we can confirm our intent to at least sustain and, as resources permit, enhance our ocean observing activity in the region. The Indian Ocean region remains a top priority. This includes a surface drifter program through the DBCP; Surface met observations through VOS; Upper ocean measurements through XBTs/SOOP; Upper ocean measurements from Argo profilers; SST observations; Sea level measurements (tsunami, climate) through the NTC; and Various products that will complement the observing system including surface wind analyses and TC predictions.

With CSIRO, the RAN and AIMS and others, we continue to advocate a substantial enhancement of the observing system. The so-called Australian Integrated Ocean Observing System is being developed as a high-level initiative within Australia. The strategic approach has been endorsed and we are planning to establish a secretariat over the coming months, probably in the National Oceans Office. The Indian Ocean region is a major focus of this plan and it will be strongly guided by the IOP Panel. We would like to emulate the success of our hosts and obtain substantial government commitment to this plan, possibly under the framework of GEOSS.

In conclusion we warmly welcome the publication of the IOP and generally support its recommendations. Specifically we support the underpinning research rationale and scientific basis; the mooring array design and initiatives to establish cooperation with the IOTWS; full Argo coverage, enhancements and changes to SOOP, and IX1 in particular; and the surface drifter network.

I would like to note in addition an upcoming major atmosphere-ocean experiment, the Tropical Warm Pool International Cloud Experiment (TWP-ICE). This experiment will be centered on Darwin and involve extensive atmospheric and air-sea observations with the aim of developing understanding of the evolution of clouds and convection in the tropical warm pool region. These processes are very important to intraseasonal variability. The experiment proper will run over Jan-Feb 2006 and involve around six aircraft as well as the R/V Southern Surveyor and contributions from many international scientists.

Again, I would like to thank the meeting for the opportunity to comment and I look forward to contributing to the IOP plans implementation”

**Dr. Guifei Jing – China;**

Dr. Jing presented the efforts from China contributing to GOOS and IOGOOS. He elaborated on the activities of the Chinese Ocean Observing System (COOS), which is a multi-platform monitoring system using satellites, aircraft and in-situ monitoring.

**Dr. Francois Gerard – France;**

He congratulated Dr. Gary Meyers and felt that the design is scientifically sound and comprehensive. He listed the activities that France conducts in the Indian Ocean such as the Regional specialized centre for cyclones at La Réunion and the newly established Tsunami warning centre. France also has research vessels operating in the Indian Ocean, able to host people from the region on their research ship. The RV “Marion Dufresne” is presently operating west of Sumatra for a post tsunami cruise, and Indian Ocean will be part of the programme of the French research fleet in 2006. France has agreed to contribute to the IOTWS and has developed plans to contribute to tidal observation networks in the Western Indian Ocean and to upgrade the warning dissemination capabilities in the region. France is willing to continue to contribute to the IBPIO action group for surface drifters; to the Argo Programme and to XBT lines. France also has the capability to contribute to ocean monitoring and forecasting thru the MERCATOR project, which will be presented later

Furthermore, Dr. Gérard elaborated that the design presented by Dr. Gary Meyers for Indian Ocean Observations is good and cannot be disputed. One of the concerns is the way that the network will be implemented and sustained. It also has to cater to operational activities since just science objectives will not be sufficient to sustain funding. He noted that the GEOSS framework can provide new approaches for securing long term funding.

He concluded, noting that in this part of the ocean 60% of the world population is living and that most members are developing countries. Therefore, as I-GOOS Chair the suggestion is that we should focus on operational oceanography that is user-driven, to mobilize governments, scientists and citizens. This is the challenge for IOGOOS and GOOS as a whole.

**Dr. Radhakrishnan – India;**

Dr. Radhakrishnan made a presentation on the Indian plan for observing systems in the Indian Ocean, elaborating on the Indian plans for ocean observation, information and advisory services. He also mentioned the satellites planned for launch for coastal and ocean studies. Dr. Mahesh Zingde of NIO commented on the insitu observations being implemented by NIO viz. XBT, Drifting buoys and current meter moorings. Dr. S. Kathirolu, Director, NIO, presented on

the Indian programme on moored data buoys, tide gauges, Argo floats and research vessels.

**Dr. Sugiarta Wirasantosa – Indonesia;**

Dr. Wiarsantosa thanked IOGOOS and the Panel for making an excellent effort. The presentations clearly brought out the importance of integrated ocean observations and international collaboration. Indonesia is contributing to the INSTANT project and working on areas related to environmental monitoring, climate studies, etc. Indonesia also welcomes the use of its facilities such as SEACORM for benefiting the Indian Ocean observations

**Dr. Jan Sopaheluwakan, Indonesia;**

Indonesia is participating and also contributing its research vessels and scientists for programmes like INSTANT, CoML as well as several marine and coastal resources management projects. Fish stock assessment, modelling on coastal transport, conservation of islands, remote-sensing stations, are some areas where Indonesia can contribute to IOGOOS. Fishing vandalism is an area, which Indonesia is willing to tackle as part of the tsunami warning project. In short, Indonesia has two agendas- Indonesia wishes to intensify their observational lines, and making Indonesia a hub for data dealing with data archival, rescue, and exchange.

**Japan: Dr. Yoshifumi Kuroda**

He thanked the IOGOOS Secretariat and BPPT for making the necessary arrangements on the behalf of TRITON project and JAMSTEC. Also he thanked Dr. Gary Meyers for making this excellent plan which provides a guidance how the IO observation systems to be implemented. JAMSTEC is developing a small size TRITON buoy that could be maintained by small vessels, and continue to contribute the IO mooring array for climate studies. The continuous vandalism is a major obstacle for the mooring array and it cannot be solved without commitment by IOGOOS member countries to reach and educate fishing fleets. JAMSTEC is also making a research cruise named MISMO focusing on air-sea interaction during MJO in 2006 by R/V Mirai that will contribute to the Indian Ocean climate studies.

**Mr. Harry Ganoo – Mauritius;**

Mauritius is a small country but is fully committed to cooperate with the world community. Mauritius has hosted the IOTWS Meeting and will host the forthcoming WIOMSA Meeting. They are members of IOCINDIO and have a national GOOS community.

Considering the importance of ocean on climate, Mauritius is committed to contributing to the moorings programme in the Indian Ocean. Two tide gauges are operational and they are also willing to



deploy Argo floats. Mauritius has expertise and would be willing to collaborate with the IOP and IOGOOS initiatives. IOGOOS should form a network of experts working on climate variability. He commented that progress in the IOGOOS projects has not been as rapid as required and that the IOGOOS officers could be given the responsibility of individual projects based on their expertise.

**Dr. Kamal Tennakkoon – Sri Lanka;**

Sri Lanka wishes to support the plan. The plan would be submitted to their steering committee and necessary endorsement would be obtained and communicated.

Sri Lanka is interested in activities related to upwelling and current systems. They are operating a tide gauge and are ready to share their data. Sri Lanka welcomes deployments of Argo floats in its EEZ. Their vessel can be used to deploy instruments in the region.

**Dr. Chester Koblinsky – USA;**

Dr. Koblinsky made a presentation on NOAA's contributions to GEOSS with a focus on the Indian Ocean. Plans of observations in the Indian Ocean need to be pointed towards the overall GEOSS programme. Ocean objectives of NOAA include observing: long term trends in sea level changes; ocean carbon sources and sinks; oceans storage and global transport of heat and fresh water; ocean – atmosphere exchange of heat and fresh water.

He wholeheartedly supported the design and encouraged implementing the plan; however, the implementation needs to be prioritized. Some challenges in implementing observing systems include (a) ship time requirement (b) international coordination.

Partnerships are needed to implement and sustain the Indian Ocean moored buoy array. The US is ready to support capacity building activities. IOGOOS could identify the areas requiring capacity building. Data from satellites also need to be used. IOGOOS needs to articulate their operational and scientific needs for satellites so that satellite systems can be sustained. He suggested IOP to consider adding a statement about the potential role of the Indian Ocean in the global climate context (teleconnections).

**Conclusions**

**Dr. Radhakrishnan, chair of the session concluded that the plan has the broad endorsement of all the participants and the suggestions made by the participants have to be taken onboard by the IOP and IOGOOS. He suggested that a formal communication could be sent by the IOGOOS Secretariat to the IOP sponsors, i.e. IOC-Perth and CLIVAR thanking them for their support and congratulating the excellent progress made by IOP in developing this plan.**

### **13 Brainstorming Session on improving effectiveness of IOGOOS**

Dr. K. Radhakrishnan, Chairman IOGOOS elicited suggestions from the participants to improve the functioning of IOGOOS.

IOGOOS has already achieved some good progress in respect of evolving a design for basin-scale observations. It has also embarked on coastal pilot projects that are complex and would take some time to see the results. The recent tsunami demanded serious attention of some of the IOGOOS functionaries for evolving the tsunami early warning system and related capacity building for the Indian Ocean. The following suggestions were received from the participants on how to further enhance the effectiveness of IOGOOS.

- There is a need to collaborate on regional projects. Individual champions are needed to take ahead successful projects.
- Projects should be able to cut across national boundaries and countries should be sufficiently convinced that the project is useful to them.
- Activities of IOGOOS including the Pilot projects and progress need to be made known at the National level.
- National GOOS coordinating committees should be formed which also include the government agencies that are involved in the pilot projects.
- IOGOOS probably needs to spend more time on delivering products and useful information through the Website, Capacity building for Modeling, tsunami, Coastal inundation modeling etc.
- It might be useful to have an IOGOOS Workshop along with the I-GOOS Meeting.
- IOGOOS needs to develop a user interface

### **14 Annual Meeting of IOGOOS**

**14.1** Chairman, IOGOOS welcomed the Members to the Annual Meeting and briefed on the Agenda items to be discussed. He welcomed the following four Institutions who have expressed interest to become Members of IOGOOS. The Meeting admitted their Membership.

- Agency for the Assessment and Application of Technology, Indonesia (Contact: Dr. Jana T. Anggadiredja, Deputy Chairman of Technology for Natural Resource Development)
- Indonesian Institute of Sciences, Indonesia (Contact: Dr. Jan Sopaheluwakan, Deputy Chairman for Earth Science)
- Agency for Marine and Fisheries Research – Ministry of Marine Affairs and Fisheries, Indonesia (Dr. Indroyono Soesilo, Chairman)

- Mercator, France (Dr. Francois Gerard)
- 14.2 Mr. Srinivasa Kumar, Secretary, IOGOOS presented the Report on the activities of the Secretariat since April 2004. A copy of the report is attached as Annexure– IX
- 14.3 Dr. Mitrasen Bhikajee, Officer of IOGOOS scrutinized and approved the financial statement that was prepared and submitted by IOGOOS Secretariat
- 14.4 The Meeting reviewed the membership dues for 2003-04 and 2004-05, and advised to remind all by fax and further recommended that (i) membership would cease if the dues is for more than 2 years (ii) however they could continue to participate as Observers,
- 14.5 The Meeting considered the report of the Sub-committees appointed by IOGOOS II to evolve guidelines for funding of participants for IOGOOS annual meetings and approved the following.

<b>Item No. 5 (vii): Suggested amendments to the MoU in relation to Representation and Election of Officers and Representation at the Annual Meeting</b>	
<b>Original Formulation in the MoU</b>	<b>Suggested New Formulation</b>
4.2. Each member will nominate one representative to participate in the Annual Meeting or a General Meeting of IOGOOS	<ul style="list-style-type: none"> <li>• All members of IOGOOS shall register a contact point and a Representative with the Secretary of IOGOOS.</li> <li>• IOGOOS communications shall be sent to both the contact point and the Representative.</li> <li>• The Representative shall participate in Annual Meetings and be eligible for election as an Officer. The Representative should have an authority, or have a delegated authority, to take decisions and vote at the Annual Meeting.</li> <li>• A member may change the Representative for the Annual meeting by notifying the Secretary in writing or by email prior to the Annual Meeting.</li> </ul>

<p>6.1. The Members at Annual Meeting will appoint the chairperson and four officers providing a balanced representation of the region</p> <p>6.2. The chairperson and Officers will serve for two years, and be responsible for all IOGOOS activities between annual meetings. They will be eligible for re-appointment for up to a maximum of two successive terms</p>	<ul style="list-style-type: none"> <li>• A notice shall be circulated to all Members notifying vacancies among the Officers and requesting nominations from members for the position of Chair of IOGOOS and for other Officers three months prior to the Annual Meeting.</li> <li>• The Officers should be broadly representative of the regions of the Indian Ocean.</li> <li>• At the annual meeting a member shall be appointed to manage nominations (the Nominations officer), to ensure representation of all regions as appropriate, to manage and encourage rotation of Officer positions among members of IOGOOS, and as far as possible reach consensus prior to the annual meeting.</li> <li>• In the event there are more nominations than vacant Officer Positions, an Election Return Officer, who is not a voting Member, shall be appointed, to oversee the election. Each member shall have a number of votes equal to the number of vacancies. The position of Chair shall be decided first, as appropriate, and the Chair shall be considered one of the five Officers.</li> <li>• Officers shall be appointed for a term of 2 years, up to a maximum of two terms. With the unanimous agreement of all members, in exceptional cases, an Officer can be extended for a further term of 2 years.</li> </ul>
<p>6.6. The chairperson or an Officer may give notice of one year in advance of his/her intention to retire, and in that case the following</p>	<ul style="list-style-type: none"> <li>• Officers serve in an individual capacity and shall not nominate substitutes. If an Officer does not attend two consecutive Annual Meetings, the position of that Officer will be considered vacant and an election will be conducted for the position. If an Officer resigns, the position shall remain vacant until the next Annual Meeting. However, if the Chair is unable to serve, one of the</li> </ul>

Annual Meeting shall appoint a replacement	Officers will be nominated by the Officers, to act as a Chair, till next Annual Meeting.
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**14.6** The Meeting considered the report of the Sub-committees appointed by IOGOOS II to evolve guidelines for detailed procedure for election of Chair and Officers and Officers including their tenure and approved the following:

**Guidelines for funding participants to IOGOOS meetings:**

IOGOOS convenes various types of meetings to execute its work plan. These generally include the Annual Meeting of IOGOOS, project workshops, conferences, meetings of IOGOOS Officers, meetings of expert groups, meetings with consultants and perhaps others.

1. As a general rule participants to all meetings should attempt to locate their own funding sources from their agencies, research grants or other means.
2. IOGOOS may fund participants to meetings if funds become available for that purpose and if such participation is deemed by the Officers to be crucial for the outcome of the meeting.
3. Preference when limited resources are available will be based on the following criteria in the priority order given (highest first):
  - Member who is an Expert and critical to outcome of meeting\*.
  - Expert critical to outcome of meeting.
  - An Officer of IOGOOS.
  - Member important to outcome of meeting.
  - Expert important to outcome of meeting.
  - Participant providing geographical balance and perspective.

\*In the above categories a paid-up member will always receive priority over a non paid-up member.

**14.7** The Meeting recommended the imperative for the Officers to take up responsibility for follow up of actions and pro-active actions, including designating them as focal points for specific areas including research. The officers were assigned the following responsibilities:

- ▶ Dr. Radhakrishnan: Tsunami related activities
- ▶ Dr. Neville Smith: Modelling and Climate related activities
- ▶ Dr. Mitrasen Bhikajee: Data Management related activities
- ▶ Dr. Johnson Kazungu: Coastal Projects
- ▶ Prof: Anthony Forbes: Remote Sensing & Capacity Building

**14.8** The Members noted the efforts put in by IOGOOS Members & IOGOOS Secretariat over the last two years for the GRAND Project. After detailed assessment of its utility vis a vis the efforts put in, it was considered appropriate to withdraw from the GRAND Project. On behalf of IOGOOS, Chairman was authorized to communicate the same to the GRAND Secretariat.

**14.9** Noting the need to sustain a proactive secretariat and keeping in view the need for close follow up of the upcoming activities of the IOGOOS; the meeting urged the host institution to immediately deploy at least two additional full time manpower to assist the Secretary.

**14.10** Host for IOGOOS – IV: The annual meeting welcomed the tentative offer of University of Dar-es-Salaam, Tanzania to host IOGOOS – IV Meeting.

**14.11** Secretariat was instructed to (a) Send out a Hard Copy and Fax of the invoice for Annual Membership rather than e-mail (b) include the address of IOGOOS Secretariat in the Letterhead, (c) mail hard copies of IOGOOS II Report to all the participants (c) circulate the action taken report well in advance before the annual meeting.

## **15 Concluding Session**

Secretary, IOGOOS presented the draft report to the meeting participants. Chairman, IOGOOS thanked all the participants and the hosts for the successful conduct of the Meeting.

### List of Participants for the IOP high-level Meeting

Dr. Neville Smith, Acting Chief of  
Division  
Bureau of Meteorology, 700 Collins Street  
Docklands, Zip: 3008, Vic,  
Tel: 03 96694444,  
Fax: 03 96694660  
E-mail: [n.smith@bom.gov.au](mailto:n.smith@bom.gov.au)

Dr. Guifei Jing,  
Chief of Division of International  
Cooperation,  
National Remote sensing Centre,  
China  
[jinggf@nrsc.gov.cn](mailto:jinggf@nrsc.gov.cn)

Dr. M. François Gérard  
Charge de Mission pour les Affaires  
Océanographiques,  
Météo France - Direction de la  
Météorologie Nationale, 1, quai Branly  
75347 Paris Cedex 07, France  
Tel: (+33) (0)1 45 56 70 11  
Fax: (+33) (0)1 45 56 70 05  
E-mail: [francois.gerard@meteo.fr](mailto:francois.gerard@meteo.fr)

Dr. K Radhakrishnan, Director  
Indian National Centre for Ocean  
Information Services  
“Ocean Valley”, PB NO.21, IDA  
Jeedimetla PO,  
Hyderabad-500 055, India  
Tel: 00914023895000  
Fax: 00914023895001  
e-mail: [radhagr@incois.gov.in](mailto:radhagr@incois.gov.in)

Sugiarta Wirasantosa  
Head of Research Center for Maritime  
Territory and Non-Living Resources,  
Agency for Marine and Fisheries Research  
(BRKP),  
Ministry of Marine Affairs and Fisheries,

Jl. MT. Haryono Kav. 52 – 53  
Jakarta 12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79191202

Dr. Jan Sopaheluwakan  
Indonesian Institute of Sciences (LIPI)  
Jl. Gatot Subroto, Jakarta

Dr. Yoshifumi Kuroda, Group Leader,  
JAMSTEC  
2-15 Natsushima, Yokosuka,  
Zip: 237-0061,  
Tel: 81-46-867-9912,  
Fax: 81-46-867-9885  
E-mail: [kuroday@jamstec.go.jp](mailto:kuroday@jamstec.go.jp)

Mr. Harry Ganoo  
Secretary to Cabinet and Head of the Civil  
Service  
and Chairman of the Mauritius  
Oceanography Institute  
Tel: +230 201 2850  
Fax: +230 208 6642  
Email: [hganoo@mail.gov.mu](mailto:hganoo@mail.gov.mu)

Dr. Kamal Tennakoon,  
Senior Reserch Officer  
National Aquatic Resources Research and  
Development Agency,  
Crow Island, Mattakkuliya, Colombo 15,  
Sri-Lanka  
Tel: ++94112521008,  
Fax: ++94112521932  
E-mail: [tkdkamal@hotmail.com](mailto:tkdkamal@hotmail.com)

Koblinsky Chester J  
OAR HQTR Route: R/OGP  
Tel: 301 427-2334  
Fax: 301 427 2222  
[Chester.j.koblinsky@noaa.gov](mailto:Chester.j.koblinsky@noaa.gov)

## List of participants for IOGOOS III

Dr.Gary Meyers,  
Research Scientist, CSIRO,  
GPO Box 1538, Hobart, Zip: 7001,  
Tasmania,  
Tel: 61 3 6232 5208,  
Fax: 61 3 6232 5123  
E-mail:[gary.meyers@csiro.au](mailto:gary.meyers@csiro.au)

Dr.Neville Smith,  
Acting Chief of Division  
Bureau of Meteorology,  
700 Collins Street  
Docklands, Zip: 3008, Vic,  
Tel: 03 96694444,  
Fax: 03 96694660  
E-mail:[n.smith@bom.gov.au](mailto:n.smith@bom.gov.au)

Dr.John Keesing,  
Research Group Leader, CSIRO  
Private Bag 5 Wembley WA 6913  
AUSTRALIA  
Perth, Zip: 6913, WA,  
Tel: 61893336500,  
Fax: 61893336505  
E-mail:[john.keesing@csiro.au](mailto:john.keesing@csiro.au)

Prof. Mervyn John Lynch  
Curtin University  
Perth, Australlia

Dr. Guifei Jing,  
Chief of Division of International  
Cooperation,  
National Remote sensing Centre,  
China  
[jinggf@nrsc.gov.cn](mailto:jinggf@nrsc.gov.cn)

Dr.Weidong YU, Associate Professor  
First Institute of Oceanography,  
State Oceanic Administration,  
6, Road Xian-Xia-Ling,  
High-Tech Park,  
Qingdao, Zip: 266061,

Shandong,  
Tel: +86 532 88967403,  
Fax: +86 532 88967403  
E-mail:[wdu@fio.org.cn](mailto:wdu@fio.org.cn)

Dr.Yeli YUAN,  
Professor, Honorary Director  
First Institute of Oceanography,  
State Oceanic Administration,  
6, Road Xian-Xia-Ling,  
High-Tech Park,  
Qingdao, Zip: 266061,  
Shandong,  
Tel: +86 532 88967908,  
Fax: +86 532 88967403  
E-mail:[yuanyl@fio.org.cn](mailto:yuanyl@fio.org.cn)

Ms.Ming LU, Associate Professor  
First Institute of Oceanography,  
State Oceanic Administration,  
6, Road Xian-Xia-Ling,  
High-Tech Park, Qingdao,  
Zip: 266061, Shandong,  
Tel: +86 532 88963908,  
Fax: +86 532 88967403  
E-mail:[luming@fio.org.cn](mailto:luming@fio.org.cn)

Prof.Friedrich Schott,  
Emeritus Prof, IFM-GEOMAR  
Duesternbrooker Weg 20, Kiel,  
Zip:D-24105,  
Tel: 49-431-371540,  
Fax: 49-431-600 4102  
E-mail:[fschott@ifm-geomar.de](mailto:fschott@ifm-geomar.de)

Dr. K Radhakrishnan, Director  
Indian National Centre for Ocean  
Information Services  
“Ocean Valley”, PB NO.21, IDA  
Jeedimetla PO, Hyderabad-500 055, India  
Tel: 00914023895000  
Fax: 00914023895001  
e-mail: [radhakr@incois.gov.in](mailto:radhakr@incois.gov.in)



Mr. T Srinivasa kumar, Head,  
Advisory Services & Satellite  
Oceanography Group  
Indian National Centre for Ocean  
Information Services (INCOIS),  
Ocean Valley, Post Bag No.21,  
IDA Jeedimetla P.O., Hyderabad,  
Ranga Reddy District - 500 055,  
Andhra Pradesh, India.  
Tel: +91 40 23895006  
Fax: +91 40 23895011  
e-mail: [srinivas@incois.gov.in](mailto:srinivas@incois.gov.in)

Mr. Freddy Numberi  
Honorable Minister for Marine Affairs and  
Fisheries, Indonesia

Dr. Indroyono SOESILO  
Chairman, Agency for Marine and  
Fisheries Research  
Ministry of Marine Affairs and Fisheries  
Jl Letjen M. T. Haryono Kav. 52-53  
Jakarta 12770, Indonesia  
Tel/Fax: +62 21 79180458  
[soesilo@rad.net.id](mailto:soesilo@rad.net.id)

Dr. Ridwan Djamaluddin,  
Head of Technology Centre for Marine  
Survey, Agency for Assessment of  
Application of Technology,  
BPPT Building I – 18<sup>th</sup> Floor,  
Jl. M.H. Thamrin 8 – Jakarta 10340,  
Indonesia  
Tel: 62 – 21 – 3168800  
Fax: 62 – 21 – 3108149  
e-mail: [ridwan@webmail.bppt.go.id](mailto:ridwan@webmail.bppt.go.id)

Dr. Jan Sopaheluwakan  
Indonesian Institute of Sciences (LIPI)  
Jl. Gatot Subroto,  
Jakarta

Dr. Aryo Hanggono  
Deputy Director for Technical Services  
Research Center for Marine Technology

Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [arfarhan@geologist.com](mailto:arfarhan@geologist.com)

Dr. Yusuf S. Djajadihardja  
Head of Center of Assessment and  
Application on Natural Resources  
Inventory Technology , Agency for  
Assessment of Application of Technology,  
BPPT Building I – 18<sup>th</sup> Floor,  
Jl. M.H. Thamrin 8 – Jakarta 10340,  
Indonesia  
Tel: 62 – 21 – 3169700  
Fax: 62 – 21 – 3169720

Parluhutan Manurung  
National Coordination Agency for Survey  
and Mapping  
Jl. Raya Bogor KM 46,  
Cibinong – Indonesia  
Tel/Fax: 62 – 21 – 87907730  
e-mail: [parluhutan@bakosurtanal.go.id](mailto:parluhutan@bakosurtanal.go.id)

Sugiarta Wirasantosa, Head of Research  
Center for Maritime Territory and Non-  
Living Resources, Agency for Marine and  
Fisheries Research (BRKP), Ministry of  
Marine Affairs and Fisheries, Jl. MT.  
Haryono Kav. 52 – 53 Jakarta 12770  
Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79191202

Tukul Rameyo Adi  
Research Center for Maritime Territory  
and Non-Living Resources,  
Agency for Marine and Fisheries Research  
(BRKP),  
Ministry of Marine Affairs and Fisheries,  
Jl. MT. Haryono Kav. 52 – 53  
Jakarta 12770 Indonesia

Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79191202  
e-mail: [rameyo\\_adi@dkp.go.id](mailto:rameyo_adi@dkp.go.id),  
[trameyo\\_adi@yahoo.com](mailto:trameyo_adi@yahoo.com)

Zainal Arifin  
Indonesian Institute for Oceanography  
Jl. Pasir Putih I, Ancol Timur,  
Jakarta 14430, Indonesia  
Tel: 62 – 21 – 64713850 Ext. 125  
Fax: 62 – 21 – 64712287  
e-mail: [zarifin@dnet.net.id](mailto:zarifin@dnet.net.id)

Joenil Kahar  
Dept. Geodetic Engineering – ITB  
Jl. Ganesha 10, Bandung 40132, Indonesia  
Tel/Fax: 62 – 22 – 2534286  
e-mail: [joenil@gd.itb.ac.id](mailto:joenil@gd.itb.ac.id)

Drs. Dede Yuliadi, MSc  
Hydro-Oceanographic Service Indonesian  
NAVY, Jl. Pantai Kuta V, No.1 Ancol  
Timur Jakarta Utara  
e-mail: [deyulose@yahoo.com](mailto:deyulose@yahoo.com)  
Tel: 62 – 21 – 64714810  
Fax: 62 – 21 – 64714809

Mr. Agus Santoso  
National Coordination Agency for Survey  
and Mapping, Jl. Raya Bogor KM 46,  
Cibinong – Indonesia  
Tel/Fax: 62 – 21 – 87907730  
e-mail: [santo@bakosurtanal.go.id](mailto:santo@bakosurtanal.go.id)

Mr. Berny A. Subki  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [bernysubki@hotmail.com](mailto:bernysubki@hotmail.com)

Dr. Wahyoe Pandoe  
Technology Centre for Marine Survey,  
Agency for Assessment of Application of  
Technology, BPPT Building I – 18<sup>th</sup> Floor,  
Jl. M.H. Thamrin 8 – Jakarta 10340,  
Indonesia  
Tel: 62 – 21 – 3168800  
Fax: 62 – 21 – 3108149  
e-mail: [wpandoe@cbn.net.id](mailto:wpandoe@cbn.net.id)

Mrs. Maryani Hartuti  
Remote Sensing Application and  
technology Centre  
Indonesian National Institute of  
Aeronautics and Space (LAPAN)  
Jl. Lapan 70, Pekayon Jakarta 13710,  
Indonesia  
Email: [maryani@lapanrs.com](mailto:maryani@lapanrs.com)

Mr. Yudi Wahyudi  
Center of Assessment and Application on  
Natural Resources Inventory Technology  
Agency for Assessment of Application of  
Technology, BPPT Building I – 18<sup>th</sup> Floor,  
Jl. M.H. Thamrin 8 – Jakarta 10340,  
Indonesia  
Tel: 62 – 21 – 3169706  
Fax: 62 – 21 – 3169720  
e-mail: [ywahyudi@webmail.bppt.go.id](mailto:ywahyudi@webmail.bppt.go.id)

Dessi Wulandhari  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [dessi\\_wulan@yahoo.com](mailto:dessi_wulan@yahoo.com)

R. Bambang Adithya Nugraha  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries

Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [badhityan76@yahoo.com](mailto:badhityan76@yahoo.com)

Aulia Riza Farhan  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [arfarhan@geologist.com](mailto:arfarhan@geologist.com)

Sitti Khadijah Nurhapy  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [adeprtkdkp@yahoo.com](mailto:adeprtkdkp@yahoo.com)

Sri Suryo Sukoraharjo  
Research Center for Marine Technology  
Agency for Marine and Fisheries Research  
(BRKP)  
Ministry of Marine Affairs and Fisheries  
Jl. MT. Haryono Kav. 52 – 53 Jakarta  
12770 Indonesia  
Tel: 62 – 21 – 79180303  
Fax: 62 – 21 – 79180188  
e-mail: [suryo\\_dkp@yahoo.com](mailto:suryo_dkp@yahoo.com)

B. Realino, SEACORM (Southeast Asia  
Center for Ocean Research and  
Monitoring), Perancak, Jembrana, Bali  
Tel: 62 – 365 – 44269  
Fax: 62 – 365 – 44278  
Email: [brealinos@yahoo.com](mailto:brealinos@yahoo.com)

Dwiyoga Nugroho  
SEACORM (Southeast Asia Center for  
Ocean Research and Monitoring)  
Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [yoga.seacorm@gmail.com](mailto:yoga.seacorm@gmail.com)

Frida Sidik  
SEACORM (Southeast Asia Center for  
Ocean Research and Monitoring)  
Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [fsidik@cbn.net.id](mailto:fsidik@cbn.net.id)

Komang Iwan Suniada  
SEACORM (Southeast Asia Center for  
Ocean Research and Monitoring)  
Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [komang\\_prtk@yahoo.com](mailto:komang_prtk@yahoo.com)

Bambang Sukresno  
SEACORM (Southeast Asia Center for  
Ocean Research and Monitoring)  
Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [krecex\\_ggm@yahoo.com](mailto:krecex_ggm@yahoo.com)

Ariani Andayani  
SEACORM (Southeast Asia Center for  
Ocean Research and Monitoring)  
Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [Ariani02@yahoo.com](mailto:Ariani02@yahoo.com)

Bayu Priyono, SEACORM (Southeast  
Asia Center for Ocean Research and  
Monitoring), Perancak, Jembrana, BALI  
Tel: 62-365-44269  
Fax: 62-365-44278  
Email: [Bayu109@lycos.com](mailto:Bayu109@lycos.com)

Mr. William ERB, Head  
IOC Perth Regional Program Office, PO  
Box1370, Perth WA 6872, Australia  
Tel: 61 08 9226 2899  
Fax: 61 08 9226 0599  
[w.erb@bom.gov.au](mailto:w.erb@bom.gov.au)

Mr.Keisuke Mizuno, Program Director,  
JAMSTEC, 2-15 Natsushima-cho,  
Yokosuka, Zip: 237-0061  
E-mail:[kmizuno@jamstec.go.jp](mailto:kmizuno@jamstec.go.jp)

Dr.Yoshifumi Kuroda, Group Leader,  
JAMSTEC, 2-15 Natsushima, Yokosuka,  
Zip: 237-0061,  
Tel: 81-46-867-9912,  
Fax: 81-46-867-9885  
E-mail:[kuroday@jamstec.go.jp](mailto:kuroday@jamstec.go.jp)

Dr. Johnson KAZUNGU, Director,  
Kenya Marine & Fisheries Research  
Institute, P.O. Box 81651  
Mombassa, Kenya  
Tel: 254-11 475 151-4  
Fax: 254-11 475 157  
[kazungu@recoscix.org](mailto:kazungu@recoscix.org);  
[jkazunga@recoscix.org](mailto:jkazunga@recoscix.org)  
[jkazungu@kmfri.co.ke](mailto:jkazungu@kmfri.co.ke)

Dr.Fredolin Tangang  
Head, Marine Science Program,  
Faculty of Science and Technology,  
National University of Selangor,  
Malaysia, Zip: 43600  
Tel: +60389213219,  
Fax: +60389253357  
E-mail:[tangang@pkriscc.ukm.my](mailto:tangang@pkriscc.ukm.my)

Mr. Ali Shareef, Meteorologist,  
Dept. of Meteorology, Orchid Building,  
Orchid Magu, Mals" 20-05,  
Republic of Maldives.  
Tel: +960-323302/324524/32347/323084  
Fax: +960-320021  
[admin@meteorology.gov.mv](mailto:admin@meteorology.gov.mv)

Mr. Harry Ganoo, Secretary to Cabinet  
and Head of the Civil Service  
and Chairman of the Mauritius  
Oceanography Institute  
Tel: +230 201 2850  
Fax: +230 208 6642  
Email: [hganoo@mail.gov.mu](mailto:hganoo@mail.gov.mu)

Dr. Mitrasen Bhikajee, Director  
Mauritius Oceanography Institute  
Tel: +230 427 4434  
Email: [bhikajee@moi.intnet.mu](mailto:bhikajee@moi.intnet.mu)

Mr. Tin Aung (Assistant Director)  
Department of Meteorology & Hydrology  
Myanmar  
Email: [dg.dmh@mptmail.net.mm](mailto:dg.dmh@mptmail.net.mm)

Prof. Anthony FORBES, Professor  
Durban School of Life and Environment  
Sciences, University of Natal, Durban  
4041, South Africa  
Tel: +270312603183  
Fax: +270312603183  
[forbesa@biology.und.ac.za](mailto:forbesa@biology.und.ac.za)

Dr. Palitha Nalin WIKRAMANAYAKE  
Lecturer, Open University of Sri Lanka,  
Department of Civil Engineering, Open  
University of Sri Lanka, Nawala,  
Sri Lanka  
Tel: +941853777  
Fax: +941822737  
Email: [tomwiks@yahoo.com](mailto:tomwiks@yahoo.com)

Dr.Kamal Tennakoon, Senior Reserch  
Officer, National Aquatic Resources  
Research and Development Agency, Cow  
Island, Mattakkuliya, Colombo 15,  
Sri Lanka  
Tel: ++94112521008,  
Fax: ++94112521932  
E-mail:[tkdkamal@hotmail.com](mailto:tkdkamal@hotmail.com)

Dr. Desiderius MASALU,  
University of Dar es Salaam  
Institute of Marine Sciences, P.O. Box 668  
Zanzibar, Tanzania  
Tel. +255 24 223 2128;  
+255 24 223 0741 (O)  
+255 24 223 4175 (res.)  
Fax: +255 24 223 3050;  
Mobile: +255 744 462 417  
[dubi@ims.udsm.ac.tz](mailto:dubi@ims.udsm.ac.tz)

Dr. Greg M WAGNER, Lecturer,  
University of Dar Es Salaam, Box 35064,  
Dar es Salaam, Tanzania  
Tel: 255 222410193  
Fax: 255222410480  
Email: [gwagner@udsm.ac.tz](mailto:gwagner@udsm.ac.tz)

Somkiat Khokiattiwong, PhD  
Phuket Marine Biological Center  
Department of Marine and Coastal  
Resources, P.O.Box 60,  
Phuket 83 000, Thailand,  
Email: [somkiat@e-mail.in.th](mailto:somkiat@e-mail.in.th)

Dr.Gullaya Wattayakorn, Deputy Director,  
Aquatic Resources Research Institute,  
Chulalongkorn University,  
Phaya Thai Road,  
Bangkok, Zip: 10330,  
Tel: 662-2185409,  
Fax: 662-2550780  
E-mail:[gullaya@chula.ac.th](mailto:gullaya@chula.ac.th)

Dr.Sidney Thurston, Program Manager  
NOAA Office of Global Programs,  
1100 Wayne Avenue Suite 1210,  
Silver Spring MD, 20910 USA  
Tel: +1-301-427-2329,  
Fax: +1-301-427-0033  
E-mail:[sidney.thurston@noaa.gov](mailto:sidney.thurston@noaa.gov)

Mr.Rene Eppi, Director, International  
Activities,  
DOC/NOAA, 1315 East West Highway  
Rm11230,  
Silver Spring, Zip: 20910, Maryland,  
Tel: 301-713-2469x132,  
Fax: 301-713-1459  
E-mail:[rene.eppi@noaa.gov](mailto:rene.eppi@noaa.gov)

## Meeting Agenda

<b>August 8, 2005 (Monday) Arrival</b>							
19:00 – 21:00	<b>Welcome Dinner and Cultural Show at Poolside</b> Mr. Jana Anggadiredja Mr. Jan Sopaheluwakan						
<b>August 9, 2005 (Tuesday)</b>							
0800 to 0900	<b>Breakfast Meeting</b> Hosted by Indonesian Minister for Marine Affairs & Fisheries, Mr. Freddi Numberi for high-level officials from Indonesian Institutions, IOC, IOGOOS						
0830 to 0900 Hrs	<b>Registration</b>						
0900 to 1000 Hrs	<b>Opening Ceremony (Ball Room)</b> Report by the Deputy Chairman of BPPT, Dr. Jana Anggadiredja Report by the Chairman of IOGOOS, Dr. Radhakrsihnan Speech by IOC Perth Regional Office Programme, Mr. William Erb Report on the Establishment of InaGOOS, Dr. Jan Sopaheluwakan Opening Speech by Minister of Marine Affairs & Fisheries, Mr. Freddy Numberi Hon. Vice Governor of Bali, Mr. Alit Kalakan will be present						
1000 to 1100 Hrs	High Tea; Photo Session, Press Briefing						
1100 to 1300 Hrs	<b>Science Workshop (Ball Room)</b> <table border="1" data-bbox="513 1446 1430 1877"> <thead> <tr> <th>Title</th> <th>Speaker</th> </tr> </thead> <tbody> <tr> <td>Overview of Multi-disciplinary Research on Coastal Marine Environment in South East Indian Ocean</td> <td>Dr. John Keesing</td> </tr> <tr> <td>Towards Modelling the Climate with Coupled AGCM-Ocean Surface Wave-OGCM and its preliminary results</td> <td>Dr. Yu Weidong</td> </tr> </tbody> </table>	Title	Speaker	Overview of Multi-disciplinary Research on Coastal Marine Environment in South East Indian Ocean	Dr. John Keesing	Towards Modelling the Climate with Coupled AGCM-Ocean Surface Wave-OGCM and its preliminary results	Dr. Yu Weidong
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	Ocean Remote Sensing – The Emerging Scenario	Prof. Mervyn Lynch
	Establishment of the Indonesian GOOS [InaGOOS]	Dr. Jan Sopaheluwakan
1300 to 1400 Hrs	Lunch	
1400 to 1530 Hrs	<b>Progress Reports from Working Groups (Ball Room)</b>	
	Indian Ocean Panel on Climate	Dr. Gary Meyers
	Remote Sensing Capacity Building Strategy	Prof. Mervyn John Lynch
	Penaeid Prawn Pilot Project	Prof. A. T. Forbes
	Coastal Ecosystems	Dr. Greg Wagner
	Coastal Erosion	Dr. N. Wikramanayake
1530 to 1600 Hrs	Coffee/Tea	
1730-1830 hrs	<b>Meeting of IOGOOS Officers</b>	
1900-2030 hrs	<b>IOGOOS Dinner</b>	

<b>August 10, 2005 (Wednesday) Round Table Discussions</b>		
0900 to 1000 Hrs	What IOGOOS can contribute to the IOTWS (Ball Room)	
1000 to 1100 Hrs	Coastal GOOS Pilot Projects (Ball Room)	
1100 to 1130 Hrs	Tea	
1130 to 1200 Hrs	Review of TRITON Project and future plan of Indian Ocean Mooring Array	Dr. Yoshifumi Kuroda
1200 to 1230 Hrs	Remote Sensing Applications (Ball Room)	
1230 to 1300 Hrs	Overview of Whale Shark research, Conservation, Management and Tourism in Indian Ocean and a proposal for an IOGOOS Pilot Project for enhanced cooperation in Indian Ocean	Dr. John Keesing

	POGO Activity in the Indian Ocean	Dr. Gary Meyers
1300 to 1400 Hrs	Lunch	
1400 to 1630 Hrs	<b>Break out session</b> of Working Groups– Arjuna Room & Nakula Room	
1630 to 1700 Hrs	Tea	
1700 to 1800 Hrs	<b>Break out session</b> of Working Groups - Arjuna Room & Nakula Room	
1800 to 1900 Hrs	<b>IOGOOS Officers Meeting</b> (Arjuna Room)	

<b>August 11, 2004 (Thursday)</b>		
<b>High-level Meeting to review the IOP implementation plan (Ball Room)</b>		
0900 to 1100 Hrs	Presentations by Panel Members	
	Weather and Intra seasonal Variability-Predictability and managing impacts	Dr. Gary Meyers
	Role of the Ocean in Climate Variability & Change	Prof. Friedrich Schott
	Operational Oceanography	Dr. Neville Smith
	The Integrated Observing System	Dr. Gary Meyers
1100 to 1130 Hrs	Tea	
1130 to 1300 Hrs	Presentations / Comments by High-level Participants Dr. Neville Smith – Australia; Dr. Yeli Yuan – China; Dr. Francois Gerard – France; Dr. Radhakrishnan – India; Dr. Sugiarta Wirasantosa – Indonesia; Dr. Jan Sopaheluwakan - Indonesia; Dr. Hiroshi Kuroda - Japan; Mr. Harry Ganoo – Mauritius; Dr. Kamal Tennakkoon – Sri Lanka; Dr. Koblinsky Chester – USA;	
1300 – 1400 Hrs	Lunch	



1400 – 1500 Hrs	Activities of MERCATOR	Dr. Francois Gerard
	Regional LOICZ Nodes & Potential Collaboration with IOGOOS	Dr. Nalin Wikramanayake
	Activities of SEAGOOS & Potential Collaboration with IOGOOS	Dr. Somkiat Khokiattiwong
1500 – 1600 Hrs	Presentation of Working Group Reports	
1600 to 1630 Hrs	Tea	
1630 –1800 Hrs	IOGOOS Work plan Discussions	
1800 – 1900 Hrs	IOGOOS Annual Meeting Only for IOGOOS Members (Existing and New)	
1900 Hrs onwards	Annual Meeting Dinner ( <b>hosted by InaGOOS</b> ) at Jimbaran (by Bus)	

<b>August 12, 2005 (Friday) (Ball Room)</b>	
0900 onwards	Finalisation of Work Plan Conclusions/Recommendations

**Speech of Minister of Marine Affairs and Fisheries Freddy Numberi**

The participants of IOGOOS Workshop and the 3<sup>RD</sup> IOGOOS Annual Meeting, Distinguished guests, Ladies and Gentlemen.

Good Morning. First of all, I would like to welcome you to the beautiful island of Bali for the opening of the IOGOOS Workshop and the 3<sup>RD</sup> IOGOOS Annual Meeting, and also the declaration of the Indonesian Global Ocean Observing System, or the INAGOOS. I want to thank the IOGOOS committee for giving the opportunity to Indonesia to host this meeting.

The beginning of this millennium is a critical time for humanity since it has proved to be a time of unprecedented scientific discovery, with more new insights gained about ourselves, the nature of the earth and the universe beyond what human has ever imagined.

The challenge was and still is daunting. The role of the ocean in the global climate system, the increasing volume of commodities transported by sea, and the need to sustain and protect marine fisheries will force us to pay much more attention to the open ocean and coastal seas over the next decades. Minimizing loss of life and property and avoiding environmental disasters requires significant improvements in the information available. The Indian Ocean Global Ocean Observing System or IOGOOS has clear mandates to respond to these needs.

As noted in the IOGOOS strategic planning, the activities on coastal module have been developed, including the region-specific observations. I am particularly interested in this aspect since the coastal regions are predicted to become vulnerable to global warming, including sea level rise, changing erosion, flooding, salt intrusion, just to mention a few of the risks we are facing. Consequently, an integrated network of observing systems would help in better understanding these potential catastrophes.

Distinguished guests, ladies and gentlemen, As the third largest ocean in the world and occupies an area of about 73.44 million km<sup>2</sup> between its northernmost extremity and 40<sup>0</sup>S latitude, and accounts for 30% of the global population, the Indian Ocean has been greatly overlooked. This notion was changed dramatically when the tsunami hit this area in December 2004, resulting in the largest ever recorded victims.

Therefore, I see this as a challenge for IOGOOS to be able to coordinate the various elements of an observing system for the whole Indian Ocean, as well as, to develop and implement pilot projects that should be a basin scale or more in its scope.

I also believe that we need to collectively and collaboratively invest our time, effort and funds in gaining additional value from the scattered data and scientific knowledge that exist in time-series manner. Meta-analysis of existing studies grouped into a mosaic of coastal ecosystems, will help define local variability and locations with the highest sensitivity to environmental change. Essentially, this is the main objective of IOGOOS

to meet the challenge of the next decades in building our strategy to protect and conserve the marine environment.

Distinguished guests, ladies and gentlemen, I want to take you back to the early days of the development of modern oceanographic expedition in Indonesia, which marked by the launching of “Operasi Baruna” or the Baruna Operation, in 1963. Since then, Indonesian scientists have been actively collecting oceanographic and atmospheric data through in-situ and ex-situ observations.

Another milestone of Indonesian oceanographic research development has been the inauguration of “Baruna Jaya” fleet, comprising of 6 research vessels that are fully equipped for coastal and off-shore research activities. Also, the establishment of Satellite Receiving Ground Station in 1976 was another high time for ocean and atmospheric studies in Indonesia, that has significantly increased the capability of our scientists in dealing with large and wide area of the ocean using remotely sensed data.

I should also point out that here in Bali, we have another facility for remote sensing data, which is called the Southeast Asia Centre for Ocean Research and Monitoring or SEACORM. I hope all of you will have the opportunity to visit that facility.

I must also mention here that after the recent Tsunami event, Indonesia has developed an integrated Tsunami Early Warning System that gives tremendous improvement to our scientists in better understanding this natural phenomenon. This integrated system should be able to work in timely and orderly manner.

I hope that the output of this meeting will also be followed by the improvement of capacity building of our scientists, especially in the field of Operational Oceanography. Indeed, I believe the IOGOOS, and the soon-to-be-launched INAGOOS will play a major role in the implementation of the ocean observing system programme being developed in each individual country, but also in the regional level as well.

Ladies and Gentlemen, It is my outmost pleasure to announce before you that through a culmination of years of collaborative work by the Indonesian scientific community, we can finally bring together the Indonesian node of the Global Ocean Observing System or the INAGOOS.

The data collected by this system will vastly improve our domestic understanding of our ocean, coastal and atmospheric environments, as well as to position our scientists to exchange information with other regional and global partners. Also, I believe this system will be a very important node for both the Indian Ocean Observing System and the Global Ocean Observing System.

Distinguished guests, ladies and gentlemen, I wish you the best of time during the workshop, and please enjoy the beauty that Bali could offer you.

Finally, I now declare the launching of the Indonesian Global Ocean Observing System (INAGOOS), and the official opening of the IOGOOS Workshop and the 3<sup>RD</sup> Annual Meeting.

**Opening statement of Mr. William Erb, Head of IOC Perth Regional Programme Office**

Minister Numberi, Minister Soesilo, High Level Officials, IOGOOS Officers and Members and invited guests. Good morning and welcome to this our Third Meeting of the Indian Ocean GOOS Regional Alliance. On behalf of the IOC it is my honor to greet you and to express my good wishes for a successful meeting.

IOGOOS has been recognized as one of the successes in the development of GOOS. IOGOOS was officially launched in Mauritius in 2002, with outstanding support by the Mauritian government under the leadership of Mr. Harry Ganoo. Our secretariat was officially established at that time at INCOIS in Hyderabad and it has been ably led by Dr Radhakrishnan and supported by Srinivas Kumar. Dr Harsh Gupta, who could not be here with us today as he has recently retired, chaired our first IOGOOS High Level Meeting which was held in Delhi in 2001. Dr Gupta has been a friend and leader of IOGOOS over these many years. For this we are grateful.

Last year our annual meeting met in Colombo, with wonderful support from Kamal Tennakon and his staff at NARA. IOGOOS II set in place a number of activities, which we will review at this meeting.

The tragic event of Boxing Day of course has impacted IOGOOS just as it has the entire region. The energy and focus of attention in the region has turned to the tsunami, the warning system and recovery from the event. Some of the important projects within IOGOOS, which we had envisioned completing have been neglected. At this meeting we have to reassess where we are, re-prioritize and continue the work that has been started.

One project that has continued to flourish is the Indian Ocean Panel for Climate project co-sponsored by IOGOOS, IOC and CLIVAR. It will be the focus of our high level meeting and this will be the first time that the results of the Panel will be reported. We hope to hear from our high level guests, their reaction to it and learn of their plans for related activities in the Indian Ocean region.

Tsunami planning in the IOC context is part of GOOS and there are many obvious components of GOOS that contribute to tsunami warning. It is acknowledged that governments organize themselves using different agencies for their warning system structure than those used for GOOS. Within GOOS our sea level, moored buoys and data programmes may be helpful in ways for the IOTWS. Also our network and capacity building. We hope to explore this during our meeting.

The IOC has taken on the greatest challenge of its time in supporting the development of the tsunami warning system. Last week the IOC inaugurated the opening the Intergovernmental Coordinating Group Secretariat as part of the IOC Perth Regional Programme Office in Australia. The First meeting of the ICG resulted in a number of

ongoing working groups, which will help build the system. Australia has kindly provided full support for the operation of the Secretariat and its related activities.

So as you can see we have a very full and interesting agenda and we are operating in exciting times. I look forward to talking with you over the next few days and planning our way forward. I particularly appreciate that the high level officials have taken time from their busy schedules to be here with us this week. I thank the Government of Indonesia for their kind hosting of IOGOOS III in this beautiful setting and particularly all the organization that Ridwan has undertaken.

## **Consolidated Progress Report of Coastal Working Groups**

### **Remote Sensing and Participatory In Situ Monitoring of Keystone Ecosystems for Improved Management of The Coast Zone and Its Resources/Biodiversity – Progress Report by Dr. Greg Wagner**

#### **Progress since IO-GOOS II at Colombo, Sri Lanka**

- Input received at IO-GOOS II (Colombo) and the Coastal Zone Asia Pacific (CZAP) Conference in Brisbane, 5-9 September 2004
- Some additional input received through email
- Some basic information for Country Implementation Plans for 8 out of the 11 countries that have shown interest in the Project
- Budget and plans prepared for a Pre-project Planning Workshop to finalize the proposal with respect to methodologies, implementation plan, budget, responsible institutions/individuals etc.
- Budget drafted for parts of the project proposal
- New work plan and timeframe prepared

#### **Penaeid Shrimp Pilot Project in the Indian Ocean – Progress Report by A.T.Forbes & N.T.Demetriades**

Introduction: This project was conceived at the inaugural meeting of the IOGOOS programme in Mauritius with the intention of meeting the goals of GOOS in the Indian Ocean. The shrimps were seen as a unifying attraction which would draw in scientists engaged in research on this biologically interesting and commercially significant group of organisms as well as people involved in research on physical and chemical processes and the significance of climate change in the coastal zone, i.e. at the interface between oceanic and catchment processes and finally the users of this natural resource.

Developments to Date: In June 2003 I made known the existence of the proposal at a meeting of the IGBP in Banff, Canada. A workshop was subsequently held in Perth at the end of 2003 attended by delegates from Australia, Bangladesh, India, Kenya and South Africa each of whom presented an account of the major features of the prawn fisheries in their home countries. Word of the workshop spread and contact was established with researchers in Tanzania, Mozambique, Iran and Malaysia. These aspects were reported at IOGOOS II in Sri Lanka in 2004.

In January 2005 I brought the proposal to the attention of LOICZ (Land Ocean Interaction in the Coastal Zone), a programme of IGBP, and where I am a member of the Scientific Steering Committee. Support was expressed for my further involvement in the pilot project and I was requested to give consideration to the possible extension of the programme.

My recent focus has been on the preparation of a review document covering all available information on the South African prawn fishery which has been submitted to the South African Directorate of Marine and Coastal Management. This document is especially relevant for the website which has been constructed although at this stage it includes only Australia, India and South Africa in order to test and obtain comment on the layout and content as well as general reaction to the proposal. This version will be demonstrated for discussion and comment at the Bali meeting and will incorporate the South African review document.

The content and design of the website is intended to meet GOOS objectives such as network facilitation, data exchange and capacity building amongst researchers and students and also to allow for use by a wider range of people who might share a common interest in the shrimps/prawns of the Indian Ocean or in the mechanics and processes that are features of the different types of coastal zones around the Indian Ocean and which influence these organisms . Possible users are anticipated to include managers, government and non-governmental institutions, research centres, Universities, research students and aquaculturists as well as climatologists and oceanographers interested in the implications of global climate change and human impacts on coastal resources. The intention was to make the website as user friendly as possible as it was assumed that not all users would necessarily speak English as a first language.

We have benefited as regards website design and expectations of possible outcomes from discussions with Dr Peter Rothlisberg who has had many years of experience with Australian penaeids and international co-operative projects while at the CSIRO marine laboratories in Brisbane, Australia. While the website will be hosted in the short term by Marine and Estuarine Research in Durban our expectation in the longer term is that it will become part of the IOGOOS site. The initial phases of the programme, including the setting up of the website have been largely sponsored by the International Oceanic Commission office in Perth, Australia but extension and further development will require new sources of funding.

### **Development of the Pilot Project on Shoreline Change – Progress Report by Dr. Nalin Wikramanayake**

Introduction: Coastal erosion was identified as one of the critical problem in the coastal areas by the participants at the first meeting. As the position of the shoreline is one of the key variables identified by the COOP program it was decided that a pilot project on monitoring of the shoreline should be developed under IOGOOS.

The aim of the project is to establish a Regional Network to quantify, understand and predict shoreline change.

The objectives of the project are as follows:

- 1) To assess historical data on shoreline change, establish trends and place these in the context of coastal geomorphology, hydrodynamic regime and natural and anthropogenic drivers of change.
- 2) To establish an adequate, cost effective system to monitor changes in the shoreline and coastal morphology.
- 3) To develop a quantitative understanding of coastal processes and the relationship between shoreline change and the various natural and anthropogenic drivers.
- 4) To develop the ability to make predictions of shoreline change due to extreme events

The outline of the project proposal is given in Appendix 4.

#### Progress since Second Meeting

The progress since the last meeting is discussed against the points in the action plan agreed on at that meeting. Additional activities are discussed afterwards.

- 1) Develop a network of contacts, institutions and countries interested in participating in the project

As explained at the last meeting an e-group was set up to facilitate discussions, information sharing and project development. A request for preliminary country information on existing monitoring, coastal zone management framework and current knowledge of coastal processes was circulated to all the participants in the coastal section of the first meeting.

Over 30 individuals from 15 countries were contacted. However the response was minimal. Some of the contacts identified others as subject specialists – but there was no response from these specialists. Recent attempts to renew contacts through WIOMSA have also failed.

It is clear from the experience of the last two and a half years that this method of generating interest in the project is not successful. There has to be recognition at the national level – including national coastal zone management and national scientific funding bodies - that the project is important. Setting up national GOOS committees would be a way to generate this national consensus.

Such an approach has been initiated in Sri Lanka in connection with the regional implementation of the Land-Ocean Interactions in the Coastal Zone (LOICZ) project. The national committee consists of natural and social scientists as well as representatives from the principal coastal zone and environmental management agencies. This approach will be initiated in the other countries in South Asia later this year.



As LOICZ is concerned with the delivery of scientific results for coastal management and GOOS is concerned with the monitoring of coastal variables and the delivery of derived products for coastal management it is clear that the two programs have a mutually beneficial agenda. Therefore the national GOOS and LOICZ committees should be linked closely.

2) Obtain information on the coastal zone management framework, state of knowledge of coastal processes and existing monitoring programs for these countries

The information received was very limited due to the poor response to the emails. Some useful information was contained the report of the UNEP/WIOMSA Coastal Erosion Workshop held in Nairobi in November, 2002 – just after the first IOGOOS meeting. Several case studies of coastal erosion from East Africa and Western Indian Ocean were presented and many follow-up activities planned. According to Dr. Kitheka of UNEP a regional synthesis report has been produced recently. The capacity building workshop for this region could build on what was presented at this workshop and any further work that has been done in the last 2 ½ years.

Some information on coastal erosion processes on the islands of the Indian Ocean was obtained from Prof. Virginie Cazet-Duvat of Reunion. She expressed her interest in the project but stated that she would be too busy to get involved until late in 2005. A manual – in French - on simple methods of monitoring shoreline change has been developed for use in such islands.

3) Interact with the Coastal Ocean Observations Panel (COOP) panel to develop suitable and feasible methodologies for monitoring

The draft of the Strategic Implementation Plan for the Coastal Module of the Global Ocean Observing System was made available for review in October, 2004. Dr. Wikramanayake was invited to review the document. The review comments submitted to the IOC are in Appendix 5. The comments made by Dr. Wikramanayake on the predecessor to this report – The Integrated, Strategic Design Plan for the Coastal Ocean Observations Module of the Global Ocean Observing System – are in Appendix 6.

The most important issues raised in these comments that are relevant to the development of the pilot project are

a) Archiving and hindcasting historical data with special reference to catastrophic events – a good example of the use of historical data to carry out a preliminary assessment is given in the paper presented at CZAP (Appendix 3). Hindcasting a catastrophic event would have the following benefits:

- i) Test the proposed monitoring and modelling systems
- ii) Demonstrate the value of the project to decision makers and the public

b) Development of measurement and data standards appropriate to the countries involved and the personnel carrying out the in-situ monitoring

The COOP document does not go to the level of detail of providing specifications for individual variables. It is expected that any experience gained with different categories of instruments and methods will be submitted to COOP when the newly constituted panel (renamed POCO) sets up a working group to deal with shoreline change.

4) Identify the relevant ocean data products from remote sensing and global models

Compilation of a list of relevant ocean data products was begun by searching the internet and contacting experts. The details collected so far are summarized in Appendix 1. The compilation is yet incomplete.

5) Initiate shore line change monitoring system in Sri Lanka

The Coast Conservation Department (CCD) of Sri Lanka had developed a pilot project of community based monitoring of shoreline change. At the Second Meeting it was decided that this also be considered as a test of methodologies proposed by the pilot project. Dr. Wikramanayake attended a planning meeting at the CCD to discuss monitoring shoreline change and the pilot project and briefed the participants on the IOGOOS project.

The pilot project was planned to begin in January 2005 in a village on the south coast of Sri Lanka. However the plan has been postponed indefinitely after the tsunami. Some of the simple methods proposed for shoreline surveys were used in a post-tsunami assessment of sand dunes and beach morphology on the south-east coast.

6) Plan the next project development meeting, which may coincide with the next IOGOOS meeting

No specific planning for a project development meeting as part of the Third IOGOOS meeting was done. This was primarily due to the inability to generate sufficient regional interest. As stated in the first section, it is unlikely that any plans developed at the meeting will be implemented if there is not recognition of the initiative at the national level.

The following activities were planned for the Third Meeting at the Second Meeting.

- i) Review country information
- ii) Develop methodology for preliminary assessment
- iii) Identify capacity building needs
- iv) Discuss results of pilot project
- v) Develop final proposal

As discussed in section 1) and 2) sufficient information related to items i) and iii) is not available due to poor response. The pilot project in Sri Lanka - item iv) – has not begun.

Therefore it is proposed that the further development of the proposal be carried forward by a series of workshops. These workshops could include

i) Workshop on monitoring, understanding and predicting shoreline change – as outlined in Appendix 4

ii) Workshops on the linking of existing coastal and monitoring data – such as produced by GCRMN, Seagrassnet, GLOMIS, fisheries, national programs etc. – to land and ocean processes – possible joint activity between GOOS and LOICZ – as outlined in Appendix 5

It is expected that these workshops would serve to raise the profile of shoreline change at the national level and also generate the basic information listed in section 1) that is needed to develop the details of the proposal. The capacity building needs of individual countries and also the region as a whole would also be identified during these workshops.

7) Participation in Special Session on GOOS/LOICZ Interactions at the Coastal Zone Asia-Pacific (CZAP) 2004 Conference

Dr. Wikramanayake participated in this session and made a presentation outlining the pilot project and the Sri Lankan experience in monitoring and managing shoreline change. The discussions that followed the presentations made at this session resulted in a general agreement on how the two programs could interact.

## Report of IOGOOS WG on the IOTWS

### 1. Topics discussed

- Sea level measurements
- Deep-sea moorings
- Ocean modeling
- Vulnerability and risk studies
- The multi-hazard framework (global, ocean-related)
- Communication to the ICG/IOTWS

### 2. General

The IOTWS is being built as a permanent system, informed by a number of Indian Ocean national tsunami warning centres, and by advice from Warning Centres from beyond the Indian Ocean. Nations will take responsibility for the issuance of warnings based on such advice.

The IOTWS will comprise an interoperable system of interconnected networks and capabilities coordinated by the ICG/IOTWS and include:

- A basin-wide network of island and coastal tide gauges for confirmation (or denial) of tsunami and to provide direct evidence on the magnitude. They will also provide data for testing and validating models, both in scenario-building mode and as forecasts/hindcasts. For critical sites, data will be collected at at least 1 minute intervals and transmitted in real-time (e.g., 15 minute blocks), perhaps with options to transmit more rapidly in times of threat.
- A targeted network of deep-sea pressure measuring DART-like moorings (tsunameters), mostly located off the Sumatran Trench in the eastern Indian Ocean and around the Makran source in the Arabian Sea. Total numbers are likely to be in the range 10-16. Systems will typically transmit in 1 hour blocks and be triggered into real-time links when major perturbations are detected.
- Ocean forecast models, initialized by sea floor perturbations estimated from seismic data and (usually) constrained by assimilated ocean pressure and sea level data. There will usually be open-ocean models and coastal embedded models, perhaps down to fine scales for inundation forecasts. These same models would also be used to construct scenarios and a subset of the scenarios will be selected based on the observations.
- Vulnerability and risk assessment models where the risks to human life, the built environment and the natural environment are assessed based on possible tsunami scenarios. The IOC Assessment process will be important for setting priorities in this area.
- A system of Centres, equipped and operated by a subset of the Indian ocean nations and with a level of capability in most if not all of the areas listed above. These Centres will generate alerts, advisories and warnings within their jurisdiction and, as agreed, for others. National Centres will have varying capabilities but will formally have the responsibility for issuing and canceling warnings for their nation, based on advice from the above and elsewhere.

For the IOGOOS, we would assume interim capability will be established in 2006 and that full capability will be established incrementally over 2006-2009. The ICG/IOTWS is fully aware of sustainability issues and is committed to a multi-hazard framework.

### 3. The Sea Level Observing System

- Like the IOGOOS, it is accepted that GLOSS will coordinate the implementation of the sea-level observation network, with emphasis on strategic locations for monitoring tsunami, in real-time.
- Many sites will be co-located with existing GLOSS sites that were established mostly for the purposes of climate.
- Our ocean and coastal prediction requirements will be satisfied by the IOTWS upgrades.
- Note that long-term drifts in the absolute sea level are germane to the long-term operation of a tsunami network since such drifts (either from sea level rise or subsidence) do impact inundation and vulnerability. Such activities also contribute to the overall quality of the data.
- **Agree that an Indian Ocean GOOS person should be nominated to join the ad hoc sea level working group established by ICG-1 under the leadership of Dr B. Kilonsky.**

### 4. The deep-sea mooring network

- Noted that the construction of moorings for tsunami and climate are different with the former having a small surface expression and requiring less-frequent servicing (2 years for mooring; 4 years for pressure sensor).
- The siting of moorings is driven by separate scientific considerations.
- Noted that there are opportunities for IOP array to piggy-back on tsunami sites, e.g. by deploying a subsurface mooring that took advantage of the same acoustic coupling [need to test impact on energy supply], or by deploying at a nearby site with a bottom pressure sensor, as a backup for the dedicated site. Conversely, there are opportunities for the IOTWS to add additional bottom pressure sensors at climate sites, perhaps only being triggered on demand [need to look at reporting requirements since latencies longer than an hour probably make the data useless].
- There are commonalities in the technology challenge with shared interests in reducing the likelihood of damage, in the mooring technology itself, and on instruments.
- The most obvious linkage between the activities of IOGOOS and the IOTWS is through logistical support and demands on ship time. The IOP has established a list of scheduled cruises in the area and opportunities to piggy-back on IOTWS work should be explored. This database could be extended with the cooperation of the ICG/IOTWS to include planned IOTWS work.
- **The IOGOOS to identify an individual familiar with the rationale and plan for the IOP network should join the IOTWS mooring discussion group.**

### 5. Ocean modeling

- The class of models being used for the IOTWS has much in common with tide and storm surge models. Both have strong dependencies on knowledge of bathymetry.

- Though the nature of storm surge and tsunami waves means they have somewhat different inundation characteristics, the vulnerability is common.
- The ICG/IOTWS is interested in establishing a robust framework for documenting and testing candidate and operational models, in order to ensure that operational systems are robust and known. The needed information include characteristics of the model, the way data are assimilated, data used to test the model, and the forecast environment.
- We conclude that the operational environment for tsunami models is likely to be similar or the same as that used for operational oceanography and that we would encourage sharing of infrastructure – this will assist the durability of the IOTWS.
- **IOGOOS to ensure that several people from IOGOOS agencies, with knowledge of IOGOOS and its work beyond tsunamis, participate in the Hyderabad Ocean modeling Workshop (12-13 Dec 2005).**
- Our long-term view is that a group with a broad mandate in operational ocean modeling be formed, to ensure that the work of the group can be sustained. This would allow experts in tides, waves and ocean prediction (e.g., currents) to be involved.

## 6. Vulnerability and Risk Assessment

- For risk assessment within a multi-hazard framework, many aspects of vulnerability are common, though the specific nature of individual hazards impacts the risk assessment.
- Just as the ICG/IOTWS has agreed to work toward a better characterization of tsunami as a hazard, based on likely earthquake scenario, **the IOGOOS could commit to provide a better characterization of other hazards such as sea level changes arising from climate and climate change; intra-seasonal/tropical cyclone events including both direct (wind, flooding) and indirect (storm surge) effects; coral bleaching; and the vulnerability of the ocean environment (reefs, ecosystems, etc.).**

## 7. The multi-hazard framework

- Noted that the resolution of the 23<sup>rd</sup> Assembly is rather vague in terms of what this framework will be.
- All are agreed that tsunami should be considered alongside other hazards, particularly when it comes to risk assessment, warning systems, and education and communication (of warnings).
- Believe the **IOGOOS should participate in the planned workshop (1<sup>st</sup> quarter of 2006), with the areas touched on in 6 to be the main topics of the paper.**

## 8. Communication to ICG

- Agreed that this discussion should form the basis of a communication to the ICG Chair and Officers.
- Should also emphasise the need to keep communication lines open and to ensure the ICG Secretariat and IOGOOS Office work closely together.

\* Kamal Tennakoon (Sri Lanka) wishes to be part of any forward discussions.

## Report of IOGOOS WG on Coastal GOOS

## Attendance

Australia	Dr John Keesing (john.keesing@csiro.au), Strategic Research Fund for the Marine Environment (Chairman) Dr Ray Steedman, WAGOOS
India	Dr. Mahesh D. Zingde, National Institute of Oceanography, Four Bungalows, Andheri West, Mumbai 400 053, India (mzingde@darye.nio.org)
Indonesia	Dr Zainal Arifin (zarifin@dnet.net.id) Research Centre for Oceanography (LIPI) Agus Santoso (santo@bakosurtanal.go.id) National Coordination Agency for Survey and Mapping (BAKOSURTANAL) Wahyu Pandoe (wpandoe@cbn.net.id) Agency for the Assessment and Application Technology (BPPT) Dessi Wulandhari (dessi_wulan@yahoo.com) Agency for Marine and Fisheries Research (BRKP) Ministry of Marine Affairs and Fisheries (DKP) Berny A. Subki (bernysubki@hotmail.com) Agency for Marine and Fisheries Research (BRKP) Ministry of Marine Affairs and Fisheries (DKP) Sitti Khadijah Nurhappy (adeprtkdkp@yahoo.com) Agency for Marine and Fisheries Research (BRKP) Ministry of Marine Affairs and Fisheries (DKP) Dwiyooga Nugroho (dwiyooganugroho@yahoo.com) Agency for Marine and Fisheries Research (BRKP) Ministry of Marine Affairs and Fisheries (DKP) R. Bambang A.N (badhityan76@dkp.go.id) Agency for Marine and Fisheries Research (BRKP) Ministry of Marine Affairs and Fisheries (DKP)
Kenya	Dr Johnson Kazungu, Kenya Marine and Fisheries Research Institute
South Africa	Professor Anthony Forbes, University of Natal
Sri Lanka	Dr Nalin Wikramanayake, Open University of Sri Lanka
Tanzania	Dr Greg Wagner, University of Dar es Salaam Dr Desiderius CP Masalu, Institute of Marine Science, University of Dar es Salaam
Thailand	Dr Somkait Khokiattiwong, Phuket Marine Biological Center Dr Gullaya Wattayakorn, Chulalongkorn University

## Background

1. Three IOGOOS Coastal Pilot Projects formulated IOGOOS I in Mauritius 2002. (a) Penaeid Prawns, (b) Monitoring Coastal Erosion (c) Monitoring Keystone Coastal Ecosystems

2. These projects were further planned and progressed between IOGOOS I and IOGOOS II and between IOGOOS II and IOGOOS III.
3. A further project on IO cooperation on whale sharks migration and its links to oceanography was also proposed at IOGOOS III.
  - It was also reported to the IOGOOS III meeting that the COOP Implementation Strategy for the Coastal Module of GOOS had been adopted by IOGOOS had recommended the following projects be developed and implemented: Marine Impacts on Lowland Agriculture and Coastal Resources (MILAC)
  - Global methods for developing, evaluating and improving ocean colour products in the coastal zone
  - Coupling Shelf and Deep Ocean Models
  - Coastal Ocean Data Assimilation Experiment (CODAE). This provided the opportunity to consider the fit of the current and proposed pilot projects to the COOP Implementation Strategy for the Coastal Module of GOOS and to evaluate if there were other projects or activities that might be proposed consistent with these It was recognized that this was the first opportunity for Indonesian delegates to contribute to group discussion on the IOGOOS Coastal Projects and as such they were invited to contribute information on existing and planned activities in Indonesia of relevance to, and with the potential to link to IOGOOS Coastal Projects.

**Group:** The objectives of the Working Group were to

1. For existing projects, progress Development/Implementation/Delivery: (a) Progress Planning for firm time lines on the development of project plans, implementation schedules and the delivery of outputs (b) Identify clear milestones in development/implementation/delivery between now and IOGOOS IV. (c) Identify key people / networks / organisations critical to success (d) Identify Implementation / Delivery Issues
2. Determine the fit of projects to the COOP strategy for the Coastal Module of GOOS plan
3. Identify new possible projects
4. Receive reports from delegates in Indonesia and elsewhere

### **Report of Working Group Deliberations**

#### **1. Penaeid Prawn Pilot Project**

Proponent: Professor Anthony Forbes, University of Natal, South Africa

The foundation of the web site has been constructed with an emphasis on graphics and user friendliness as it is intended to be accessed as a general source of



information and used not only by researchers in the field. At this stage it is populated by data describing the South African situation but will be extended in the near future to include those countries where contacts have already been established. These countries include Mozambique, Tanzania, Kenya, Iran, India, Sri Lanka, Bangladesh, Malaysia and Australia. Additional contacts in Indonesia and Thailand were established at the IOGOOS III meeting. These contacts will simultaneously be involved in the refinement of the structure and content of the website to allow for local priorities. This extension of the website will require additional funding.

As the original motivation for the prawn programme included the significance of these animals as integrators of oceanic and catchment interactions, consideration will be given to the use of the Thukela Bank off South Africa as an initial study area to couple long term catch and catchment runoff data with archived remote sensed data of the local oceanic environment.

It is expected, pending adequate funding, that the bulk of the website details will be completed by the end of 2005 and the site hosted by the IOGOOS secretariat on the website by mid-2006 in advance of the IOGOOS IV meeting.

The Penaeid Prawn Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS.

## **2. Coastal Erosion Pilot Project**

Proponent: Dr Nalin Wikramanayake, Open University of Sri Lanka

In order to progress the pilot project a number of important steps were identified as follows. These relate principally to gauging continued interest in the project, a project planning and capacity building workshop. A number of these items request support from the IOGOOS Secretariat to promote interest in the project and to help source funding. (1) Gauge interest in this project at WIOMSA Meeting in – beginning September 2005, (2) Poster/Written Information provided to WIOMSA – Dr. Wikramanayake to develop flyer/poster to be sent from IOGOOS provide to Dr. Bhikerjee to deliver, (3) Workshop proposed, follow up to UNEP Workshop, these may be regional depending on level of interest – March 2006, (4) Workshop(s) would require funding IOGOOS? IOC? UNEP?, (5) Seek support from IOGOOS to promote projects for funding by member countries (they should need to nominate relevant agency, funding source) important to do this before committing funding to that countries participation in workshop), (6) Seek to integrate post-tsunami monitoring of shoreline recovery into the proposal development process

Dr Wikramanayake also tabled outline of the proposed workshop which is attached as Appendix I to this report.

The workshop will combine capacity building and proposal development. The specific capacity building needs will depend somewhat on the state of knowledge in

each country. The workshop may be held regionally if existing regional groupings can be made use of.

The aim of the workshop is to develop the capacity of the participants to use existing historical data on shoreline change and a knowledge of coastal processes and forcing from the land and the ocean to obtain a preliminary understanding of the reasons for the changes and design a monitoring system.

Participants at the workshop would be coastal scientists with some background in coastal physical oceanography, coastal sediment transport and the use of remote sensing. It may be necessary to invite separate participants to bring in the remote sensing expertise in some cases. Participants would be required to compile a status report on shoreline change in their countries before the workshop.

This report would include a description of the shoreline, information on waves, tides and riverflows, available information on shoreline change, a summary of previous studies of shoreline change, a description of the coastal zone management framework and details of past or current monitoring. IOGOOS may assist in this stage by providing some remote sensing images for analysis and also data on waves, wind etc. from remote sensing and global models.

The outputs of the workshop would include (1) An improved, quantitative understanding of shoreline change (2) A list of priority studies needed to improve this understanding (3) A design for a monitoring system for shoreline change, including identified sites, institutional responsibilities for each country, methodologies, costs, etc.

These outputs would be used to develop a detailed proposal for the pilot project in time for IOGOOS IV.

The Coastal Erosion Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS.

### **3. Coastal Ecosystems Pilot Project**

Proponent: Dr Greg Wagner, University of Dar es Salaam, Tanzania

The project has established some contacts made in the countries listed below, though there is a need to firm up these contacts and get commitments.

Australia, Bangladesh, India, Indonesia, Iran, Kenya, Mauritius, Reunion, Sri Lanka, South Africa, Thailand, Tanzania. Prof. Mervyn Lynch has been contacted re capacity building in Remote Sensing and there is likely collaboration also with CORDIO, WIOMSA.

In order to progress the Coastal Pilot Project the following steps were identified leading up to a project planning and capacity building workshop. A number of these

items request support from the IOGOOS Secretariat to promote interest in the project and to help source funding. (1) Hold preliminary discussions at WIOMSA Symposium– early Sept 2005, (2) Hold project planning workshop on 16 –20 February, Uni of DSM (re-evaluate venue). The overall objective of this workshop will be to finalize the project proposal for submission to donors and discuss details of how to implement the project. Specifically, the following will be discussed: (a) Agreement on methodologies; (b) Work plan and timeframe (c) Overall project implementation (d) Country Implementation Plans - Lead Implementing Institutions/individuals responsible, Collaborating institutions, Study sites (e) Resources and equipment available (f) Resources and equipment required (g) Budget, (3) IOC, WIOMSA, CORDIO may provide airfares for limited numbers and/or other support, (4) Identify funding sources for the project – CoML, IOC, POGO?, (5) Establish links to other projects, (6) Seek support from IOGOOS to promote projects for funding by member countries (they should need to nominate relevant agency, funding source) important to do this before committing funding to that countries participation in workshop), (7) The Work plan/Timeframe for the project has been revised as set out in Appendix 2 of this report

By IOGOOS IV it is planned to report that the project proposal, including all country plans, is finalised and approaches made to international and national donors.

The Coastal Ecosystems Pilot Project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS.

#### **4. New Proposals**

##### **A. ENHANCED COOPERATION IN OBSERVATIONS ON WHALE SHARKS IN THE INDIAN OCEAN**

Proponent: Dr John Keesing, Research Director, Strategic Research Fund for the Marine Environment, CSIRO, Australia

##### **Proposal:**

The proposal emanated from the 1<sup>st</sup> International Whale Shark Conference held in Perth, Australia in May 2005. The Conference had delegates and/or reports from 23 countries worldwide including the following from the Indian Ocean: South Africa, Madagascar, Seychelles, Kenya, Djibouti, Maldives, India, Sri Lanka, Bangladesh, Thailand, Indonesia, Christmas Island, Australia. Other countries in the region represented included Singapore, Taiwan and Philippines.

The conference issued a Communiqué calling for world wide halt to Whale Shark harvesting, enhanced collaboration in international research and encouraged moves towards sustainable socio-economic development uses other than harvesting. Indian Ocean countries include those that are among the worlds most active in research and conservation and where new opportunities for the development of sustainable ecotourism exist. The Indian Ocean also includes

countries which still harvest Whale Sharks and opportunities exist to influence a change to moves towards sustainable ecotourism as an alternative.

In recognition of the existing activities and networks in the Indian Ocean Region and the enthusiasm for enhanced regional cooperation together with the significant benefits to be obtained from such regional cooperation, the 1<sup>st</sup> International Whale Shark Conference agreed that a presentation be made to the IOGOOS III meeting to assess the interest of IOGOOS in supporting the development of a project of regional collaboration.

As well as summarizing the known distribution, status, uses and research activities in each Indian Ocean country the following was presented to cover the background to and scope of the proposal:

**About Whale Sharks:** Largest fish in the ocean; World-wide tropical/subtropical distribution, Harmless plankton feeder; Biology poorly understood; Highly Migratory – behavioural links to physical and biological oceanography; Threatened as a result of fishing in Indian Ocean and SE Asia – several indicators of decline in Indian Ocean; International trend to move from harvest to sustainable ecotourism for better socio-economic outcomes **Apparent yet poorly understood link between migration and oceanography:** Whale sharks move at least at the scale of whole oceans; Local seasonal reappearance of same individuals each year suggestive of migratory behaviour; Season coastal aggregations often linked to biological oceanographic events; ENSO affects migratory behaviour (at least in Australia)

**Opportunities for the future cooperative research and observations on Whale Sharks:** Harness local activities throughout Indian Ocean; Develop well integrated mix of high tech / low tech approaches - Satellite (tracking and archival) tagging, Conventional tagging, Photo ID, Genetic “tagging”; Link observations of Whale Sharks to biophysical observations including those made through remote sensing

**Why Whale Sharks for IOGOOS?: relevance and reasons for successful outcomes:** Apparent yet poorly understood link between migration and oceanography; Mechanism to link IOGOOS oceanographic observations to biology and socio-economic activity; Range of existing activities in place; As yet not well coordinated (except perhaps East Africa/Seychelles); Committed people with good networks; Conservation and community building socio-economic outcomes not just research; Link to strong international conservation agenda; Whale Sharks = Smart Argo buoys!, ability to provide oceanographic depth/temperature profiles

**Possible future focus /objectives for IOGOOS Whale shark project:** Build a project around linking existing activities - observations of whale sharks, IOGOOS coastal, ocean, climate and satellite observations; Which better integrates data collected on whale shark migration patterns (tagging and photo ID) and also -

Fosters and implements larger, better coordinated satellite tracking programs, Seeks to understand the links between ocean dynamics and Whale shark movement/migration, Encourages community involvement, Facilitates greater data sharing

**Possible role for IOGOOS:** Host regional meetings and workshops (the framework of regular regional IOGOOS meetings provides a useful timetable for meetings); Endorse project under IOGOOS Coastal Projects framework; Support capacity building through IOC (e.g. In Photo ID); Support Remote Sensing requirements; Facilitate data availability and exchange; Support applications to member country governments for funding

**Development and Implementation:** Given the enthusiasm of delegates to IOGOOS III to the opportunities the proposed project has to link existing Whale Shark observation activities with oceanographic observation systems being established by IOGOOS, it is proposed to carry out the following:

Affirm the commitment of individuals in the Indian Ocean region to a cooperative regional approach in the form of an IOGOOS Coastal Project – Dr Keesing to contact interested individuals/organisations in each country (these already identified for the countries identified above (and invite additional contacts to be put forward by other countries) September 2005

Determine the interest/relevance/links to COOP Implementation Strategy for the Coastal Module of GOOS – Dr Keesing to discuss with the IOGOOS Secretariat and IOC Perth Office the best way to do this.

If there is sufficient agreement and commitment among individuals in the Indian Ocean, then a proposal will be developed to hold a workshop in 2006 to bring together all existing observations and make firm plans to finalise the development of and plan implementation of the project plan. Support and sponsorship for the workshop would need to be sought from a variety of sources.

The scope for the activity of the workshop and the project would be a jointly authored and owned effort of the partners and the detail is yet to be developed. However draft objectives for the Workshop and Project could be as follows:

**Workshop: (a)** Bring together existing observations on Whale Shark occurrences (space/time) in the Indian Ocean (as 1<sup>st</sup> output of the project), (b) Develop plan for coordinated approaches to Photo ID practice and data and compilation of regular reporting (as regular –annual?- output of the project), (c) Determine capacity building needs to enhance number and quality of observations of Whale Sharks in Indian Ocean, (d) Determine on the basis of existing knowledge the highest priority locations and timing for Satellite tagging of Whale Sharks, (e) Plan strategies to achieve target levels of satellite tagging required in the region, (f) Determine needs on type of observations of coasts, oceans and climate including through the use of remote sensing and the output of ocean and climate

models required to infer oceanographic influences on Whale Shark movements at country, regional and Indian Ocean scale.

**Project:** (a) Bring together and make available existing observations on Whale Shark occurrences (space/time) in the Indian Ocean and invoke mechanisms for sustained reporting, (b) Implement plan for coordinated approaches to Photo ID practice and data handling (duplicate systems in region are OK but need to ensure 100% data exchange) and compilation of regular reporting in consolidated format, (c) Conduct capacity building exercises to expand the number of nodes of activity and quality and quantity of observations on Whale Sharks in Indian Ocean, (d) Plan and implement strategies to build on an incremental basis, the level of satellite tagging of Whale Sharks in the Indian Ocean to better understand the patterns (space and time) of Whale Shark movements. This would include the development of funding applications, (e) Infer oceanographic influences on Whale Shark movements at country, regional and Indian Ocean scale through links to IOGOOS observations of coasts, oceans and climate including through the use of remote sensing and the output of ocean and climate models.

A report on activities would be made at IOGOOS IV. The next International Whale Shark Conference will be held in Mexico in 2007. It is expected a paper on IOGOOS sponsored activities and a review of activities in the Indian Ocean would be presented at that meeting.

Links to other initiatives include a funding proposal being prepared for expansion of satellite tagging in Australia (intended to be a part of the proposed IOGOOS project). There will also be a submission to the National Science Foundation (USA) to expand satellite tagging internationally, this is being lead by USA collaborators but will link to the IOGOOS proposal.

The proposed project is consistent with the Marine Impacts on Lowland Agriculture and Coastal Resources project of the COOP Implementation Strategy for the Coastal Module of GOOS and has relevance to the Coastal Ocean Data Assimilation Experiment (CODAE).

#### B. TIMOR SEA DEEP OCEAN TO CONTINENTAL SHELF MODEL DEMONSTRATION PROPOSAL

Proponent: Dr Ray Steedman, Chairman of WAGOOS

Proposal: WAGOOS to examine the feasibility of demonstrating the coupling of the deep ocean operational model Bluelink with a shelf model. The project is consistent with the Coupling Shelf and Deep Ocean Models strategy of the COOP Implementation Strategy for the Coastal Module of GOOS.

Application in Timor Sea: Apply model to Timor Sea considering (a) Bluelink (Australia – Navy/CSIRO/Bureau of Meteorology); (b) Appropriate higher order shelf model; (c) Data and information; (d) Assimilation; (e) Application to environment and or engineering

Responsibility for Proposal: WAGOOS; Indonesian Institute and person – to be identified

Implementation: R Steedman, chairman of WAGOOS, will present the concept to next WAGOOS meeting. If approved WAGOOS shall proceed with (a) seek an Indonesian partner agency; (b) develop a plan (c) determine funding mechanism

## **5. Additional Information provided by delegates to the Coastal Workshop outlining active research activities and outlining links to projects identified for IOGOOS.**

### **Tanzania**

Dr Desiderius CP Masalu, Institute of Marine Science, University of Dar es Salaam

There is active work at the University of Dar es Salaam on dolphin research and management related to ecotourism and this could provide a contact to link with the proposed Whale Shark project. Dr N. Jiddawi, [jiddawi@ims.udsm.ac.tz](mailto:jiddawi@ims.udsm.ac.tz)

### **Thailand**

Dr. Somkait Khokiattiwong, Phuket Marine Biological Center, Thailand

There are some few research projects, which related to IOGOOS projects, have been developed in Andaman Sea (links to Wagner Project) such as;

1. Bay of Bengal Large Marine Ecosystem (BOBLME): BOBLME project has been developed for some time and the final plan is to start implement in late of 2005. As some reason it seem to relay starting date. This project will be fund by GEF through the World Bank and FAO is implementing agency. The project composes with many sub-projects which due to trans-boundary aspect. There is one main project namely “Murgui Archipelago Project”. The study area is between southern part of Myanmar and northern part of Andaman Sea Coast of Thailand. There are sub-project which compose of ;

- 1.1 Oceanography: will study on water circulation in the study area as it is the important parameter to control physical, chemical, and biological processes. In the plan will do field measurement and using available model.

- 1.2 Mapping of Coral Reefs: Thai's water has been carried out the big project on coral reefs mapping since ten years ago and keep up date information frequently but in Myanmar still lack of this information. The project plan to work with volunteers, tourist boat which mainly comes from Thailand (Phuket) following reef-check programme but might need to modify the method to get more efficiency information as during PMBC carry out the reefcheck programme they could see some problem in the method. The project will support PMBC to do some update information of coral reefs in Thai's water and establish the data base and GIS under the main umbrella of BOBLME (there is capacity building under the main project of BOBLME)
- 1.3 Seagrass mapping (by field survey) has well study in Andaman Sea of Thai's water but still lack information in Myanmar. In the project will support to build up data base and GIS.
- 1.4 Marine Mammal Project will study on distribution of whale, dolphin, and dugong. The study will gather information from volunteer and tourist boat which project will support training (how to do observation) for volunteers. For dugong's population and distribution study will apply tagging (satellite) method and /or genetic study.
- 1.5 Whale shark study will be support by BOBPLME for field observation and data collection in both Thai's and Myanmar's waters.
2. Thai-German project: this project is developed under cooperation programme between Nation Research Council of Thailand (NRCT) and DFG (research funding agency in German). There was the meeting between NRCT, DFG, and scientist from both Thai and German and agree to develop the projects which consist of;
  - 2.1 Geo-science; the main study will be on bathymetric mapping in Andaman Sea and searching for any potential area on the seafloor that can be land-slide and cause to tsunami.
  - 2.2 Oceanography; there are two sub-project;
    - 2.2.1 Water circulation in Andaman Sea, it will consist of large scale and meso-scale study. The large scale will cover the Andaman Sea of Thai's water and meso-scale will cover the some offshore Island, Samilan and Surin Island. The purpose of meso-scale study is to support the 2.2.2
    - 2.2.2 Influence of nutrient on coral reef community and coupling pelagic-benthic in coral reef area (around the island). The project will concern on impact of new nutrient (from shore and deep water) on coral reef community.
    - 2.2.3 Natural hazards management.



Those projects suppose to be carried out in year 2006 for next 4 years.

3. UNDP project; this project is after the tsunami. The purpose is to do the clean up the reefs and rehabilitation including management in Andaman Sea after Indian Ocean tsunami. The project has been carrying out by PMBC since early of 2005 and the end of project will be in December 2005. The project may be probably get an extension after finish the first phase.

## **Indonesia**

Dr Zainal Arifin, Research Centre for Oceanography

- a. Interest in Coastal processes, link to INSTANT (International Nusantara STRatification ANd Transport), 6 research vessels active in collection of oceanographic data
- b. Coastal processes (Land and Ocean interaction). The program covers various subjects such as nutrient budget, biogeochemistry and coastal modeling.
- c. Census of Marine Life; the initial program phase will be carried out for 5 years, 2003-2007. There are 10 sub-projects under this program among others; there are: mangrove, seagrass-coral connectivity, sea cucumber, flying fish, deepsea snapper, shark and marine bioprospecting. The research focuses on life history, population dynamics, and trend of the population. For year of 2005 the budget is about US\$ 200,000.00.

We would like to explore possibility on partnership program and capacity building.

Agus Santoso, National Coordination Agency for Survey and Mapping

- a. MCRMP ((Marine Coastal Resources Management Project)
- b. These projects may link to Coastal project

Wahyu Pandoe, Agency for the Assessment and Application Technology (BPPT)

Consider long term study for operational oceanography and practical use, such as coupling ENSO-IODM. The Research Vessels Baruna Jaya I, II, III, IV, VII and VIII are ready to support the IOGOOS program

Dessi Wulandhari, Agency for Marine and Fisheries Research (BRKP), Ministry of Marine Affairs and Fisheries

Ongoing projects in Agency for Marine and Fisheries Research (BRKP), Ministry of Marine and Fisheries Affairs that may fit into the existing IOGOOS programs are (a) SEACORM (Southeast Asia Center for Ocean Research and Monitoring) → Ocean Modeling and Observation, (b) National Marine Data Centre Development, (c)

Coastal protection → Mangroves rehabilitation to protect abrasion over Bali island, (d) Indonesian Lagoons Inventory and Mapping, (e) Climate change → using isotope technology on coral reefs (f) Acknowledge and regional interest on Climate-ocean interaction; e.g. INSTANT cruise program (g) Fish stock assessment, (h) Marine mammals, (i) Modelling on coastal transport (j) National Estuary Program, (k) Conservation on small islands.

### **Appendix 1: Outline of Capacity Building Workshop on Monitoring, Understanding and Predicting Shoreline Change**

**Aim :** To develop the capacity of the participants to use existing historical data on shoreline change and a knowledge of coastal processes and forcing from the land and the ocean to obtain a preliminary understanding of the reasons for the changes and design a monitoring system

**Objectives :** At the end of the workshop the participants will be able to (1) Describe the important coastal processes – including coastal development - and land and ocean forcing that result in shoreline change (2) Collect and use historical data from all available sources to determine as quantitatively as possible past changes in the shoreline (3) Use available remote sensing data to quantify recent shoreline changes (4) Identify coastal cells based on geo-morphological criteria (5) Estimate the important components of the coastal sediment budget for the coastal cells (6) Combine the knowledge of observed changes, sediment budget, coastal development, etc. to make a preliminary assessment (7) Use the preliminary assessment to identify the most critical gaps in knowledge, design a monitoring program and plan future studies (8) Assess the relevance of the findings to current coastal zone management practices in the area

**Participants :**Participants will be coastal scientists with some background in coastal physical oceanography, coastal sediment transport and the use of remote sensing. It may be necessary to invite separate participants to bring in the remote sensing expertise in some cases. The participants should also be conversant with the coastal zone management framework in their countries.

**Preliminary Work :** Prospective participants should collect background information in the form of a status report on shoreline change well before the workshop. It may be necessary to bring together a group of scientists in each country and have them run through a checklist in a preparatory workshop. The status report should include (1) Description of coastline including important geomorphologic features, rivers, etc. (2) Available information on the coastal wave climate, tides and currents (3) Available information on shoreline position that can be used to assess coastal change – including old maps and plans, photographs, surveys of senior citizens, aerial photographs, etc. (4) Available information on the coastal wave climate and coastal sediment movement (5) Available information on sediment transport from land to sea including seasonal variability (6) A summary of existing studies and reports on shoreline change, coastal processes, sediment budgets, wave climates etc. (7) Current

monitoring programs for shoreline change and wave climate (8) Existing Coastal Zone Management framework

It is recognised that some countries may have already carried out significant parts of this work while some may have only basic information.

The participants could identify – with the assistance of IOGOOS – suitable remote sensing images (for example from the IRS). IOGOOS could arrange for these images to be made available to the country groups for use in their assessments. These images could be related to long term changes or to catastrophic events – i.e. passage of a cyclone.

IOGOOS could also help the participants obtain time series of ocean forcing – waves and wind – from remote sensing and global models.

It may be better to divide the countries in the region into two groups based on the coastal geomorphology. The first group would consist of relatively large countries with sandy coasts and significant sediment supply from the land. The second group would be the small islands whose coasts have mostly coral sand, with coral reefs and rocks leading to complex hydrodynamics. The reason for dividing the countries in this manner is because the two groups would have quite different processes that dominate shoreline change and also have different degrees of vulnerability to cyclones and other extreme events.

The workshop would include the following modules: (1) Coastal geomorphology (2) Coastal sediment processes (3) Wave climate and quantification of coastal sediment transport (4) Sediment supply from rivers and other sources (5) Impact of shoreline development on coastal processes (6) Identification of shoreline change using remote sensing and other sources (7) Development of sediment budgets (8) Design of a monitoring system

The outputs of the workshop would include: (1) An improved, quantitative understanding of shoreline change (2) A list of priority studies needed to improve this understanding (3) A design for a monitoring system for shoreline change, including identified sites, institutional responsibilities for each country, methodologies, costs, etc.

## APPENDIX 2. WORKPLAN AND TIMEFRAME FOR PROJECT

Activity	2005	2006	2007	2008	2009
<b>Pre-Project Period</b>					
• Work on country plans, budget & proposal through email	→				
• Hold Pre-project Planning Workshop		→			
• Submit proposal to donors for funding		→			
<b>Project Implementation</b>					
• Initiate project with International Training of National Trainers		→			
• National Training of Trainers in each country		→			
• Training of participants (district staff + communities) in each study site			→		
• Session I of participatory in situ monitoring			→		
• Phase I of remote sensing			→		
• Analysing and reporting of Session I/Phase I (baseline data)			→		
• Session II of participatory in situ monitoring				→	
• Analysing and reporting of Session II (Change detection by participatory in situ monitoring)				→	
• Session III of participatory in situ monitoring					→
• Phase II of remote sensing					→
• Analysing and reporting of Session III/Phase II (Change detection by remote sensing and participatory in situ monitoring)					→

**Report of IOGOOS WG on Remote Sensing Capacity Building**

**Remote Sensing Satellites for Oceans and Coasts:** Satellite missions that are valuable sources of remote sensing data for IOGOOS are INSAT, MTSAT, IRS P5/6, Oceansat1, Feng Yung, NOAA AVHRR, SeaStar, Hyperion, Meteosat, Envisat, Quikscat, Topex/Poseidon, ERS-2, Jason. New satellite systems to be launched in the near future include Megha Tropiques Oceansat2, NPP/NPOESS and METOP. These platforms variously include visible, infrared, microwave sensing instruments.

**Parameters and products of interest to IOGOOS are listed below**

Sea surface temperature	Coastal Ecosystems	Benthic covers
Thermal Front	Insolation	Potential Fishing Zones
Eddies	Sediments	Upwelling
Sea Surface Height-	Shore line changes	Yellow Substance
Wind Vector	Coastal Zonation	Primary production
Wave parameters	Coastal Topography	Shallow Water
Surface Currents	Coastal Land use	Bathymetry
Vessel movement	Inherent optical properties	Coastal Inundation
Oil spill	Chlorophyll	
Harmful Algal Blooms		
Tricodesmium		

**Countries in the region with a remote sensing program:** Australia, India, Reunion, Pakistan, Indonesia, Thailand, Malaysia, Mauritius, Singapore, Iran, Kenya and South Africa are the countries in the Indian Ocean region having a remote sensing programme

**Ocean Remote Sensing Capability in the Region:** Australia, India, Indonesia, Reunion and South Africa are the countries having capability for ocean remote sensing in the Indian Ocean region

**Remote Sensing Training Facilities in the region are (a)** Australia,-Leeuwin Centre, Universities, (b) India-Indian Institute of Remote Sensing, CSSTE-Asia Pacific, Dehradun, Universities (c) Thailand-AIT Bangkok (d) Indonesia-Lapan, Bakosurtanal, University of Gajah Mada, (e) South Africa-Capetown

**Short Duration Training Programs proposed:** At least two or three should be conducted during 2006. IOGOOS Secretariat to follow up on the following prospects (a) India, Hyderabad 2006: “Ocean Colour Applications” (Funding: IOCCG / POGO-SCOR-IOC) (b) India, Ahmedabad 2006: “Physical Oceanographic Parameters” (Funding: POGO-SCOR-IOC) (c) India, Dehradun 2006: “Coastal Remote Sensing and GIS” (Funding: IOCCG / POGO-SCOR-IOC), (d) Thailand, Bangkok 2006: “Coastal Remote Sensing and GIS” (Funding: IOCCG / POGO-SCOR-IOC)

**Long Duration Training Program proposed:** CSSTE: Asia-Pacific, Dehradun

**Web Tutor:** (a) IOGOOS web site to host ocean remote sensing tutor, (b) Content generation and case studies (volunteers and IOGOOS Secretariat), (c) Links to sites that provide ocean data sources (IOCCG, CEOS, PODAAC, NDC etc).

**Expert Faculty sponsored to Country/Institution**

For on-the-job training, it was suggested that a programme be worked out where the trainer visits the trainees. Sponsorship could be requested from the Nippon Foundation / POGO

## Action Taken Report from IOGOOS Secretariat

S.No.	Action	Status
1	<p><b>Annual subscription of Members:</b> It was decided that all Members should send intimation to the Secretariat as soon as the money is remitted so that it could be easy for the Secretariat to trace the transfer and acknowledge the members.</p>	<ul style="list-style-type: none"> <li>• Invoice for the Annual Membership Fee for the Year 2005-06 was sent out from the Secretariat on March 04, 2005</li> <li>• Membership Fee has so far been received from 4 Members for the current Year</li> <li>• Dues received from 6 Members for 2004-05 and 2 Members for 2003-04</li> <li>• Source of Funds is becoming extremely difficult to trace</li> </ul>
2	<p><b>Funding for Annual Meetings:</b> Since, in future, limited funds would be available from IOC for supporting the Annual Meetings, it was decided that, in principle, members should be prepared to fund themselves. The available funds for supporting the participation of important participants should be regulated by the Secretariat following a set of guidelines to be worked out by a team. Mr. William Erb, Dr. Sidney Thurston &amp; Dr. Neville Smith volunteered to be part of this team.</p>	<ul style="list-style-type: none"> <li>• So far, funds being provided by the IOC-Perth Office have been sufficient to cover the Travel and Per-diem of all the participants requiring Funds.</li> <li>• However, the said guidelines are yet to be worked out</li> </ul>
3	<p><b>Tenure of Officers and Procedure for Election:</b> It was decided to constitute a Team to draft detailed procedure for election of Chair and Officers in future, including their tenure. Dr. Neville Smith, Dr. Shailesh Nayak and Dr. Johnson Kazungu volunteered to be part of this team.</p>	<ul style="list-style-type: none"> <li>• Action Completed. Draft Available</li> </ul>
4	<p>It was decided that the following experts would provide interface between IOGOOS and other external programmes. These experts have agreed to provide at least quarterly updates to IOGOOS Secretariat on the latest developments in the assigned areas. Dr. Sidney Thurston on GEO &amp; JAMSTEC's Monsoon Experiment</p>	<ul style="list-style-type: none"> <li>• Updates provided by the Experts have been circulated to the IOGOOS Community.</li> <li>• Capacity Building initiatives of POGO</li> </ul>

	<p>Dr. K. Radhakrishnan and Dr. Steve Piotrowicz on Argo Project; Dr. Neville Smith on GODAE; Prof. Merv Lynch on Remote Sensing; Dr. Gary Meyers on Indian Ocean Panel</p> <p>It was also decided that the IOGOOS Secretariat could inform the Members about the Capacity Building opportunities in the Region such as POGO, etc. This could be done by posting such information on a separate page in the IOGOOS Website as well as by providing links to other sites offering such opportunities.</p>	<p>are being circulated to the IOGOOS Members as and when it is being announced</p>
5	<p><b>Next Annual Meeting:</b> The meeting requested the interested hosts to send a letter of interest to the IOGOOS Secretariat before end-June 2004. The meeting venue and dates need to be decided well in advance so that the secretariat has sufficient time to organize funding support from the sponsors. The venue for the next annual meeting would be decided based on the following considerations:</p> <p>Geographical Distribution; Commitment of funds from the host to meet all the local expenses that is expected to be of the order of USD 5000/-; Security</p>	<ul style="list-style-type: none"> <li>• IOGOOS Secretariat circulated the request to all IOGOOS Members &amp; Potential Members to host IOGOOS III. No response was received.</li> <li>• During subsequent deliberations, Indonesia has come up with the kind offer to host IOGOOS III</li> </ul>
6	<p>Briefing Session on IOGOOS on the sidelines of IOC-EC: It was decided that a briefing session be organized at the next IOC Executive Council scheduled in June 2004.</p>	<ul style="list-style-type: none"> <li>• Briefing Organized on June 24, 2004 and presentations were made by Johnson, Nasser, Peter, Satish &amp; Neville</li> </ul>
7	<p><b>Enhancement of Manpower at IOGOOS Secretariat:</b> The meeting noted that Secretariat had done an excellent job in coordinating the activities of IOGOOS. Keeping in view the quantum of work involved and the recent initiatives it had taken up in Ocean data and Information management, the members recommended that there is a need to immediately augment the manpower at the IOGOOS Secretariat by recruiting two persons. IOGOOS thanked the Indian Department of Ocean Development for its gracious offer to provide this manpower for the Secretariat.</p>	<ul style="list-style-type: none"> <li>• One Person inducted</li> <li>• Support from INCOIS for Accounts and other logistics</li> </ul>



<b>Other Items</b>		
1	General	<ul style="list-style-type: none"> <li>• Refunded Airfares to IOGOOS II Participants</li> <li>• Moved into the new campus of INCOIS during August 2004 and established the IOGOOS Secretariat</li> <li>• Finalised and circulated the IOGOOS II Meeting report. Hardcopies have been made</li> <li>• Prepared Progress Reports for presentation in IOGOOS VII held in Paris during April 4-7, 2005</li> </ul>
2	IOGOOS e-groups & discussion forum	<ul style="list-style-type: none"> <li>• Developed the interface on IOGOOS Website (<a href="http://www.incois.gov.in/Incois/iogoos/home_group1.jsp">http://www.incois.gov.in/Incois/iogoos/home_group1.jsp</a>) and sent out a mail to all IOGOOS Officers, Project Coordinators and IODE with instructions on “How to Use” and requesting their comments before the interface is made online- No comments received</li> </ul>
3	GRAND	<ul style="list-style-type: none"> <li>• IOGOOS Secretariat circulated the First Phase of GRAND Questionnaire to all IOGOOS Members and Potential Members (25 Contacts) on July 15, 2004</li> <li>• 18 Contacts have provided inputs. Consolidated the inputs and submitted to GRAND Secretariat in September 2004</li> <li>• Attended the First GRAND Workshop during September 4-6, 2004 at Imperial College, London where participants were briefed on the GRAND Strategy as well as Imperial College Ocean Model and Virtual Ecology Workbench</li> <li>• GRAND Progress Reports submitted in August 2004 and March 2005</li> <li>• GRAND Financial Statement submitted on March 15, 2005</li> <li>• Second Phase of Survey – To be done</li> </ul>
4	Preparations for IOGOOS-III	<ul style="list-style-type: none"> <li>• Notification: May 11, 2005</li> <li>• Invitation for the IOP High-level invitees: June 02, 2005</li> <li>• Invitations for IOGOOS – III: June 30, 2005</li> <li>• Interactions with Local Host, Participants, IOC-Perth, Funding Arrangements, Logistics, etc.</li> </ul>