EAS Congress 2012
Changwon City
Republic of Korea
EAST ASIAN SEAS CONGRESS

Building a Blue Economy: Strategy, Opportunities and Partnerships in the Seas of East Asia

9-13 July

SUBTHEME 2

Accelerating Blue Innovations in Support of an Ocean-based Blue Economy

WORKSHOP 2

Monitoring, reporting and forecasting: Applications, benefits and on-the ground applications

CO-CONVENING AGENCIES:

Plymouth Marine Laboratory (PML)

Korea Institute of Ocean Science and Technology (KIOST)

Chair: **Prof. Stephen de Mora**
Plymouth Marine Laboratory

Co-chairs: **Prof. Trevor Platt**
Partnership for the Observation of the Global Oceans

Dr. Kyung-Tae Jung
Korea Institute of Ocean Science and Technology (KIOST)

Global Environment Facility
United Nations Development Programme
United Nations Office for Project Services
Partnerships in Environmental Management for the Seas of East Asia
Ministry of Land, Transport and Maritime Affairs
City Government of Changwon, RO Korea

The East Asian Seas Congress 2012
"Building a Blue Economy: Strategy, Opportunities and Partnerships in the Seas of East Asia"
Changwon City, RO Korea, 9-13 July 2012

Subtheme 2: Accelerating Blue Innovations in Support of an Ocean-based Blue Economy
Workshop 2: Monitoring, reporting and forecasting: Applications, benefits and on-the-ground applications

10 July 2012

Co-convening Agencies:
Plymouth Marine Laboratory and
Korea Institute of Ocean Science and Technology (KIOST)

Chair:
Prof. Stephen de Mora, Plymouth Marine Laboratory

Co-chairs:
Prof. Trevor Platt, Partnership for the Observation of the Global Oceans
Dr. Kyung-Tae Jung, KIOST

1. INTRODUCTION

1.1 The 4th East Asian Seas (EAS) Congress, co-organized by the Government of RO Korea through the Ministry of Land Transport and Maritime Affairs, the City Government of Changwon, RO Korea and the Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), was held at the Changwon Exhibition and Convention Center (CECO) in Changwon City, RO Korea from 9-13 July 2012. Carrying the theme "*"Building a Blue Economy: Strategy, Opportunities, and Partnerships in the Seas of East Asia,"* the EAS Congress 2012 provided participants with the prospect of identifying contributions, progress and achievements in the governance of regional/sub-regional seas within the framework of the Sustainable Development Strategy for the Seas of East Asia (SDS-SEA), as well as new opportunities for strengthening partnerships, which are essential in realizing the full potential of the ocean economy of East Asia.

1.2 The EAS Congress featured the Fourth Ministerial Forum, the International Conference on Sustainable Coastal and Ocean Development, the annual meeting of the PEMSEA Network of Local Governments, the Third EAS Youth Forum, an Exhibition, and other special events. About 1,200 stakeholders — policymakers, resource and economic managers, business professionals, scientists, members of the academe, local and international nongovernmental organizations (NGOs), youth and community representatives, and other members of civil society from 25 countries within and outside the EAS region — participated in the Congress.

1.3 The International Conference on Sustainable Coastal and Ocean Development comprised of five major subthemes, namely: (1) Nurturing Coastal and Ocean-based Blue Economies at the Local Level: Opportunities and Challenges; (2) Accelerating Blue Innovations in Support of an Ocean-based Blue Economy; (3) Securing Ecosystem Services through Integrated Coastal and Ocean Management; (4) Good Governance, Good Business; and (5) Meeting Institutional and Individual Capacities for Integrated Coastal and Ocean Governance.

1.4 The Workshop on "Monitoring, Reporting and Forecasting: Applications, Benefits, and on-the-ground Applications" was one of the workshops under the subtheme on Accelerating Blue Innovations in Support of an Ocean-based Blue Economy. The workshop was co-convened by the Plymouth Marine Laboratory (PML) and the Korea Institute of Ocean Science and Technology (KIOST), formerly the Korea Ocean Research and Development Institute (KORDI).

1.5 Prof. Stephen de Mora, Chief Executive of the Plymouth Marine Laboratory, served as the workshop chair and provided the overview, including the objectives and expected outputs of the workshop. He underscored the need to maximize the benefits that can be derived from innovations in space science and ecosystem modeling for sound planning and decisionmaking for ocean and coastal management. Scientific information is readily available from earth observation platforms as well as global ocean models, but efforts should be continued in localizing and synthesizing information that can be understood and utilized by planners and decisionmakers in coastal and marine management. He also stressed the significance of the EAS Congress as venue for linking the governments and the scientific community for the sustainable development of the oceans and coasts.

1.6 The workshop specifically aimed to:

- To demonstrate of the applications of global ocean observation platforms and ocean ecosystem models in various aspects of ocean and coastal management;
- To discuss how results from science-based tools can be applied in coastal management, including monitoring and reporting systems at the local level to derive benefits to coastal communities; and
- To discuss the importance of regular monitoring and reporting system at all levels (i.e., local, national and global) as input to adaptive coastal management.

1.7 The workshop consisted of three sessions, namely:

- **Session 1:** Sea from space: Harnessing information from ocean observation platforms for sound planning and decision making
- **Session 2**: Today's models, tomorrow's future
- **Session 3:** Making it a habit: Regular monitoring and reporting system for coastal and marine management

1.8 The list of resource persons and participants in the workshop is given in **Annex 1**.

SESSION 1: SEA FROM Space: HARNESSING INFORMATION FROM OCEAN OBSERVATION PLATFORMS FOR SOUND PLANNING AND DECISIONMAKING

1.9 Prof. Trevor Platt, Executive Director of the Partnership for the Observation of the Global Oceans, chaired this session, which presented the technological advances in monitoring key properties and processes in the coastal areas through the application of remotely-sensed information. The session showed how results are synthesized into information that can be useful input for planning and decisionmaking.

1.10 Dr. Joo-Hyung Ryu, Director of the Korea Ocean Satellite Center, KIOST, provided the keynote on the application of ocean observation and remote sensing for ocean and coastal management. He pointed out that remote-sensing is a cost-effective alternative tool for monitoring the coastal regions in terms of hazards, environment and habitat quality, and climate change as it provides high spatial and high resolution data as compared to *in-situ* or field monitoring data.

Dr. Ryu presented the application of remotely-sensed information in monitoring the changes in the habitat structure of the large tidal flats in the western coast of the Korean Peninsula, of which 25% had been lost in the past 10 years due to coastal developments and reclamation. The monitoring of habitat changes requires frequent *in situ* surveys, which are tedious and expensive to conduct. However, through satellite information coupled with GIS-based models, habitat changes can be monitored and mapped as input to the conservation and rehabilitation of the economic and ecological properties of coastal habitats (e.g., decline and/or improvement in area and distribution of tidal flats, coral reef, seagrass, etc.). The accuracy of satellite information when compared to *in-situ* measurements is about 72%–86%.

Dr. Ryu introduced the application of RO Korea’s first Geostationary Ocean Colour Imager (GOCI-I), which was launched on 27 June 2010 and whose mission is to provide satellite data for ocean environmental monitoring, disaster monitoring, and prediction and forecasting. The near-real time data service of the GOCI is readily available and accessible, and currently being used to monitor sea surface heights, the areal extent of an oil spill incident (e.g., Bohai Sea oil spill incident on June 13, 2011), ship dumping, green tide monitoring in the Yellow Sea, monitoring coastal changes, including powerplant fire after the Tsunami incident off Sendai, Japan, in 2011, monitoring the movement of sea fog, yellow dust and sea ice, monitoring of chemical plant fire (e.g., chemical plant fire in Bohai Sea in February 2012), etc. In order to expand the mission of the GOCI, the development of the GOCI-II will commence in 2012 and is targeted to be launched in 2018. The GOCI-II will have higher resolution, user-definable observations request, and will have global monitoring capability.

1.11 Dr. Shubha Sathyendranath, science staff of the Plymouth Marine Laboratory, presented the application of ocean colour products and the selection of criteria for algorithms for climate change studies and in understanding marine ecosystem properties. The term “ocean colour” refers to the remote measurements of the water-leaving radiance at visible wavelengths by polar orbiting satellite sensors, while algorithms are applied to translate this water-leaving reflectance into estimates of water quality parameters such as chlorophyll, dissolved organic matter and suspended sediments concentrations. She stressed that ocean-colour data provides the much-needed longtime series data that will enable the understanding of variability in the state and processes of the marine ecosystem.

Dr. Sathyendranath described the on-going initiative as part of the Global Climate Observing System project in deriving the most complete and consistent possible time series of multi-sensor global satellite data products for climate research and modeling. The presentation detailed how the Ocean Colour Climate Change Initiative of the European Space Agency addresses uncertainties in order to ensure the detection of long-term trends superimposed with high natural variability at shorter time scales, as well as ensuring the use of algorithms that would attribute specific changes correctly and not mistake one type of change for another.

1.12 Dr. Joji Ishizaka, Professor of the Atmospheric Research Center, Nagoya University presented the application of remotely-sensed data in the early detection of harmful algal blooms (HABs) in Japan, which can be utilized by local fishers in their quick response for aquaculture management. Fish kills caused by HABs is a serious problem for coastal aquaculture in the southwestern part of Japan and advanced warning of HABs increases the options for managing these events and minimizing their harmful impact on society. Because of the large spatial scale and high frequency of observations needed to assess bloom location and movements, ocean-colour satellite data are key components of HAB forecasting. However, based on surveys conducted in 2009 with a local fisheries experimental station, despite the high expectations on its benefits, very few people are using satellite data for their monitoring. It was recognized that information dissemination (manuals, software, etc.) and trainings are key in order to achieve the full benefits from remotely-sensed information.

Dr. Ishizaka also presented the current initiative of the Northwest Pacific Action Plan (NOWPAP) in developing eutrophication maps in the NOWPAP areas using remotely-sensed information, similar to the eutrophication map developed in the Baltic Sea area. Preliminary assessment of eutrophication status in Toyama Bay and northwest Kyushu area in Japan, Yangtze River estuary and adjacent area in China, Jinhae Bay in RO Korea and Peter the Great Bay in Russia was confirmed with *in situ* measurements and showed comparable results except for the Yangtze River estuary because of its highly turbid waters. It is therefore essential to determine the criteria applicable for each region (such as the Yangtze River estuary) in interpreting remotely-sensed information, as well as separating the influence of other factors (e.g., climate change) in order to have the best interpretation of the state of the system.

1.13 Dr. Laura David, Professor of the Marine Science Institute, University of the Philippines, shared an approach in determining the typologies and climate change exposure of coastal areas in the Philippines and Southeast Asia making use of available remotely-sensed information such as sea surface temperature (SST), precipitation (precip), sea surface height (SSH) and winds. Results show that Southeast Asia naturally clusters into 16 water mass types while the Philippine waters cluster into 11 types.

The different clusters were ranked based on severity of exposures to the different climate change variables (i.e., SST, precip, and SSH). The severity of exposures identifies the priority areas that need to be considered in planning for climate change adaptation. The different clusters also identify which coastal areas can work together and implement a single policy in terms of climate change monitoring, which may not be applicable in other coastal areas or clusters. Maps showing the spatial distribution and relative magnitudes of the different climate change exposure variables are useful in targeting priority areas and prioritizing appropriate adaptation measures to develop.

1.14 The highlights of discussion during this session were as follows.

- Different tools for monitoring ecosystem properties and changes are available at different time scales, from less than daily (e.g., monitoring harmful algal blooms) to many years (e.g., monitoring climate), as well as in varying spatial scales and degrees of complexity.
- Retrieval algorithms for remote-sensing should be checked for robustness, particularly in consideration of the effect of climate change.
- Climate change is a long-term phenomenon and remote-sensing data, which have only been available since the 1970s, are not sufficient for climate change studies; thus there is a need for models to expand and extrapolate data for long-term coverage.
- Remote-sensing is immensely useful in coastal management, especially if data from different sensors are used (e.g., ocean colour, SST, SSH, wind, precipitation) in complementary manner.

SESSION 2: TODAY'S MODELS, TOMORROW'S FUTURE

1.15 Dr. Kyung Tae-Jung, Principal Research Scientist of the Marine Environment and Conservation Department, KIOST, chaired this session, which tackled some of the available ecosystem models and their significance in understanding processes of the coastal and marine environment.

1.16 The keynote on the application of ecosystem modeling for coastal management was delivered by Prof. Icarus Allen, Head of Science, Marine Ecosystem Modeling, Plymouth Marine Laboratory. He discussed the availability of modeling tools in varying complexity and applied in various scales (i.e., global, national and local level). He underscored that a good model should allow insights into ecosystem properties and should help identify gaps in ecosystem knowledge, as well as allow projection of the ecosystem dynamics in the future. The significance of modeling is that: it allows the description of the state of a system, including how it probably evolved (e.g., chlorophyll concentrations, temperature, fish production, primary production, fishery yield, etc.); it represents the dynamics of an ecosystem and its response to climatic and anthropogenic pressures (e.g., sensitivity of seabed oxygen in North Sea to land derived nutrients; impact of terrestrial nitrogen load changes reduction on primary production in Baltic Sea, etc.), and assesses the risk of a negative indicator event (e.g., eutrophication).

Prof. Allen mentioned that existing models have varying levels of maturity and are designed for different purposes. However, it is recognized that most model developments are driven by research push and not by user demands. Challenges still remain particularly in: (i) improving model skills, which require field observations and monitoring data; (ii) translating terabytes of model outputs into useful information to end-users; (iii) demonstrating the usefulness of model outputs to end-users; (iv) the operationalization of the models in identifying coastal management strategies; and (v) application of models as management-strategy-evaluation (MSE) and decision-support tools.

1.17 The application of ecosystem modeling in understanding the impacts of global warming (i.e., high anthropogenic CO_2) in the marine ecosystem dynamics was discussed by Dr.

Akio Sohma, Research Director, Mizuho Information and Research Institute. He underscored the importance of numerical models in understanding the mechanisms or processes that are driving the carbon cycle, as well as in predicting the effects of global warming. Models are used to extrapolate observed data in order to understand biochemical processes and predicting ecosystem response to environmental management (e.g., ocean fertilization).

In an effort to localize the application of ecosystem models, Dr. Akio Sohma described an on-going initiative in Tokyo Bay. The project entails the development of a model to understand the blue carbon mechanism in Tokyo Bay; undertaking sensitivity analysis to determine the impact of high carbon environment in different habitats (e.g., tidal flats, etc.); and developing indexes for carbon dioxide absorption, biological productivity and water quality, which would eventually address the ideal coastal management strategies for CO_2 reduction, biological productivity and water quality improvement in the bay.

1.18 Dr. Hongjun Song, Assistant Research Scientist of the First Institute of Oceanography (FIO), State Oceanic Administration (SOA), presented the application of remotely-sensed ocean color data, field observation analysis and numerical modeling in understanding the seasonal and inter-annual changes in the phytoplankton dynamics in the Gulf of Maine and its adjacent coastal waters. Remotely-sensed data provided the general spatial and inter-annual variability of seasonal phytoplankton blooms, while modeling provided the simulations of the variability in the timing and magnitude of phytoplankton blooms in the Gulf of Maine from 1984-2007.

The study revealed that salinity seemed to greatly influence the timing and magnitude of phytoplankton bloom in the Gulf of Maine region, while surface heating and surface wind stress had weaker impact on the blooms variability. On the other hand, nutrient level influences bloom magnitude, but only has minor effect on bloom timing. This initiative is currently being replicated in the Yellow Sea to understand phytoplankton dynamics in the area.

1.19 The use of ecosystem models in understanding habitat changes in the inter-tidal zone of Ganghwa and Saemangun, western Korea, was discussed by Dr. Hongyeon Cho, Principal Research Scientist of KIOST. The habitat model was used to simulate the habitat changes in these areas, where large coastal developments, such as sea-dike construction, reclamation and dredging projects, are happening. The changes in bathymetry, salinity and tidal patterns as a result of these projects will greatly impact the species distribution in the inter-tidal areas.

It was pointed out that in order to have a more reliable habitat model, gathering more monitoring data is essential. It was also recognized that tidal flats have an important function in the ecosystem dynamics and interaction in the coastal zones, thus the need to consider linking it with ecosystem models to better understand this interaction (e.g., nutrient contributions of tidal flats in the coastal and marine environment).

SESSION 3: MAKING IT A HABIT: REGULAR MONITORING AND REPORTING SYSTEM FOR COASTAL AND MARINE MANAGEMENT

1.20 Ms. Nancy Bermas, PEMSEA Resource Facility presented the State of the Coasts (SOC) Reporting System, which was primarily developed as a monitoring and evaluation tool of local governments implementing integrated coastal management (ICM) in the EAS region. She stressed that with the increasing interest in ICM implementation, as a result of its recognition as a framework for achieving sustainable development in the Rio+20, showcasing the good practices and lessons learned, including setting up a regular monitoring, evaluation and reporting mechanism to assess progress and show the benefits of ICM implementation, is imperative. She also underscored one of the outcomes of the Rio+20 on the need for reporting mechanism and information management at the local level. The SOC reporting includes 35 indicators that provide the basis for measuring current status, changes over time, management responses, targets and impacts of management actions in accordance with the framework for sustainable development of coastal areas through ICM implementation.

Despite some challenges in developing the SOC report which included data gathering and availability, technical requirements in data analysis and interpretation and the engagement of various sectors in the reporting process, its implementation is anticipated to expand in the coming years. Its implementation has been adopted by 29 member local governments of the PEMSEA Network of Local Governments for Sustainable Coastal Development (PNLG) through the Dongying Declaration, and targets 100 percent implementation of its members by 2015. With more local governments adopting the reporting system, confidence will be built allowing for further refinement and expansion of the SOC reporting taking into consideration new trends and emerging concerns related to building a blue economy (e.g., climate change mitigation and adaptation, marine spatial planning and networks, fisheries for food security, pollution control and mitigation, etc.), as well as requirements of ICM sites with varying conditions (e.g., island ecosystem, urban ecosystem, etc.).

1.21 The process, results, benefits and challenges in the development of the SOC report of Dongying, China, was presented by Dr. Zhang Zhaohui, Associate Professor at the First Institute of Oceanography, State Oceanic Administration of China. The SOC of Dongying, which was published in 2010, evaluated 12 indicators for governance and 20 indicators for the sustainable development of the coastal and marine areas in Dongying. Dongying is one of PEMSEA's ICM parallel sites in China and started implementing ICM in 2005.

The SOC of Dongying indicated that except for the setting up of coordination mechanism, the city has shown positive achievements in setting up governance mechanisms for ICM. In terms of sustainable development aspects, the socioeconomic indicators showed improving trends, while results showed that coastal water quality and protection of natural wetland areas need to be improved. The results also indicated that support to environmental protection activities, including public participation and government investment, need to be further strengthened.

1.22 Ms. Arlette Depamaylo, staff of the Project Management Office of the ICM program in Guimaras, provided a presentation on the SOC of Guimaras Province, an island ecosystem in the Philippines. The development of the SOC of Guimaras was led by a 32-member multisectoral task team. Ms. Depamaylo emphasized the relevance of engaging the various sectors in the development and implementation of the reporting system.

Results showed that progress had been achieved in putting in place policies and institutional mechanisms, including promoting stakeholders participation in ICM implementation. Some indicators relevant to the Millennium Development Goals also showed positive trends while many of the indicators revealed baseline or insufficient data to indicate trends.

Ms. Depamaylo mentioned that some of the challenges encountered in preparing the SOC report included the difficulty in accessing data due to lack of database and information management in some agencies, and data inconsistencies resulting to delays in validation. She emphasized however that it was recognized that a regular reporting system is needed to guide their local ICM implementation, and that the province will endeavor to regularly update their SOC at least every five years.

1.23 The process, results and challenges in the development of the State of the Coasts of Danang, Vietnam were presented by Ms. Pham Thi Chin, Chief of the Seas and Islands Division of the Department of Natural Resources and Environment, Danang. The SOC of Danang evaluated the socioeconomic and environmental trends from 2000-2010 covering 32 indicators, and utilized the Integrated Information Management System (IIMS) as one of the major sources of data and information for the SOC. Results showed positive achievements relevant to 23 indicators evaluated, while five indicators, including environmental cases, budget for ICM, social and economic losses due to disasters, and water and air quality indicated negative trends. The rest of the indicators did not show any clear trend or were not evaluated due to insufficient data.

Among the challenges encountered in the development of the SOC report of Danang included: (1) inadequate data and information; (2) technical requirements in data gathering, analysis and interpretation of results since the SOC covers various aspects of governance and sustainable development, in determining the relationships of the various indicators and their implications; and (3) report development. Some indicators that Danang finds particularly relevant particularly are those related to urbanization, sand mining, and construction works along the coast. These indicators are not included in the current SOC reporting, but can be considered in the next reporting cycle. Ms. Chin emphasized that Danang recognized the relevance of a regular reporting system in evaluating and refining the ICM program and will endeavor to update the SOC reports every five years.

1.24 Following the three sessions of this workshop was a moderated discussion chaired by Prof. Stephen de Mora. The highlights of discussions were as follows.

- ***QA/QC of data used in the development of the SOC reports.*** It was explained that QA/QC may not be needed for the governance indicators as these mostly do not require scientific data. On the other hand, for the data requirements for the sustainable development indicators, the scientific community and the academe, including relevant sectors are engaged in the process of developing the SOC, and should be able to validate the accuracy of data used.
- ***Frequency of SOC preparation.*** It should be based on the benefit of continually reviewing and assessing the progress and achievements of the ICM program, as well as the financial and technical capacity of the local government, but as a minimum, should be conducted at least every 5 years.
- ***Access of local governments to remote sensing data and other available resources.*** It was recognized that lack of data is a common issue for most of the local governments and the ability to access these resources could be beneficial.

Most space agencies make remote sensing data freely available. The issue however lies on the available capacity of local governments to interpret and process these data.

- ***Need for scientists to share the process of the development and application of tools to local governments to promote ownership and appreciation of the results.*** The Philippines shared its experience in conducting the field work for the application of vulnerability assessment tools with both scientists and local governments, and local governments were involved in refining those tools.
- ***Scientific results should be in forms useful to local governments that will guide them in crafting good development and management plans.*** PEMSEA shared its experience in integrating the impacts of sea level rise and disaster risks in the macro-scale zoning plan for Manila Bay and how scientific information can be mainstreamed in local development planning.
- ***Need for platform for the interplay between governments and scientific community.*** The importance of the EAS Congress as a venue where governments and the scientific community can convene and share about coastal and marine issues, and possible solutions was recognized. Dialogue between scientists and end-users is essential.
- It was appreciated that many local governments in the EAS region are “listeners” and consider options for the management of the coastal and marine areas, including listening to scientists’ recommendations.

SUMMARY AND CONCLUSIONS

- Different modeling tools are available at different time scales, i.e., from less than daily (e.g., monitoring harmful algal bloom) to many years (e.g., climate trends), as well as at varying spatial scales and degrees of complexity. It is important to exploit all available resources based on issues being addressed.
- Regional approach, supported by a functional classification scheme, facilitates information-based management decisions, which are built on sound understanding of ecosystem variability and responses to anthropogenic perturbation, including climate change.
- Remote sensing is immensely useful in coastal management and climate-change studies, especially if data from different sensors (ocean colour, sea surface temperature, sea surface height, wind, precipitation) are utilized in a complementary manner.
- The compilation of time series data and the extraction of phenology (seasonal changes) from various models are key to understanding the dynamics and impacts of inter-annual variability in an ecosystem.
- The development of systems for utilization of imagery, such as from the Korean GOCI (Geostationary Ocean Color Imager) and its successor missions, which are unmatched anywhere in the world, should be supported.
- The case studies, such as the State of the Coasts reports initiated by PEMSEA and developed in China, Philippines and Vietnam, are pioneering and exemplary prototypes for demonstrating the value of close collaboration between science and decision-making.
- The awareness and high utility of remotely-sensed products for coastal-zone management should be enhanced through education and outreach.

- Scientists should be encouraged to synthesize remotely-sensed data in a manner that is useful to decisionmakers.

RECOMMENDATIONS

- Existing open-source data (e.g., remotely-sensed information, ecosystem models) should be exploited to the full to address specific issues.
- Capacity building, including education and outreach to decisionmakers in the access, interpretation and processing of remotely-sensed data, is required in the East Asia Seas Region.
- It is important to communicate to decisionmakers what science-based tools are available to facilitate policy design and implementation.
- Scientific process should be shared with decisionmakers, and not just the results of science-based tools, in order to promote appreciation, full engagement and ownership.
- It is important to develop further and replicate the PEMSEA SOCs in other areas.

ANNEX 1. LIST OF RESOURCE PERSONS AND STAFF

Prof. Stephen De Mora
Chief Executive
Plymouth Marine Laboratory
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom
Tel: +44-7500958670
Email: sjdm@pml.ac.uk

Prof. Trevor Platt
Executive Director for the
Partnership for the Observation of the
Global Oceans
Plymouth Marine Laboratory
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom
Tel: +44(0) 1752 633164
Fax: +44(0) 1752 633101
Email: tplatt@pml.ac.uk
Website: www.ocean-partners.org

Dr. Kyung Tae-Jung
Principal Research Scientist
Marine Environment and Conservation
Research Department
Korea Institute of Ocean Science and
Technology
1270 Sadong, Ansan 426-744
Republic of Korea
Email: ktjung@kordi.ac.kr

Dr. Joo-Hyung Ryu
Director
Korea Ocean Satellite Center
Korea Institute of Ocean Science and
Technology
1270 Sadong, Ansan 426-744
Republic of Korea
Email: jhryu@kordi.ac.kr

Dr. Shubha Sathyendranath
Science Staff
Plymouth Marine Laboratory
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom
Email: ssat@pml.ac.uk

Dr. Joji Ishizaka
Professor
Hydrospheric Atmospheric Research Center
(HyARC)
Nagoya University
Furo-cho, Chikusa-ku, Nagoya, Aichi,
Japan 464-8601
Tel: +81-52-789-3487
Fax: +81-52-789-5508
Email: jishizak@hyarc.nagoya-u.ac.jp;
joji.ishizaka@gmail.com
Website: http://co2.hyarc.nagoya-u.ac.jp/

Dr. Laura David
Professor
Marine Science Institute
University of the Philippines
Diliman, Quezon City
Philippines
Email: ltd_pawikan@yahoo.com

Prof. Icarus Allen
Head of Science
Marine Ecosystem Modelling
Plymouth Marine Laboratory
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom
Email: jia@pml.ac.uk

Dr. Akio Sohma
Research Director
Mizuho Information and Research Institute
2-3 Kanda Nishikicho, Chiyoda-ku, Tokyo
101-8443 Japan
Email: sohmanzz@gmail.com

Dr. Hongjun Song
Assistant Research Scientist
First Institute of Oceanography
State Oceanic Administration
Marine Ecology Research Center
6 Xianxialing Road, Qingdao,
266061, China
Email: songhongjun@fio.org.cn

Dr. Hongyeon Cho
Principal Research Scientist
Marine Living Resources Research Department
Korea Institute of Ocean Science and Technology
1270 Sadong, Ansan 426-744
Republic of Korea
Tel: +82(0) 31-400-6318 ;
+82-(0)10-2417-5711,
Fax : +82-(0)31-400-7868
Email: hycho@kiost.ac

Dr. Zhang Zhaohui
Associate Professor
First Institute of Oceanography
State Oceanic Administration
6 Xianxialing Rd, Hi-tech Park, Qingdao
266061 PR China
Tel: ＋86 532 8896 7112;
＋86 135 8920 3873
Email: zhang@fio.org.cn

Ms. Arlette Depamaylo
Guimaras Environment and Natural Resources Office
Provincial Capitol
San Miguel, Jordan
Guimaras, Philippines
Email: depamayloa@yahoo.ca

Ms. Pham Thi Chin
Seas and Islands Division
Department of Natural Resources and Environment
Danang, Vietnam
Email: chindng@gmail.com

Dr. Dosoo Jang
Director
Center for International Cooperative Programs (CICOP)
Korea Institute of Ocean Science and Technology
1270 Sadong, Ansan 426-744
Republic of Korea
Tel: 82-31-400-6441
Fax: 82-31-400-6505
Mobile: 82-10-5590-4149
Email: dsjang@kordi.re.kr

Ms. Thecla Keizer
Plymouth Marine Laboratory
Prospect Place, The Hoe
Plymouth PL1 3DH
United Kingdom
Email: tke@pml.ac.uk

Ms. Sanghee Lee
Center for International Cooperative Programs (CICOP)
Korea Institute of Ocean Science and Technology
1270 Sadong, Ansan 426-744
Republic of Korea
Tel: 82-31-400-7759
Fax: 82-31-400-6505
Mobile: 82-10-2027-8406
Email: sang1220@kordi.re.kr

Ms. Nancy Bermas
PEMSEA Resource Facility
DENR Cmpd., Visayas Avenue,
Quezon City, Philippines
Tel: 632-9292992
Fax: 632-9269712
Email: nbermas@pemsea.org

Ms. Cristine Ingrid Narcise
PEMSEA Resource Facility
DENR Cmpd., Visayas Avenue,
Quezon City, Philippines
Tel: 632-9292992
Fax: 632-9269712
Email: cinarcise@pemsea.org

Ms. Daisy Padayao
PEMSEA Resource Facility
DENR Cmpd., Visayas Avenue,
Quezon City, Philippines
Tel: 632-9292992
Fax: 632-9269712
Email: dpadayao@pemsea.org