

**CBA2012-06NSY-ZHANG**

# Capacity Building Assessment for Integrated Marine Biogeochemistry and Ecosystem Research in the Asia-Pacific Region

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**ABSTRACT:** In order to enhance Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) in the Asia-Pacific region, the present project, which began in May 2012, brought together about 20 marine scientists and capacity building experts from 14 countries to share their experience in capacity building and case studies, assess capacity building needs, and consider potential collaboration for future capacity development for IMBER-related research. The project identified capacity building needs in the context of marine scientific research, evaluated current capacity building efforts within IMBER and other oceanic research programs active in the Asia-Pacific region, summarised critical issues and gaps that need to be addressed, analysed the challenges faced and discussed potential solutions to improve research capacity in the region. The results from this project show that three marine research topics, namely, climate change impact, ecosystem health and food security require top capacity building attention. Some key suggestions for effective capacity development include: building and sustaining a regional network for capacity building, promoting regional involvement in capacity building, and developing human capital. These practical suggestions have been published in *Eos, Transactions American Geophysical Union* (Hu et al., 2013) and *Marine Pollution Bulletin* (Morrison et al., 2013).

**KEYWORDS:** *capacity building, marine science, needs assessment, IMBER, Asia-Pacific*

## Introduction

Global change, as one of the vital factors threatening human societies, has become a dominant challenge to environmental safety and global sustainable development. To develop a comprehensive understanding of and accurate predictive capacity for, ocean responses to accelerating global change and the consequent effects on Earth System and human society, IMBER was initiated in 2004 by the International Geosphere-Biosphere Programme (IGBP) and the Scientific Committee on Oceanic Research (SCOR). One of the priorities of the IMBER Science Plan and Implementation Strategy is to promote capacity development along with integrated studies of biogeochemistry and end-to-end food webs. The Capacity Building Task Team (CBTT) was therefore established at an early stage of IMBER's implementation.

The Asia-Pacific region encompasses more than half of the world's population and is also home to some of the world's largest economies (e.g., US, Canada, Russia, Japan, China, India, etc.). The marine ecosystem in this region, especially at a number of



**Figure 1.** Participants of the 2012 Capacity Building Workshop.



**Figure 2.** The workshop ended with plenary reports/Question and Answer session.

## HIGHLIGHTS

- » Mapping international, regional and national capacity building activities on marine science in the Asia-Pacific region.
- » Identification of capacity building needs in the context of marine scientific research.
- » Identification of capacity building needs and challenges for IMBER relevant research, providing potential solutions to the challenges.
- » Three marine research topics require top capacity building attention: climate change impacts, ecosystem health, and food security.
- » Regional/international capacity building resources, networking and potential collaboration opportunities were explored.

small, Pacific Island states, is particularly susceptible to human-induced climate change (Dupont et al., 2008). However, developing and emerging countries in the Asia-Pacific region are not very involved in international marine research in the open sea across the globe.

To enhance the scientific capacity of marine research in the Asia-Pacific region, especially in less developed countries, this project was proposed and an international workshop was convened as the main activity. The main objectives of the project were (1) to synthesise current capacity building efforts, analyse successes and lessons learned, and identify whether they meet the requirements for improved capacity building within the IMBER community, particularly in the Asia-Pacific region; and (2) to provide suggestions for improved capacity building within the IMBER community, particularly in the Asia-Pacific region.

## Methodology

The main activity of this project was the workshop referred to above held from 31 July to 4 August 2012 at the East China Normal University (ECNU), Shanghai, China. Participants comprise about 20 scientists from eleven APN member countries, additional IMBER CBTT members and representatives of international agencies (Figure 1).

These participants were chosen on the basis of their actual or potential involvement in marine research and relevant capacity building knowledge in the Asia-Pacific region. The international organisations involved in this effort included IMBER,

APN, SCOR, IOC/WESTPAC (Intergovernmental Oceanographic Commission, Sub-commission for the Western Pacific) and POGO (Partnership for Observation of Global Oceans).

The workshop opened with discussion of the goals and activities of IMBER, a review of its objectives, and an overview of capacity building concepts and processes. This was followed by a series of presentations from all participants that focussed on evaluation of recent activities and analysis of capacity needs.

After this plenary discussion, proposals for future action were developed in two complementary working groups, the first group involving the regional country representatives and the second group involving participants from IMBER and other international organisations. After the working group discussions, all participants met in a plenary session to consider outcomes and develop an agreed integrated set of future actions (Figure 2).

## Results and Discussion

The survey of capacity building activities on marine sciences in the Asia-Pacific region from 2007 to 2012 demonstrated that current national/regional capacity building efforts do not fully address the tremendous marine research needs in the Asia-Pacific region, where capacity development needs for marine science are predominantly driven by social and economic priorities. The top three marine research topics identified as priorities for capacity building efforts were climate change impacts, ecosystem health, and food security. Capacity development efforts particularly needed for each topic were summarised in Table 1.

The following challenges of the regional capacity building activities were analysed and published in the Marine Pollution Bulletin (Morrison et al., 2013): appropriate alignment of the research goals and societal and policy-relevant needs; training in

Social and Economic Priorities	Capacity building efforts needed
1. Climate change impacts <ul style="list-style-type: none"> <li>» Ocean response to climate change</li> <li>» Disaster risk reduction</li> <li>» Mitigation of natural disasters</li> </ul>	New observation techniques and methods Skills in interpretation of data Data calibration Numerical models on physics, biogeochemistry, ecosystems Downscaling global models to regional and national levels Prediction on ecosystem response and evolution Vulnerability assessment of impact on ecosystem of sea level rise, temperature increase Early warning system and techniques
2. Ecosystem health <ul style="list-style-type: none"> <li>» Reducing eutrophication, contamination, pollution</li> <li>» Reducing incidence of harmful algal blooms (HABs)</li> <li>» Addressing habitat loss</li> <li>» Reducing coastal erosion, sea intrusion, land subsidence</li> </ul>	Identification and management of nutrient/pollution sources Composition and structure of food-webs from end to end Understanding nutrient transport, transformation, biogeochemical cycles Prediction of HABs Monitoring and developing early warning systems, formulating decision tools Methods of organic pollution estimation Use of isotopes/rare earth elements as tracers Natural recovery and mangrove rehabilitation Appropriate methods/technology for coastal protection Adaptation and mitigation Mapping habitats and potential of resources
3. Food security <ul style="list-style-type: none"> <li>» Sustaining fisheries production</li> <li>» Assuring seafood safety</li> </ul>	Methods of collecting oceanic data Skills in interpretation of data Monitoring and developing early warning systems, decision tools Aquaculture technology Understanding oceanic food webs and changes in production system e.g. aquaculture Science integrated marine aquaculture Adaptive ecosystem-based management

**Table 1.** Synthesis on capacity development needs for marine sciences in the Asia-Pacific region (IMBER CBTT, 2012).

	IAEA	IFS	INOC	IOC	IOI	PICES	POGO	SCOR	START
Grants to attend meetings	X	X		X		X		X	X
Grants for training in data and information management			X	X					
Summer schools			X	X		X		X	
Shipboard experience			X	X			X		
Visiting professorships							X	X	X
Centres of excellence in oceanography training				X			X		
Distance learning				X					
Alumni networks							X	X	
Mentoring					X			X	
Regional graduate networks									

**Table 2.** Matrix of capacity building approaches for ocean science, observations, and data/information management (Morrison et al., 2013).

multidisciplinary research; increasing capacity for overall synthesis of scientific data; building the capacity of technical staff; keeping highly qualified personnel in marine scientific research roles; cross-cultural issues in training; minimising duplication in training activities; improving linkages among human capital, project resources and infrastructure.

Some key suggestions to help enhance the regional marine research capacity (Hu et al., 2013) were also identified. These include (1) building a regional capacity building platform, targeting the aforementioned regional research priorities in collaboration with relevant institutions/organisations and regional programmes/projects; (2) promoting globalisation by shifting the locations of capacity building activities from region to region with particular focus to developing countries; and (3) sustaining network and facilitating the emergence of new generations researchers focusing on marine research in this region.

During the workshop, existing regional/international capacity building resources were explored (Table 2). Potential collaboration and dedicated financial resources for capacity building activities targeting the regional needs were also discussed. It is important for scientists and organisations/institutions in the

region to be aware of these resources and to utilise them to the fullest extent possible.

## Conclusions

The proposed objectives of this project have been fully achieved through analysing capacity building approaches of the IMBER project and other marine science programmes/projects in the Asia-Pacific region, and by examining the successes and lessons learned from regional capacity building activities. The full content of those analysis and discussions could be found in the final project report. Based on the results from this project, a strategic paper “Developing human capital for successful implementation of international marine scientific research projects” has been published in *Marine Pollution Bulletin* (Morrison et al., 2013). Practical suggestions summarised in that paper will be distributed widely to enable the relevant agencies and projects to develop appropriate capacity building strategies.

As a follow-up action to the project, IMBER decided to hold its 2014 summer school (ClimEco4) in China to benefit more students and early career scientists in the Asia-Pacific region. Moreover, this project developed linkages between

international/regional organisations and countries from the APN region, which may facilitate future collaboration, not only on capacity building activities, but also on marine research in this region.

The Asia-Pacific region is highly diverse geographically, culturally and ecologically. The marine research capabilities of the countries in this region differ greatly. There are obvious similarities among some countries and there needs to be greater support from more advanced countries in this region to raise the level of research capacity in those countries that need and desire that support.

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## Acknowledgements

The project team would like to acknowledge financial support provided by APN, the SCOR/IGBP-IMBER, State Oceanic Administration of the People's Republic of China, and by the State Key Laboratory of Estuarine and Coastal Research based in ECNU.

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### PROJECT TITLE

**International Workshop: Needs Assessment for Capacity Development for Integrated Marine Biogeochemistry and Ecosystem Research in the Asia-Pacific Region**

### COUNTRIES INVOLVED

China, Australia, India, Pakistan, Philippines, Korea, Thailand, USA, Chile, South Africa, Turkey

### PROJECT DURATION

One-year project

### APN FUNDING

US\$ 27,275

### PROJECT LEADER

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