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Intergovernmental Oceanographic Commission
Reports of Meetings of Experts and Equivalent Bodies

**Sixth Expert Workshop on the Pilot Project of
SEAGOOS on the Monsoon Onset Monitoring
and its Social and Ecosystem Impacts
(MOMSEI-VI)**

Yangon, Myanmar
10-12 September 2012

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**UNESCO/IOC SUB-COMMISSION FOR THE WESTERN PACIFIC
(WESTPAC)**

**Sixth Expert Workshop on the Pilot Project of SEAGOOS on the Monsoon Onset
Monitoring and its Social and Ecosystem Impacts (MOMSEI-VI)**

Yangon, Myanmar, 10-12 September 2012

Summary Report

1. OPENING

1. The Sixth Expert Workshop of the IOC Sub-Commission for the Western Pacific (WESTPAC) on the Pilot Project of SEAGOOS “Monsoon Onset Monitoring and its Social & Ecosystem Impacts (MOMSEI)” began in the Chatrium Hotel, Royal Lake Yangon, Myanmar, at 0900 on 10 September 2012. The workshop was organized by the IOC Regional Office for the Western Pacific (WESTPAC Office) in collaboration with the Department Meteorology and Hydrology (DMH), Ministry of Transport, Myanmar. Dr Somkiat Khokiattiwong from the Phuket Marine Biological Center, Thailand served as the chairman for the workshop in his capacity as the Chairperson of the Sub-Commission.
2. Dr Hrin Nei Thiam, Director General of Department of Meteorology and Hydrology, Ministry of Transport, on behalf of Union Minister of Transport and the Local Organizing Committee, welcomed all participants to Myanmar. While expressing her appreciation to the WESTPAC Office for bringing the MOMSEI-VI into Myanmar, She highlighted the need for the development of this project, and emphasized the importance to improve the understanding on the Asian Monsoon and its multi-scale variations in view of its significant impact on the agriculture and livelihood of people across the region, particularly the great damage to the agriculture and loss of property and lives in Myanmar over past years due to anomalous southwest monsoon. She reiterated the willingness of Myanmar to engage in this project and encouraged all participants to contribute their ideas, knowledge to ensure the workshop and MOMSEI project a great success.
3. Speaking on behalf of the Intergovernmental Oceanographic Commission of UNESCO, Mr Wenxi Zhu, Head of the WESTPAC Office, thanked the Government of Myanmar, particularly its Department of Meteorology and Hydrology, for the great support provided throughout the organization of this workshop. He further recalled the pledge by Director General of UNESCO, during her first visit to Myanmar one month ago, of her organization’s full support to Myanmar in the areas of its competence, Education, Science, Culture and Communication. Organizing this workshop has been duly demonstrating the willingness of UNESCO and its intergovernmental Oceanographic Commission (IOC) to work together with scientists of Myanmar, improving the knowledge and understanding on the nature and resources of the oceans and coastal areas for the mitigation of the impact and adaptation to the climate change and variability, prevention and reduction of the impact of natural disasters and

safeguarding the health of marine ecosystem. In light of the fact that Myanmar remains a primarily agricultural economy and Myanmar's rice exports hit a near-record high in 2009 but experienced a more than 50% drop in 2010 due to drought, delayed monsoon rains, he stressed the need for Myanmar's active involvement into this project and other WESTPAC programmes to build its capacity for marine scientific research, observations. He finally confirmed the commitment of IOC and its WESTPAC to assisting Myanmar to build capacity, and expected a fruitful cooperation between IOC/UNESCO and Myanmar in the near future.

4. Dr Somkiat Khokiattiwong, Chair of IOC Sub-Commission for the Western Pacific (WESTPAC), expressed his appreciation to Dr Hrin Nei Thiam and all her staff for the warmhearted hospitality provided and excellent arrangement made for all participants. He recalled the objectives of MOMSEI project to enhance the regional ocean observing capability to mitigate the social and ecosystem impact of climate change and variability. He congratulated on the substantial progress made in the form of joint cruise, summer school and regular expert workshops. In closing, he expected continuous contribution from Member States to the MOMSEI project and wished the workshop a great success.

2. SELF-INTRODUCTION OF PARTICIPANTS

5. All participants were invited to give a self introduction in the meeting. The list of participants was attached as Annex II to this report.

3. ADOPTION OF THE AGENDA

6. Mr Wenxi Zhu introduced the preliminary agenda and timetable, and invited comments from all participants.
7. The meeting adopted the Agenda without any modification, which was attached as Annex I in this report.

4. BRIEF REVIEW ON THE MAJOR OUTCOMES FROM THE FIFTH EXPERT WORKSHOP IN SEPTEMBER 2011

8. Mr Wenxi Zhu reviewed the major outcomes from the 5th Expert Workshop (MOMSEI-V, Yogyakarta, Indonesia, 28-30 September 2011), including the development of MOMSEI Science Plan, preparations of MOMSEI Joint cruise in equatorial eastern Indian Ocean, organization of the third MOMSEI Summer School, cooperation with FAO/GEF Bay of Bengal Large Marine Ecosystem project (BOBLME) and the secondment from the First Institute of Oceanography, China to WESTPAC office assisting in the development and implementation of MOMSEI project.
9. Following Mr Zhu's briefing, Dr Weidong Yu, MOMSEI Project Leader, reported in brief major progress since the MOMSEI-V, covering one multi-disciplinary cruise conducted in the equatorial eastern Indian Ocean, one MOMSEI mini workshop on monsoon onset outlook, capacity building and relevant publications, and relevant bilateral cooperation established in support of the implementation of MOMSEI project.

5. PROGRESS REPORT SINCE THE FIFTH EXPERT WORKSHOP

5.1 Development of MOMSEI Science Plan

10. Dr Yu presented the progress made on the development of MOMSEI Science Plan which was initially proposed at the second expert workshop of MOMSEI (MOMSEI-II, Qingdao, China, 8-9 August 2009). Taking into account of plenty of suggestions made over previous workshops, Dr Yu outlined that the revised structure of MOMSEI Science Plan would be built around one core scientific question on why monsoon first occurs over Bay of Bengal, with in-depth analysis on the social and ecosystem impact of monsoon onset anomaly, such as flood, drought, coral bleaching and oxygen minimum zone.
11. Speaking of the core scientific question, Dr Yu assumed that it is probably owing to the higher SST over BOB than adjacent seas before the summer monsoon onset, when associated with northward propagating intraseasonal oscillation (ISO), that the earliest monsoon onset over BOB. He further speculated that the southward spread of the fresh water input from northern BOB may greatly contribute to the higher SST over BOB due to its shoaling of mixed layer depth. Therefore, he stressed the need for MOMSEI to conduct in-situ observations and data analysis to further verify this speculation.
12. In respect of social and ecosystem impact of monsoon onset anomaly, in addition to possible severe flood or drought when the monsoon onset deviates from its normal pattern, Dr Yu referred to the massive coral bleaching in 2010 in Andaman Sea as a result of late monsoon onset which led to the persistence of high SST for more than one month. Furthermore, Dr Yu introduced another interesting phenomenon on the intrusion of low oxygen water from deep Andaman Sea into its eastern continental shelf. He pointed out, during the monsoon transitional period, the upper boundary of the Oxygen Minimum Zone (OMZ) shoals due to the local cyclonic wind curl and remote forcing from equatorial Kelvin wave. Meanwhile, the internal waves triggered from the Andaman island chains very likely bring the low oxygen water from the OMZ region to the continental shelf. The low oxygen water intrusion possibly lasts until the monsoon breaks out, and it probably imperils the benthic ecosystem on the shelf if monsoon onset is late. Hence, the monsoon onset monitoring and its social & ecosystem impacts were very vital for the MOMSEI member countries and even the whole South East Asian region.
13. Dr Yu emphasized the importance of the MOMSEI Science Plan to define the objectives, set out research and monitoring focus, and provide a guideline for the implementation of MOMSEI project. To ensure the high quality of the Science Plan, he also pointed out the challenges to be addressed after the workshop, including the linkage of MOMSEI with national programs, improvement on relevant contents related to social and ecosystem impact.
14. The meeting expressed their appreciation to Dr Yu for his preparations of the MOMSEI Science Plan in the initial stage. With full consideration of the demand for MOMSEI Science Plan to enable scientists, institutes and countries interested to

understand well the objectives, research focus and implementation of MOMSEI project, the meeting decided to form one small open-ended drafting group initially consisting of Dr Weidong Yu (China), Dr Somkiat Khokiattiwong (Thailand), Prof Fredolin Tangang (Malaysia), Ms Khin Cho Cho Shein (Myanmar), Prof Daw Nan Mya Han (Myanmar) and Dr T.Adi (Indonesia).

5.2 Summary of the 2012 cruise in Equatorial Eastern Indian Ocean

15. Mr Huiwu Wang, Chief Scientist, briefed on the MOMSEI cruise in the equatorial eastern Indian Ocean conducted on 26 April-14 May 2012 in collaboration with the Agency for Marine and Fisheries Research and Development (AMFR), Indonesia and First Institute of Oceanography (FIO), China in order to capture the complete process of monsoon onset. Compared with the previous MOMSEI cruise in 2011, the MOMSEI cruise 2012 was designed as a comprehensive and multi-disciplinary one with measurement on carbon dioxide and fishery stock in addition to the routine ocean-atmosphere observation. He added more results could be released after all data were analyzed.

5.3 Summary of the 3rd MOMSEI Summer School

16. Dr Li Zhi reported on the organization of the third MOMSEI Summer School, which took place in Qingdao, 6-10 August 2012, organized in collaboration with the FAO/GEF Bay of Bengal Large Marine Ecosystem Project (BOBLME) with a view to providing young scientists with the state-of-the-art scientific knowledge on monsoon climate and its social & ecosystem impact. This Summer School prompted extensive interests from MOMSEI participating countries and countries surrounding the Bay of Bengal with total 31 participants from Myanmar, Malaysia, Thailand, Indonesia, China, India, Bangladesh, Maldives and Sri Lanka. Besides the knowledge on monsoon climate and tropical ocean-atmosphere interaction, the third Summer School provided several lectures on ocean fishery and upper ocean ecosystem in order to make participants understand the importance of multi-disciplinary approach to the research on ecosystem impact.
17. The meeting noted the increasing interests received on the MOMSEI Summer School, and highlighted the need for MOMSEI project to build the capacity, in a sustainable manner, of young scientists from MOMSEI participating countries and other countries interested. It was suggested that preparations for the next MOMSEI Summer School be made as early as possible, and lectures be video-recorded and widely shared via internet in order to generate benefits to the greatest possible extent.

5.4 Cooperation with BOBLME and other programmes

18. Dr Somkiat Khokiattiwong was invited to introduce the FAO/GEP Bay of Bengal Large Marine Ecosystem Project (BoBLME). He stressed the need to develop cooperation with BOBLME in view of the same geographic coverage of both project and common interests in developing the capacity of countries surrounding BOB for marine scientific research and observations. He reported that cooperation had been well established through the organization of previous MOMSEI Summer Schools with four

BOBLME funded junior scientists participating in the second MOMSEI summer school in 2011, and seven BOBLME funded participants joining in the third MOMSEI Summer School in 2012. He also suggested that, with WESTPAC's support, cooperation could be possibly explored between MOMSEI and the Sustained Indian Ocean Biogeochemical and Ecological Research (SIBER) in the future.

5.5 MOMSEI outreach and publications

19. The development and implementation of MOMSEI project has been demonstrating its value as an effective platform for MOMSEI participating members to share their scientific findings on Monsoon onset and its impact on the ecosystem and society. Five scientific papers were published in 2012, including:
 - Somkiat Khokiattiwong and Weidong Yu, 2012: Note on the occurrence of high sea surface temperatures in the Andaman Sea, in 2010, PHUKET MARINE BIOLOGICAL CENTRE RESEARCH BULLETIN, No. 71. This paper was intended to uncover the link of late monsoon onset in 2010 with massive coral bleaching in the Andaman Sea. YU Wei-Dong, SHI Jian-Wei, LIU Lin, LI Kui-Ping, LIU Yan-Liang and WANG Hui-Wu, 2012: The Onset of the Monsoon over the Bay of Bengal: The Observed Common Features for 2008–2011, Atmospheric and Oceanic Science Letters, 5(4), 314-318. The paper described the common features of monsoon onset over BoB through the analysis of the buoy data.
 - YU Wei-Dong, LI Kui-Ping, SHI Jian-Wei, LIU Lin, WANG Hui-Wu and LIU Yan-Liang, 2012: The Onset of the Monsoon over the Bay of Bengal: The Year-to-Year Variations, Atmospheric and Oceanic Science Letters, 5(4), 342-347. This paper presented the inter-annual variations of monsoon onset in BoB.
 - Zhi Li, Weidong Yu, Tim Li, VSN Murty, and Fredolin Tangang, 2012: Bimodal character of cyclone climatology in Bay of Bengal modulated by monsoon seasonal cycle. J. Climate, doi: <http://dx.doi.org/10.1175/JCLI-D-11-00627.1>. This paper analyzed the mechanism of distinct climatological distribution feature of BoB cyclone from the perspective of monsoon climate.
 - Kuiping Li, Weidong Yu, Tim Li, V. S. N. Murty, Somkiat Khokiattiwong, T. R. Adi and S. Budi, 2012: Structures and mechanisms of the first-branch northward-propagating intraseasonal oscillation over the tropical Indian Ocean. Climate Dynamics, doi:10.1007/s00382-012-1492-z. This paper introduced the climatological feature of the first-branch northward-propagating intraseasonal oscillation (ISO) and analyzed its impact on monsoon onset over BoB.
20. The meeting stressed the importance of outreach materials and scientific publication with a view to enhancing the visibility of MOMSEI, and demonstrating the value of cooperation in addressing common scientific interests. The meeting further

encouraged all members to enhance the communication and develop joint studies under the framework of MOMSEI project.

6. PRESENTATION BY INDIVIDUAL EXPERTS ON THE LINKS AND/OR CONTRIBUTION OF MOMSEI FROM/TO OTHER PROGRAMMES WITH AND/OR OUTSIDE THEIR COUNTRY/INSTITUTE

21. Mr Kyaw Kwin Oo, DMH, Myanmar, provided in brief the information on the nation's meteorological service, and the extreme events of heavy rain and severe drought the country experienced due to the anomalous monsoon onset. To explore potential links with and contributions to MOMSEI, he briefed on the ongoing programmes, including: build the extreme weather monitoring system with Japanese International Cooperation Agency; WMO – UNESCAP - RIMES Project on reducing risks of tsunami, storm surge, large waves and other natural hazards in low elevation coastal zones; and strengthening capacity development program with Norwegian Meteorological Institute.
22. Mr Phyo Mg Mg, DMH Myanmar, presented his research on the post-tsunami survey, paleoseismology survey, sea level monitoring system and tsunami scenario simulation in Myanmar. Dr Htay Aung, Mawlamyine University Myanmar, raised possible link may exist between the tsunami and the abnormal weather which occurred following the tsunamis in 2004 and 2011.
23. Prof Daw Nan Mya Han, Myeik University Myanmar, pointed out the impact of climate change, monsoon onset and land-based pollution on the marine Ecosystems in the Myeik Archipelago. Among others, she particularly focused on the impact of anomalous monsoon onset on the coral and fishery. Given lack of adequate capacity, she strongly suggested MOMSEI further consider the possibility of joint research in Myanmar adjacent waters and enhance the capacity of young scientists in Myanmar for marine scientific research, observations.
24. Prof Khin Maung Cho, Patheingyi University Myanmar, reported on the different spatial and temporal distribution of dinoflagellates as a result of the intraseasonal variability of rainfall, temperature, salinity, seawater pH, dissolved oxygen, macronutrient PO₄-P and NO₃-N in Myanmar waters. Therefore, the buoy, which is to be deployed in northern BoB to monitor the monsoon onset, is of great help to further understand the spatial and temporal distribution of dinoflagellates .
25. Mr Zaw Lunn, Biodiversity and Nature Conservation Association (BANCA) Myanmar, presented the status of coral in Myanmar, and relevant information on BANCA/FFI project which aimed to improve the coastal and marine conservation capacity and establish the marine protected areas. Mr Aye Thwin, Fisheries Department Myanmar, introduced in-shore fishery, off-shore fishery, and Marine Protected Area & Species in Myanmar.
26. Dr Widodo S. Pranowo, Research and Development Center for Marine and Coastal Resources, Indonesia, briefed on the national action plans for green house gas reduction and climate change. Dr Andreas A. Hutahaean, Research and Development

Center for Marine and Coastal Resources, introduced the national pilot project on integrated Blue Carbon study conducted in Derawan Islands, East Kalimantan, which was designed to understand the critical role of tropical coastal-marine ecosystems for carbon cycle and its social impacts, particularly in the Derawan Islands.

27. Prof Fredolin Tangang, presented the monsoon influence on SST in the South China Sea and its possible tele-connection with changes on SST in BoB. He also pointed that coral bleaching in the southern South China Sea often occurs in tandem with those in BoB due to SST annual cycle in the context of monsoon climate. Moreover, in view of the significant impact of winter monsoon on Malaysia, he also suggested MOMSEI may need to incorporate necessary study on winter monsoon. It was suggested that Prof Fredolin Tangang consider providing more inputs on winter monsoon in the development of MOMSEI Science Plan.
28. Dr Somkiat Khokiattiwong, Phuket Marine Biology Center, Thailand, detailed the link between the late monsoon onset and SST over BoB, and the massive coral bleaching 2010 in Andaman Sea as a result of SST anomaly.
29. Dr Patama Singhruck, Chulalongkorn University, Thailand, introduced the Madden-Julian Oscillation (MJO), the most prominent mode in the tropical ocean-atmosphere system, and its impact on the rainfall patterns in Thailand. She suggested that MOMSEI joint cruise data could provide insight into the mechanisms of northward propagation of MJO.
30. Dr Weidong Yu, First Institute of Oceanography of China, briefed on several bilateral cooperation established between MOMSEI participating countries, in order to facilitate the development of MOMSEI project. He further emphasized the top priority has been accorded by his institute to MOMSEI in view of the ever-increasing the challenges of climate change and variability.

7. BRAINSTORMING SESSION ON THE DEVELOPMENT AND IMPLEMENTATION OF MOMSEI AT NATIONAL LEVEL, INSTITUTE LEVEL

31. With consideration of the above presentations, participants were invited to brainstorm more practical ideas how to further strengthen the development and implementation of MOMSEI either at national level or institute level.
32. Salient points were prompted in light of the current status of MOMSEI project. In terms of MOMSEI Science Plan, the meeting encouraged the open-ended drafting group to conduct their work as soon as possible, in order to make the MOMSEI Science Plan available in 2013, with Dr Yu in overall charge of the Plan and Dr Somkiat taking care of relevant inputs concerning coral bleaching.
33. With respect to capacity building, it was suggested if MOMSEI Summer School could possibly design and provide progressive trainings to the same group of young scientists who are involved in the project, or if other training opportunities could be further explored with MOMSEI participating countries within their domain of focus. Responding to the high demand from Myanmar for training opportunities on marine

scientific research, observations, and ecosystem conservation, the meeting decided to start developing one country-specific capacity development program for Myanmar based on the current strengths of MOMSEI participating countries. It was suggested WESTPAC convene one mini workshop with participation of interested institutes and relevant institutes of Myanmar.

8. WORK PLAN AND BUDGET IMPLICATIONS FOR 2012-2013 INCLUSIVE

8.1 MOMSEI Joint Cruise, MOMSEI Summer School, MOMSEI Workshop

34. Despite the fact that MOMSEI cruises have been conducted for three years in the Andaman Sea and tropical east Indian Ocean respectively, it is becoming increasingly necessary to conduct observation in the north BOB on the fresh water flux received from river discharge with consideration of its southward spreading and leading to intense salinity stratification in the Bay of Bengal (BoB) and helping maintain warmer surface temperature. The meeting suggested conducting one MOMSEI cruise 2012 in the Bay of Bengal and initiating negotiation with relevant authorities in Myanmar in order to seek the approval in time on the cruise plan.

35. In respect of the fourth MOMSEI Summer School, the meeting accepted the kind offer of Prof. Fredolin Tangang from Malaysia to host the Summer School in Malaysia, and requested WESTPAC Office to start preparations in consultation with Prof. Fredolin as early as possible.

36. Meanwhile, the meeting noted with appreciation the willingness of FIO to host the next MOMSEI workshop in China, and decided to organize the 7th MOMSEI expert workshop in the late of third quarter or early of the fourth quarter 2013.

8.2 Involvement of new members into MOMSEI

37. The meeting noted with satisfaction the cooperation was established between MOMSEI and BOBLME, mainly through the organization of MOMSEI Summer School, and further expected to enhance the cooperation by getting the involvement of more countries surrounding BOB into MOMSEI project.

9. COORDINATION WITH OTHER ORGANIZATIONS AND PROGRAMMES

38. Dr. Somkiat briefly introduced the current cooperation with BOBLME programme. In light of similar scientific interests, he emphasized the need for BOBLME and MOMSEI to further the cooperation in many aspects such as capacity building. He assured the workshop of his commitment to coordinating the activities between BOBLME and MOMSEI in order to promote the collaboration under the framework of WESTPAC. Moreover, Dr Weidong Yu expressed he would work with other member countries to try to launch the cooperation between MOMSEI and SIBER based on IOC/WESTPAC's guidance and assistance.

10. OTHER MATTERS

39. No other matters were raised for discussions.

11. CLOSURE

40. In closing, Mr Wenxi Zhu extended his sincere thanks to Dr Somkiat for chairing the workshop, Dr Yu and all other experts from China, Myanmar, Thailand, Indonesia and Malaysia for their hard work done in the development of MOMSEI project. Moreover, he particularly extended his appreciation to Dr Hrin Nei Thiam for her great support provided throughout the organization of this workshop, Ms Khin Cho Cho Shein and all Myanmar colleagues for their thoughtful arrangement for this MOMSEI workshop. He believed the MOMSEI project would be continuously promoted through collective efforts. Dr Weidong Yu, as the project leader, thanked Myanmar colleague for their warmhearted hospitality. Dr Somkiat, on behalf of WESTPAC, thanked Myanmar colleagues for their organization of MOMSEI workshop and he also appreciated Myanmar for its great contribution for MOMSEI. Ms Khin Cho Cho Shein, on behalf of DMH, thanked the WESTPAC Office for organizing this workshop in Myanmar, and all participants for their contribution to ensure the workshop a great success. She wished a prosperous cooperation between Myanmar Scientists and other countries in the near future.
41. The workshop closed at 18:00, on Wednesdays, 12 September 2012.

ANNEX I

Sixth Expert Workshop on the Pilot Project of SEAGOOS on the Monsoon Onset Monitoring and its Social and Ecosystem Impacts (MOMSEI-VI)

Yangon, Myanmar, 10-12 September 2012

AGENDA

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ANNEX II

Sixth Expert Workshop on the Pilot Project of SEAGOOS on the Monsoon Onset Monitoring and its Social and Ecosystem Impacts (MOMSEI-VI)

Yangon, Myanmar, 10-12 September 2012

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