Item 5.2.6 of the Provisional Agenda

PROGRESS REPORT ON
HARMFUL ALGAL BLOOMS
(May 2015–April 2017)

In accordance with Terms of Reference of IOC Sub-Commission for the Western Pacific, the report is provided to facilitate the consideration by the Sub-Commission on the progress made on the WESTPAC project on Harmful Algal Blooms in the Western Pacific (WESTPAC-HAB).

The Sub-Commission is invited to discuss about the progress made over the past intersessional period, provide directives and advice on its future development, and further identify resources and national commitments to its implementation in the region.
I. Project

1. Harmful Algal Blooms in the Western Pacific (WESTPAC-HAB)

II. Project objectives and expected outputs/outcomes

2. Long term objectives are:
   1. Understanding of the biological and chemical nature, population dynamics and environmental effects of harmful algae and their bioactive products
   2. Prevention of ill consequences caused by HABs, through providing scientific knowledge useful for establishment of reliable cost- and load-effective management systems including monitoring and research

III. Principal Investigator (Chairperson) and Project Steering Group

Dr. Gustaaf Hallegraeff (Australia)
Dr. Songhui Lu (Jinan University, China)
Ms. Hikmah Thoha (Indonesian Institute of Science, Indonesia)
Dr. Yasuwo Fukuyo (University of Tokyo, Japan)
Dr. Mitsunori Iwataki (University of Tokyo, Japan; PI)
Dr. Chan Kyu Lee (National Fisheries Research and Development Institute, Korea)
Dr. Po-Teen Lim (University of Malaya, Malaysia)
Dr. Rhodora Azanza (University of the Philippines, Philippines)
Ms. Elsa Fugen Durio (National Fisheries Research and Development Institute, Philippines)
Dr. Sandric Chee Yew Leong (National University of Singapore, Singapore)
Dr. Tatiana Morozova (Russian Academy of Science, Russia)
Dr. Thaithaworn Lirdwitayaprasit (Chulalongkorn University, Thailand)
Dr. Don Anderson (USA)
Dr. Dao Viet Ha (Institute of Oceanography, Vietnam)
Dr. Nguyen Van Nguyen (Research Institute of Marine Fisheries, Vietnam)

IV. Terms of Reference of the Project Steering Group

1. Review the condition of HAB occurrences in the region and identify project requirements;
2. Promote efficient and cost-effective implementation of the WESTPAC Project and prepare recommendations on this implementation to the IOC Sub-Commission for the Western Pacific and the IOC’s Intergovernmental Panel for HAB;
3. Identify the resources necessary to meet HAB project needs;
4. Ensure effective interaction and communication with WESTPAC and IOC Intergovernmental Panel on HAB, as well as other regional intergovernmental, (e.g., NOWPAP, PEMSEA, PICES) and non-governmental (e.g., SCOR) organizations involved in research on harmful algal blooms; and
5. Report to the IOC Sub-Commission for the Western Pacific and IOC’s Intergovernmental Panel on HAB.

V. Activities carried out and/or to be carried out during the last intersessional period (May 2015 – April 2017)

3. During this intersessional period, from May 2015 to May 2017, this project has carried out/to be carried out mainly four meetings, which include three workshops for strategic discussion and another meeting for capacity building. Capacity building meeting was a training workshop on identification of HAB species, which was hosted by National University of Singapore. As well as these meetings, we carried out two other workshops, two other capacity building activities, and seven
international collaborative researches in the region, in conjunction with other research projects on harmful algae.

**V-1 Strategic Planning Workshops**

**V-1-1 The WESTPAC-HAB project workshop in May 2016**

4. The project workshop was held at WESTPAC Office, Bangkok, on 10–11 May 2016, to exchange recent novel HAB issues occurred in Malaysia, Singapore, Thailand, Vietnam and Cambodia, and discussed on strategic workshop plan in near future. Drs Mitsunori Iwataki, Yasuwo Fukuyo (Univ Tokyo, Japan), Po Teen Lim, Chui Pin Leaw (Univ Malaya, Malaysia), Thaithaworn Lirdwitayaprasit and graduate students (Chulalongkorn Univ, Thailand), Dao Viet Ha (Institute of Oceanography, Vietnam), Somkiat Korkiatiwong (Phuket Marine Biological Center, Thailand), and Mr Wenxi Zhu and Ms Nachapa Saransuth (WESTPAC Office, Thailand) have participated.

**V-1-2 The WESTPAC-HAB project workshop in December 2016**

5. The WESTPAC workshop on the development of a research strategy for Harmful Algal Blooms “Toward the future development of HAB science in the Western Pacific – What we know, and what we do not know on HABs” was held on 19–22 December 2016, at Institute of Oceanography, Nha Trang, Vietnam. Twenty-three participants mainly from steering members of the project joined from eight countries, including Dr Mitsunori Iwataki (Univ Tokyo, Japan), Dr. Somkiat Khokhiaitiwong (Phuket Marine Biological Center, Thailand) and Mr Wenxi Zhu (WESTPAC Office). The workshop aims to, (i) share information of recent HAB events to observe any trend of occurrence and emerging problem, (ii) review current knowledge on HAB science, techniques and technologies, (iii) identify scientific problems/questions/gaps in the region to address HAB problems, (iv) develop a research strategy for future HAB studies and management, and (v) publish a report to announce current and future HAB science status of the region. On 23 December, some members continue to discuss on documentation of the report and planned workshop during WESTPAC Scientific Conference in Qingdao, China.

**V-1-3 The WESTPAC-HAB project workshop in April 2017 (to be carried out)**
6. The project workshop will take place during WESTPAC Scientific Conference in Qingdao in April 2017. Drs Mitsunori Iwataki (Univ Tokyo, Japan) and Po Teen Lim (Univ Malaya, Malaysia) will organize the workshop and discuss on scientific research strategy with all participants, based on the report discussed in the previous project workshop at Nha Trang, Vietnam in December 2016.

V-1-4 Other workshops

V-1-4-1 The WESTPAC project workshop in May-June 2015

7. The workshop was held at Asian Natural Environmental Science Center, the University of Tokyo, Japan, from 31 May to 1 June 2015. The workshop aimed to exchange ideas for future scientific research and collaboration among Japan Funds-in-Trust (JFIT) supported WESTPAC projects. Drs Mitsunori Iwataki, Yasuwo Fukuyo, Teruhisa Komatsu (Univ Tokyo, Japan), Kazumi Wakita (Tokai Univ, Japan), Dao Viet Ha (Institute of Oceanography, Vietnam), and Wenxi Zhu (WESTPAC Office) attended the workshop and discussed on collaboration among projects of Harmful Algal Blooms, Ocean Remote Sensing for Coastal Habitat Mapping, and Marine Toxins and Seafood Safety.

V-1-4-2 International seminar in February 2016

8. The international seminar, Asian CORE-COMSEA Seminar on Coastal Ecosystems in Southeast Asia, was carried out at Atmosphere and Ocean Research Institute, the University of Tokyo, Kashiwa, Japan. This seminar has a research group of harmful algae and from WESTPAC-HAB members, Drs Mitsunori Iwataki, Yasuwo Fukuyo (Univ Tokyo, Japan), Kazumi Wakita (Tokai Univ, Japan), Hikmah Thoha (RCO-LIPI, Indonesia), Po Teen Lim, Chui Pin Leaw (Univ Malaya, Malaysia), Elsa Furio (NFRDI, Philippines), Thaithaworn Lirdwitayarprasit (Chulalongkorn Univ, Thailand), Nguyen Van Nguyen (RIMF, Vietnam) have attended and exchanged current information of harmful algae. This seminar was supported by Japan Society for the Promotion of Science (JSPS) and the University of Tokyo.

V-2 Capacity Building Meetings

V-2-1 Regional Training Course on Identification of Harmful Algal Bloom Species in the ASEAN Region, Singapore, 18th-22nd July 2016

9. A regional training course on identification of harmful algal bloom (HABs) species in the ASEAN region was held at St. John’s Island Marine Laboratory, Tropical Marine Science Institute (TMSI), National University of Singapore (NUS) from 18 to 22 July 2016. This training course was hosted by TMSI NUS, Southeast Asian Fisheries Development Center (SEAFDEC) and Agri-Food & Veterinary Authority of Singapore (AVA), sponsored by Japan Funds-in-Trust, and contributed by WESTPAC-HAB, Japan Funds-in-Trust (JFIT), WESTPAC and Asian Natural Environmental Science Center (ANESC). This training workshop was hosted by Dr Sandric Leong of NUS and five trainers Dr Yasuwo Fukuyo (University of Tokyo), Dr Lim Po Teen (University of Malaya), Dr
Mitsunori Iwataki (University of Tokyo), Dr Kazumi Wakita (Tokai University) and Dr Lim Hong Chang (Tunku Abdul Rahman University College) were invited.

10. This training course was attended by twenty participants from ten countries (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam) from Fisheries Agencies. The main objective of this training course was to equip and improve the identification knowledge and skills on harmful micro-algae through lectures and laboratory sessions. This course focused on the identification of harmful and red tide causative species including diatoms, dinoflagellates and raphidophytes that are commonly found in ASEAN regions. Moreover, another goal of this course was to encourage the participants to establish an international network for communication and exchange of bloom information in an event of a breakout. We also had a short introduction to freshwater bloom-forming phytoplankton species, in particular cyanobacteria, for country which has no marine HABs problem. Moreover, participants were encouraged to organize local or regional training courses to train more experts on harmful algae and species identification. This course also created a platform for participants and trainers to exchange HABs information in each country and establish networks among scientists and managing authorities. Posters on toxin-producing dinoflagellates and red tide species are expected to be produced by participants by end of this year. Subsequently, the posters will be distributed to local community to enhance the public awareness on HABs.
V-2-2 Other capacity building activities

V-2-2-1 Young researchers exchange in November 2015

11. Young researchers and graduate students under WESTPAC-HAB network were invited to Japan, during 15–27 November 2015. Mr Ridho Sianturi (RCO-LIPI, Indonesia), Ms Tan Suh Nih (Univ Malaya, Malaysia), Ms Phan Bao Vy (Institute of Oceanography, Vietnam) visited to the University of Tokyo and adjacent cities in Japan, and exchange research ideas. This visit was supported by Japan Science and Technology Agency (JST) and the University of Tokyo.

V-2-2-2 Young researchers exchange in October 2016

12. Young researchers and graduate students under WESTPAC-HAB network were invited to Japan, during 21–28 October 2016. Mr Garry Benico (Univ Philippines, Philippines), Ms Nantapak Potisarn (Chulalongkorn Univ, Thailand), Ms Thi Kim Dung Nguyen (Research Institute of Marine Fisheries, Vietnam), and Mr Law Ing Kuo (Univ Malaya, Malaysia) visited to the University of Tokyo and adjacent cities in Japan, and exchange research ideas. This visit was supported by Japan Science and Technology Agency (JST) and the University of Tokyo.

V-3 Outcomes

V-3-1 Scientific papers under international collaboration of WESTPAC-HAB

V-3-2 Scientific research strategy on harmful algae

V-4 International collaborative research

13. V-4-1 During 7–9 September 2015, collaborative research on toxic dinoflagellates was carried out at Bachok, Malaysia. Taxonomy and phylogeny of the toxic dinoflagellate Ostreopsis spp. were discussed and bloom samples of Alexandrium minutum were collected. Drs Mitsunori Iwataki
(Univ Tokyo, Japan), Thaithaworn Lirdwitayaprasit (Chulalongkorn Univ, Thailand), Po Teen Lim, Chui Pin Leaw and graduate students (Univ Malaya, Malaysia) participated to the discussion and sampling.

14. **V-4-2** During 6–9 October 2015, collaborative research on socio-economic impacts due to harmful algae was carried out at Manila, Philippines. Drs Mitsunori Iwataki, Yasuwo Fukuyo (Univ Tokyo, Japan), Kazumi Wakita (Tokai Univ, Japan), Mr Juan Relox Jr. (BFAR, Philippines), Valeriano Borja and Ms Elsa Furio (NFRDI, Philippines) have attended and exchange information on shellfish poisoning cases.

15. **V-4-3** During 19–23 October 2015, collaborative research on harmful dinoflagellate *Cochlodinium polykrikoides* were carried out at Lampung Bay, Indonesia. Drs Mitsunori Iwataki, Yasuwo Fukuyo, Teruhisa Komatsu, Kazuya Takahashi (Univ Tokyo, Japan), Kazumi Wakita (Tokai Univ, Japan), Minoru Wada (Nagasaki Univ, Japan), Mr Ridho Sianturi, Estelle Masseret (RCO-LIPI, Indonesia) and Ms Muawanah (BBPBL, Indonesia) have participated the sampling.

16. **V-4-4** From 28 February to 3 Mar 2016, collaborative research on socio-economic impacts due to harmful algae was carried out at Manila and Roxas, Philippines. Drs Mitsunori Iwataki, Yasuwo Fukuyo (Univ Tokyo, Japan) and Mr Juan Relox Jr., Sandra Arcamo (BFAR, Philippines), Ms Elsa Furio and Mr Valeriano Borja (NFRDI, Philippines) have joined and exchanged information on toxic microalgae and shellfish market. Current framework of monitoring of HABs, technique of
toxin analysis, and challenges of monitoring of HABs were interviewed to officers of Roxas City. Through the interviews, it was clarified that there were 9 PSP cases in the Philippines in 2015 and 2 of them were casualties happened outside of monitoring areas.

17. V-4-5 In response to request from the Ministry of Environment (MoE) of Cambodia through PEMSEA (Partnership in Environmental Management for the Sea of East Asia), WESTPAC and PEMSEA requested to HAB project to send an expert to identify pollution causing mass mortality of marine organisms occurred in Kep Province of Cambodia. The project sent one of the steering group member, Dr. Yasuwo Fukuyo, Japan, to work with PEMSEA staff and Cambodian technicians during 15-20 May 2016. The field survey and analysis of preserved plankton samples collected from red tide water clarified that the causative organism was a dinoflagellate Noctiluca scintillans, one of the most common dinoflagellates in the Gulf of Thailand, and that unusual weather condition made the Noctiluca red tide water pushed shore side and stayed more than a week. Consequent anoxia caused mass mortality and strong odor. Dr. Fukuyo reported the observation to the MoE and suggested to keep closer communication among MoE, WESTPAC and PEMSEA for prevention of recurrence of the problem.

18. V-4-6 During 25–27 April 2016, collaborative research on novel harmful red tide species in northern Vietnam coast was carried out at Research Institute of Marine Fisheries, Hai Phong, Vietnam. Drs Mitsunori Iwataki, Yasuwo Fukuyo, Kazuya Takahashi (Univ Tokyo, Japan), Nguyen Van Nguyen and young staffs (RIMF, Vietnam) and Dao Viet Ha (Institute of Oceanography, Vietnam) joined sampling of harmful algae and discussed on species identification of the newly occurred red tide species.
19. V-4-7 During 14–21 June 2016, collaborative research on harmful benthic dinoflagellates between the State Key Laboratory in Marine Pollution (SKLMP), City University of Hong Kong (Led by Dr Leo Lai Chan) and Institute of Ocean and Earth Sciences, UM (Dr Po Teen Lim) had been initiated. A workshop “Culturing and Identification of Benthic Harmful Marine Dinoflagellates”, drew over 16 participants, including representatives from the Agriculture, Fisheries and Conservation Department of Hong Kong, had been conducted at City University of Hong Kong. The trainers included Dr Po Teen Lim (UM), Dr Chung Kuang Lu (National Research Institute of Chinese Medicine) and Dr Chui Pin Leaw (UM).

20. V-4-8 During 8–13 August 2016, collaborative research on harmful dinoflagellate Cochlodinium polykrikoides were carried out at Lampung Bay, Indonesia. Drs Mitsunori Iwataki, Yasuwo Fukuyo, Kazuya Takahashi (Univ Tokyo, Japan), Kazumi Wakita (Tokai Univ, Japan), Minoru Wada (Nagasaki Univ, Japan), Mr Ridho Sianturi, (RCO-LIPI, Indonesia) and Ms Muawanah (BBPBL, Indonesia) joined the sampling, especially for the resting cysts of the species. Information related to aquaculture development and socio-economic data were collected at offices of the Integrated Statistic Bureau and Fisheries Bureau of Lampung Province.
21. V-4-9 During 20–23 September 2016, collaborative research between Tropical Marine Research Institute, NUS and Institute of Ocean and Earth Sciences, UM on HAB and fish kills along the Johore Strait. A scientific visit to Bachok Marine Research Station, IOES was led by Dr Sandric Leong and his team members. The group was participated in a training workshop on “Molecular Characterization of Harmful Marine Dinoflagellates” conducted by Dr Po Teen Lim and Dr Chui Pin Leaw. The workshop is aimed to provide a basic knowledge on HAB molecular detection techniques. The HAB issues were discussed and planned for joint-research sampling.

VI. Problems encountered and actions to be considered by the 11th Intergovernmental Session, tentatively scheduled for April 21-23, 2017, Qingdao, China

22. Seeking budget for activities is always problem. We are deeply grateful to Japan Government to provide us budget for activities from Japan Funds in Trust to UNESCO. We also thank to the University of Tokyo, University of Malaya, Chulalongkorn University, Institute of Oceanography, for providing financial and in kind support. We wish to express our sincere appreciation to WESTPAC office for the kind advises for activates of WESTPAC-HAB.
### VII. Workplan and Budget for May 2017 – May 2019

<table>
<thead>
<tr>
<th>Program/Project</th>
<th>Activities</th>
<th>Objectives</th>
<th>Expected outputs/outcomes</th>
<th>Date and place</th>
<th>Funding Required</th>
<th>Other sources (i.e. from national or international)</th>
<th>Remark</th>
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</thead>
<tbody>
<tr>
<td><strong>Harmful Algal Blooms in the western Pacific (WESTPAC-HAB)</strong></td>
<td>1. Strategic meeting</td>
<td>Discussion on future activities, especially on capacity building, and scientific development</td>
<td>List of training courses Drafts of outreach material</td>
<td>Place not decided in 2017 and 2018</td>
<td>20,000 USD</td>
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<td></td>
<td>2. Establishment of regional network</td>
<td>Facilitation of information exchange and dissemination</td>
<td>Networking</td>
<td>2017-2019</td>
<td>No cost</td>
<td></td>
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<td>3. Capacity building</td>
<td>Local training workshops</td>
<td>Trained scientists and technicians</td>
<td>2017-2019</td>
<td>20,000 USD</td>
<td>30,000 USD (Univ. Tokyo, Univ. Malaya, National Univ. Singapore, Chulalongkorn Univ)</td>
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<td></td>
<td>4. Interaction with other HAB projects</td>
<td>Information exchange and collaboration of activities</td>
<td>Enhance effectiveness of activities</td>
<td>2017-2019</td>
<td>No cost</td>
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<td>5. Production of outreach material</td>
<td>Information dissemination</td>
<td>Better understanding on HAB problems</td>
<td>2017-2019</td>
<td>3,000 USD (Univ. Tokyo)</td>
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<td>6. Preparation of textbook</td>
<td>Increase effectiveness of training</td>
<td>Increased skill of HAB monitoring, improved training material</td>
<td>2017-2019</td>
<td>3,000 USD (Univ. Tokyo, Univ. Malaya, National Univ. Singapore, Chulalongkorn Univ)</td>
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