

**Report of the Second CEARAC Expert Meeting on Eutrophication
Assessment in the NOWPAP Region
(22 March 2019, Vladivostok, Russia)**

Background leading to this meeting

1. Since its inception in 2002, Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC) of the Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Action Plan (NOWPAP) has implemented various activities on monitoring and assessing of the marine and coastal environment by applying remote sensing techniques.
2. CEARAC started activities on eutrophication assessment in 2008 and developed Procedures for the assessment of eutrophication status including evaluation of land-based sources of nutrients for the NOWPAP region (the NOWPAP Common Procedure) in 2009.
3. During the following biennium (2010-2011), the procedure was applied in selected sea areas in the NOWPAP member states, then refined based on the assessment results.
4. After the assessment results were reviewed, the refined NOWPAP Common Procedure was finalized in 2013 (UNEP/NOWPAP/CEARAC/FPM 13/Ref3), which has two steps in assessing the eutrophication status: screening procedure (initial diagnosis) to detect symptoms of eutrophication with the minimum required parameters; and comprehensive procedure (second diagnosis) to assess the status and possible causes of eutrophication using the four categories (Degree of nutrient enrichment, Direct effects of nutrient enrichment, indirect effects of nutrient enrichment, and other possible effects of nutrient enrichment).
5. Then, in 2014-2015, trial application of the screening procedure of the NOWPAP Common Procedure to the entire NOWPAP region was conducted. As an outcome, a web-based map on potential eutrophic zone in the NOWPAP region was constructed in the website of the Marine Environmental Watch Project.

6. Following a recommendation in the 14th CEARAC Focal Points Meeting on continuation of eutrophication assessment activity, the First CEARAC Expert Meeting on Eutrophication Assessment in the NOWPAP Region was organized on 18 October, 2017 in Qingdao, China with relevant national experts of the NOWPAP member states to review the progress of CEARAC activity on eutrophication assessment and discuss future actions to be taken for updating information of the developed map of potential eutrophic zone.
7. After presentation by the national experts and discussion, the meeting agreed on continuation of eutrophication assessment and regular organization of the expert meeting besides following items:
 - Clarifying dissolved oxygen (DO) level to determine hypoxia on the webGIS and adding explanation of observation method and frequency of monitoring; and
 - Updating satellite chlorophyll-a (Chl-a) information on annual basis by CEARAC.
8. Index of coastal eutrophication became one of the sub Indicators of the Sustainable Development Goal (SDG) 14.1. Therefore, assessment of eutrophication in the NOWPAP region can contribute to the achievement of SDGs as well. Within NOWPAP, POMRAC initiated a project to set Ecological Quality Objectives (EcoQOs) in the NOWPAP region and organized a workshop on Development of reregional NOWPAP EcoQO targets aligned with SDG indicators on 20-22 March 2019.

1 Opening of the Meeting (Introduction of the Meeting and Participants)

9. The meeting was opened at 9:00 at Bay Grand Hotel in Vladivostok, Russia on 22 March 2019 by Dr. Genki TERAUCHI, Senior Researcher of CEARAC. He briefly explained past and on-going CEARAC activities on eutrophication assessment and introduced the objectives of the second expert meeting. Dr. Ning LIU, Programme Officer of NOWPAP Regional Coordinating Unit welcomed the participants to the meeting and stressed the contribution of eutrophication assessment to address global environmental challenges which highlighted by the United Nations Environmental Assembly. Then, each participant of the meeting self-introduced themselves.

2 Follow-up and review of SDG 14 through the Regional Seas Programmes

10. Dr. Ning LIU, Programme Officer of NOWPAP, introduced mechanism of SDGs and reported the progress of indicator developments related to the SDG 14 to all meeting participants. He briefed that UNEP proposed to use the existing Regional Seas mechanisms for the follow-up and review process of the ocean-related SDG indicators, particularly 14.1.1, 14.2.1 and 14.5.1.

3 Introduction to NEAT (NOWPAP Eutrophication Assessment Tool)

11. Dr. TERAUCHI introduced NOWPAP Eutrophication Assessment Tool, NEAT that uses concentration level and trend of satellite based chlorophyll-a concentration to detect potential eutrophic zones in the NOWPAP region. Dr. Visily Kachur suggested application of Case 2 in-water algorithm in the Peter the Great Bay to accurately estimate chlorophyll-a concentration.

4 Status Reports from National Experts

4-1. Report from China

12. Dr. Zhiming YU, Professor at Institute of Oceanology, Chinese Academy of Sciences, reported results of eutrophication assessment around Qinhuandao City in Bohai Sea, one of potential eutrophic zones detected by the NEAT in China. Dr. YU explained that assessment results obtained by the comprehensive procedure showed consistency with the assessment result with the NEAT to a certain extent. While riverine nutrients showed an increasing trend in Qinhuangdao coast, DIN in the coastal waters showed decrease in recent years. Therefore, it was considered that Luanhe river may not be the major factor to affect the coastal water quality. Nevertheless, number of HABs still show sign of eutrophication, the area still needs management effort.

4-2. Report from Korea

13. Dr. Seung Ho BAEK, Principle Researcher in Risk Assessment Research Center, Korea Institute of Ocean Science and Technology (KIOST), South Sea Institute, reported results of eutrophication assessment in the potential eutrophic zones in Korea. Dr. BAEK reported that the hypoxia in the Jinhae Bay is attributed to eutrophication due to dense oyster culture farm and thermal stratification based on the naturally sluggish water circulation, particularly in only summer season. On the other hand, the hypoxia in Masan Bay is due to eutrophication resulting from domestic land use, and industrial waste input, which have been influenced by limitation of water circulation of semi-enclosed bay. Dr. BAEK explained that

decrease of nutrients inputs is not regulating abundance of hypoxia in Jinhae Bay or Masan Bay. Dr. Osamu MATSUDA commented that Seto Inland Sea in Japan is in a similar situation where decrease of nutrients loading alone is not leading to recovery in the fish catch in comparison with the level in the past.

4-3. Report from Russia

14. Dr. Alexandr ABAKUMOV, Professor and Head, Laboratory of Mathematical Modelling of Ecological Systems, Institute of Automation and Control Processes Far Eastern Branch, Russian Academy of Sciences, reported a research of phytoplankton abundance in the eastern NOWPAP sea area by a mathematical modeling with the use of satellite data. Dr. Vladimir SHULKIN, Head, Laboratory of Geochemistry, Pacific Geographical Institute, Russian Academy of Sciences reported results of eutrophication assessment in the Peter the Great Bay, Russia. Sign of eutrophication were observed in north parts of the Amursky and Usurysky Bays, areas close to the Tumen River and coastal areas adjoining to Vladivostok city. Dr. ISHIZAKA pointed out that it is important and helpful to differentiate natural and anthropogenic eutrophication from seasonal variability of chlorophyll-a concentration for management of eutrophication.

5 Invited Lectures

5-1. Toward the Management of Eutrophication of NOWPAP Sea Area: Monitoring by New Satellites and Modeling

15. Dr. Joji ISHIZAKA, Professor, Division for Land-Ocean Ecosystem Research Institute for Space-Earth Environmental Research (ISEE), Nagoya University, presented toward the Management of Eutrophication of NOWPAP Sea Area: Monitoring by New Satellites and Modeling. He suggested use of new ocean color sensors such as Second-Generation Global Imager (SGLI) of JAXA for continuous assessment of eutrophication in the NOWPAP region. Dr. ISHIZAKA also introduced recent findings of a research project of the Ministry of Environment Japan, S-13: Development of Coastal Management Method to Realize the Sustainable Coastal Area (2014-2018) led by Dr. Tetsuo YANAGI as a reference to use numerical modeling for managing eutrophication.

5-2. Introduction to EcoQO activity and possible eutrophication target

16. Dr. Osamu MATSUDA, Professor Emeritus, Hiroshima University, and an expert of NOWPAP POMRAC, introduced POMRAC's activity on development of NOWPAP's Ecological Quality Objectives (EcoQOs) and briefed results of discussion from the workshop on development of regional NOWPAP EcoQO targets aligned with SDG indicator was organized by NOWPAP POMRAC from March 20-21 in Vladivostok right before the CEARAC expert meeting. Dr. MATSUDA introduced that POMRAC decided to work on development of 4 EcoQO targets: EcoQOs 3.1.1 (nutrient concentration), EcoQOs 3.2.1 (chlorophyll-a concentration), EcoQOs 4.1.1. (concentration of contaminants) and EcoQOs 5.1.1. (trends in amount and composition of litter washed ashore). Dr. MATSUDA then encouraged collaboration between CEARAC and POMRAC in setting EcoQO targets on nutrients concentration and chlorophyll-a concentration.

6 Discussion on Setting NOWPAP Eutrophication Target

17. The meeting participants discussed the way forward on setting NOWPAP Eutrophication Target and acknowledged that a clear demarcation between CEARAC and POMRAC is necessary to avoid unnecessary duplicated effort within the NOWPAP framework. The meeting participants suggested CEARAC to continue development of the NEAT to identify potential eutrophic zones in the NOWPAP region using remote sensing and POMRAC to develop EcoQO targets for nutrient concentration and chlorophyll-a concentration in designated area in NOWPAP member states.

18. The meeting participants then agreed on the following suggestions towards setting NOWPAP eutrophication target in the future.

- Continue organizing another CEARAC Expert Meeting on Eutrophication Assessment collaboration with POMRAC experts' group on EcoQOs.
- Encourage CEARAC to further develop the NEAT with new OC sensors by inter calibration of sensors and cross validation with in situ Chl-a.
- Suggest CEARAC and POMRAC to unify terminology between related to EcoQOs 3.1.1 (nutrient concentration) and EcoQOs 3.2.1 (chlorophyll-a concentration) referring to the NOWPAP Common Procedure for eutrophication assessment.

7 Closure of the Meeting

19. The Second CEARAC Expert Meeting on Eutrophication Assessment in the NOWPAP Region was closed at 15:45 on 22 March 2019.