

## **1. Background**

Importance of collaboration between WG3 and WG4 has been emphasized at the past NOWPAP WG3 and WG4 meetings. Especially since the 3<sup>rd</sup> NOWPAP WG3/WG4 joint meeting, joint activities between WG3 and WG4 to share common themes such as eutrophication and HAB have been suggested for future activities of CEARAC by the experts, and it was integrated into the mid- and long-term strategies of CEARAC and goals of NOWPAP WG3 and WG4.

Eutrophication Monitoring Guidelines by Remote Sensing for the NOWPAP Region were made in 2007 and are expected to take a role for enhancing utilization of remote sensing techniques into monitoring and assessment of HAB. However, remote sensing application methods for marine environment conservation still needs improvement in order to satisfy requirements of HAB experts.

In addition, Land Based Source for pollution was included in CEARAC activity based on the approved new direction for the NOWPAP at the 10<sup>th</sup> Inter-Governmental Meeting (IGM) (Toyama, Japan, 24-26 November 2005) of NOWPAP.

Recognizing these backgrounds, developing common procedures for assessment of eutrophication status, by utilizing remote sensing techniques, including evaluation of land based sources of nutrients for the NOWPAP region, was proposed at the 5<sup>th</sup> CEARAC FPM and approved at the 12<sup>th</sup> NOWPAP IGM as a joint activity between NOWPAP WG3 and WG4 for the 2008-2009 biennium.

## **2. Objective**

Objective of this activity is developing useful procedures for assessment of eutrophication status (nutrient enrichment, HAB occurrence, and other direct and indirect effects from nutrient enrichment) by utilizing remote sensing techniques that can be shared among the NOWPAP members, based on lessons learned from a pilot study conducted in Toyama Bay.

## **3. Main tasks**

CEARAC will develop draft procedures for assessment of eutrophication status by March 2008, based on the validation results from a pilot study to be conducted in Toyama Bay by NPEC in reference to activities against eutrophication in other regional seas. Draft table of contents of the draft procedures is attached in Annex.

CEARAC prepared this workplan for developing common procedures for assessment of eutrophication status. Upon approval of the workplan at the CEARAC FPM, CEARAC will conclude MoU with national experts recommended by WG3 experts or WG4 experts

themselves to review and refine the draft procedures.

Upon the conclusion of the MoU, experts are expected to review and refine the draft procedures prepared by CEARAC. Then, the result of review and refinement will be harmonized and compiled into the common procedures for assessment of eutrophication status for the NOWPAP region by a consultant hired by CEARAC.

The developed procedures for assessment of eutrophication status will be used to conduct case study in each NOWPAP member state in the near future.

#### 4. Expected outcomes

The developed procedures will contribute to assessment of eutrophication status, including evaluation of land based sources of nutrients, by utilizing remote sensing techniques in each NOWPAP member state.

#### 5. Schedule

Proposed schedule will be as follows.

Time		Actions	Main body
/2008	Q1	<ul style="list-style-type: none"> <li>Preparation of workplan for development of procedures for eutrophication</li> </ul>	CEARAC/ consultant
	Q1	<ul style="list-style-type: none"> <li>Review of prepared workplan by WG3/WG4 experts</li> </ul>	WG3/WG4 experts
	Mar (6 <sup>th</sup> CEARAC FPM)	<ul style="list-style-type: none"> <li>Approval of workplan and budget for development of common procedures for assessment of eutrophication status</li> <li>Discussion on the interim progress of the draft procedures for assessment of eutrophication status (the draft procedures)</li> </ul>	CEARAC FPs
	Q2	<ul style="list-style-type: none"> <li>Completion of the draft procedures</li> </ul>	NPEC / CEARAC
	Q2	<ul style="list-style-type: none"> <li>Conclusion of MoU with national experts</li> </ul>	CEARAC / national experts/ consultant
	Q2 to Q3	<ul style="list-style-type: none"> <li>Review and refinement of the draft procedures</li> </ul>	National experts / consultant
	Q3 (4 <sup>th</sup> WG3/WG4 Meetings)	<ul style="list-style-type: none"> <li>Review of interim progress of review and refinement of the draft procedures</li> </ul>	WG3 and WG4 experts
	Q4	<ul style="list-style-type: none"> <li>Review and refinement of the draft procedures (continue)</li> </ul>	National experts
2009	Q1 to Q2	<ul style="list-style-type: none"> <li>Harmonization of the result of review and refinement of the NOWPAP member states</li> </ul>	CEARAC / consultant
	Q3	<ul style="list-style-type: none"> <li>Review of harmonized draft (final draft) procedures for utilizing remote sensing data</li> <li>Publication of procedures for utilizing remote sensing data for assessment of eutrophication status and refinement plan of the procedures</li> </ul>	WG3 and WG4 experts /CEARAC FPs CEARAC / consultant

## 6. Budget

<b>Contract</b>	<b>Timing</b>	<b>Output</b>	<b>To be completed</b>	<b>Couterpart</b>	<b>Budget (US\$)</b>
MoU for refinement of the draft procedures by national experts	2008 Q2	Refined procedures	2008 end of Q4	Expert in China	2,000
				Consultant /expert in Japan	2,000
				Expert in Korea	2,000
				Expert in Russia	2,000
MoU for harmonization of refinement results of NOWPAP member states on the draft procedures	2009 Q1	Harmonized procedures based on refined procedures from NOWPAP member states	2009 Q1	Consultant	2,000
Total					10,000

## Annex

### Draft procedures for the assessment of eutrophication status for the NOWPAP region ( as of Mar 5, 2008 )

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## 1. Introduction

### 1-1. Background

1.1. Development of the ‘Draft procedures for assessment of eutrophication status including evaluation of land based sources of nutrients for the NOWPAP region (draft procedure)’ was proposed and approved at CEARAC FPM 5.

1.2. As part of the development process of the draft procedure, NPEC has implemented a case study in Toyama Bay (Toyama Bay case study), by referring to the ‘Common Procedure for the Identification of the Eutrophication Status of the OSPAR Maritime Area’.

### 1-2. Characteristics of the draft procedure

1.3. The draft procedure was developed based on the following principles:

- i) The procedure should be adjustable to various types of sea area in the NOWPAP region
- ii) Remote sensing will be incorporated into the assessment procedure
- iii) The eutrophication status is assessed through a holistic approach with aspect of degree of nutrient enrichment, direct/indirect effects of nutrient enrichment and other possible effects of nutrient enrichment.
- iv) The eutrophication status is assessed in relative ways
- v) The Toyama Bay case study is attached for reference

### 1-3. Overall structure

1.4. The assessment procedure is broadly separated into six parts, namely i) Scope of study, ii) Defining assessment criteria, iii) Data processing, iv) Assessment process and results, v) Review/Verification of results, vi) Conclusion/recommendation. “Scope of study” involves the determination of assessment area and assessment parameters, “Defining assessment criteria” involves how to define assessment criteria, “Data processing” involves processing of raw data into data sets for the assessment, “Assessment process and results” involves the process and results for assessment or eutrophication status, “Review/Verification of results” involves reviewing of the assessment results and verification of obtained results by remote sensing. “The conclusion/recommendation” will identify future issues and actions, based on the results of the preceding parts.

The following chapters are structured in order of the above parts.

## 2. Scope of study

### 2-1. Defining assessment objectives

2.1. State the objectives of the assessment

2.2. To assist the understanding of the assessment results, clarify the preconditions and limitation of the assessment.

### 2-2. Setting of assessment area

2.3. Select an area of assessment that is considered be one marine area.

2.4. Area of assessment shall be as big as possible. Existing monitoring/assessment program, geographical condition, fishery/recreational activities and administrative boundaries should be considered when setting the assessment area.

2.5. An area of assessment can be an area where existing environmental monitoring and assessment programs are being conducted.

### 2-3. Collection of relevant information

2.6. Collect relevant information of the assessment area such as, status of water quality monitoring (monitoring locations, frequency, parameters), status of wastewater discharge, status of coastal use (recreational beaches, etc.), population of catchment area, land use, industrial activities (industries that have potential impact on eutrophication) and so on.

2.7. Collect data from organizations that monitor chemical, biological and physical parameters that directly or indirectly relate to eutrophication. The followings are some relevant organizations:

- i) Organizations that monitor water quality for environmental protection
- ii) Organizations that monitor harmful algal blooms to protect fishery resources
- iii) Organizations that monitor shellfish poisoning for food safety

2.8. Sort the collected monitoring data of each organization by survey objective, period, parameter, frequency, location, etc.

2.9. Ideally, other relevant information such as ocean current and water temperature should also be collected.

### 2-4. Division of assessment area into sub-areas

2.10. In order to understand and assess the causes and direct/indirect effects of eutrophication at more localized scales, the assessment area may be divided into sub-areas.

2.11. A sub-area should have similar water quality and ocean current regime within its boundary. Factors such as location of riverine input, monitoring locations, fishery activities, underwater topography, salinity distribution, ocean/tidal currents, red-tide events can be considered when dividing into sub areas.

## 2-5. Selection of monitoring/survey results

2.12. Select the most appropriate data source for the assessment procedure based on the processes of section 2-3.

2.13. The following types of data sources should not be used for the assessment procedure.

- i) Surveys conducted at very limited frequency
- ii) Data that are not directly related to eutrophication
- iii) Surveys that are not conducted at regular locations and frequency
- iv) Surveys that are not conducted for monitoring water quality and aquatic organisms (e.g. academic research)
- v) Surveys that employ uncommon analytical methods

## 2-6. Determination of assessment parameters

### 2-6-1. Categorization of monitored/surveyed parameters

2.14. Categorize all eutrophication related parameters that are monitored/surveyed within the assessment area into one of the following 4 categories:

- i) Category I      Parameters that indicate degree of nutrient enrichment
- ii) Category II     Parameters that indicate direct effects of nutrient enrichment
- iii) Category III    Parameters that indicate indirect effects of nutrient enrichment
- iv) Category IV     Parameters that indicate other possible effects of nutrient enrichment

2-6-2. Selection of assessment parameters

2.15. After the categorization process, select assessment parameters that are applicable for the assessment procedure. The assessment parameters should be selected based on availability of reliable and continuous data on the condition that assessment methods are established.

2.16. In principle, all available eutrophication related survey/monitoring parameters should be selected for the assessment procedure. If certain parameters are to be excluded from the assessment procedure, the reasons must be stated.

2.17. Reliable and continuous data may refer to data that are collected at fixed locations at regular frequency and over certain periods.

2.18. The following table shows examples of assessment parameters that fall under the above 4 categories.

Category	Description	Parameters
	Parameters that indicate degree of nutrient enrichment	Nutrients load (N/P and river discharge) Nutrients concentration in winter (DIN, DIP) N/P ratio in winter TN and TP
	Parameters that indicate direct effects of nutrient enrichment	Chlorophyll-a concentration (ship) Chlorophyll-a concentration (satellite) Number of red tide occurrence
	Parameters that indicate indirect effects of nutrient enrichment	Dissolved oxygen Change of benthos and kills Fish kill COD
	Parameter that indicate other possible effects of nutrient enrichment	Shellfish poison

2-6-3. Setting data source for each parameter

2.19. Set the data source to be applied for each selected assessment parameter.

2.20. In principle, all available data sources should be used as far as practical.

2-7. Defining assessment period

2.21. Define the assessment period in accordance with the assessment objectives taking into account of data availability.

### 3. Defining assessment criteria

3.1. To assess the eutrophication status of the area of assessment, define assessment criteria with respect to each data, each parameter, parameters category and area/sub-area of assessment basis.

3.2. Assessment value of each parameter should be defined by considering the eutrophication mechanism based on scientific knowledge.

#### 3-1. Defining identification criteria for each data

3.3. Define identification criteria for each data based on the following identification tools.

i) Identification by comparison: eutrophication status identified by comparing data with background values or environmental standards

ii) Identification by occurrence: eutrophication status identified by occurrence or non-occurrence

iii) Identification by trend: eutrophication status identified by trend analysis

3.4. State clearly how the identification criteria of each assessment parameter were defined with objective reason.

#### 3-2. Defining classification criteria for each parameter

3.5. Define classification criteria for each parameter based on the identification results of each data.

3.6. The following table shows examples of assessment criteria for each parameter

Comparison or Occurrence	Trend	Classification result for each parameter
+	+	+
+	-	+
-	+	+
-	-	-
(None)	+	+
(None)	-	-

Note

If data from multiple monitoring sites are employed for the classification for each parameter, each parameter will be classified as '+' if there are more than one monitoring site resulted '+' classification.

3-3. Defining classification criteria for each parameters category

3.7. Define classification criteria for each parameters category based on the classification results of each parameter.

3.8. The following table shows an example of classification criteria for each parameters category

1) Results of each parameters category are classified as “+” if one parameter of the category is classified as “+”.
2) Results of each parameters category are classified as “-” if all parameters of the category are classified as “-”.

3-4. Defining classification criteria for area/sub-area

3.9. Define classification criteria for area/sub-area based on the classification results of parameters category.

3.10. The following table shows examples of Classification criteria for area/sub-area

Category I	Category II	Category III and IV	Classification results of area/sub-area
+	+	+	Relatively affected area
+	+	-	Relatively affected area
+	-	+	Relatively affected area
+	-	-	Non problem area
-	+	+	Relatively affected area
-	+	-	Relatively affected area
-	-	+	Relatively affected area
-	-	-	Non problem area

## 4. Data processing

### 4-1. Setting the data processing procedure

4.1. Set a common data processing procedure for each assessment parameter.

### 4-2. Data screening

4.2. Exclude data that are not suitable for the assessment procedure within the selected data source.

4.3. State the reasons for their exclusion in case certain data are excluded. Possible reasons could be related to survey location, data reliability and so on.

### 4-3. Sorting data into sub-areas

4.4. If the assessment area is divided into sub-areas, the data applied for the assessment of each sub-area should be screened and sorted into each sub-area group by referring to the location of the survey/monitoring sites. Data processing for assessment parameter

4.5. Process the collected data based on the pre-set data processing procedure.

4.6. In principal, data processing should be conducted for each survey/monitoring site.

4.7. Data should be processed by sorted data sets for each assessment parameter and data survey/monitoring site.

## 5. Assessment process and results

5.1. Identify survey results by each site based on the defined identification criteria for each data

5.2. Classify survey results by each parameter based on the defined classification criteria for each parameter (If there are multiple survey/monitoring sites within the assessment area/sub-area, the eutrophication status is determined by taking into account all the identification results obtained for each survey/monitoring sites).

5.3. Classify survey results by each parameters category based on the defined classification criteria for parameters category.

5.4. Classify survey results by each area/sub-area based on the defined classification criteria for area/sub-area.

## 6. Review/Verification of results

6.1. Upon completion of the assessment, the following points should be reviewed by experts.

i) Review whether all relevant information/data were available and complete (completeness check).

ii) Review whether the methodology, assessment criteria, data processing, etc. were consistent (consistency check).

6.2. The assessment report should have all necessary information required for the review.

6.3. Remote sensing is recommended to be used for the verification of the assessment results.

## 7. Conclusion/recommendation

7.1. Based on the assessment results, provide recommendations for future actions.

7.2. Possible recommendations may be in regards to, requirements for more detailed surveys, addition of monitoring locations, readjustment of assessment area and so on.