

1. Background

Seagrass and seaweed beds provide various ecosystem services: habitats, spawning and nursery grounds, and places of feed production for aquatic biota; functions for seawater purification by absorbing nutrient (nitrogen and phosphorus) and for CO₂ fixation. According to Costanza et al., (1997), economic value of ecosystem services provided by seagrass and seaweed in coastal areas (about 19,000USD/ha/year) is much higher than that in terrestrial biome such as tropical rainforests and freshwater ecosystem (about 2,000 USD/ha/year). In addition, 'Blue Carbon' (CO₂ absorbed by aquatic biota) (2009, UNEP) reported that seagrass and seaweed beds, tidal flats, mangrove forests, and phytoplankton absorb approximately 55% of all CO₂ absorbed by biota on earth. These facts draw attention to seagrass and seaweed beds; not only in terms of ecosystem conservation but also of reduction of greenhouse gas.

In the coastal areas in the NOWPAP member states, while seagrass and seaweed beds have shrunk by landfill in shallow waters, eutrophication, port construction, and/or dredging, information on the distribution and its changing pattern of seagrass and seaweed is sparse. Considering the current situation of seagrass and seaweed beds and their function to maintain marine biodiversity, an activity for developing habitat maps for coastal ecosystems using remote sensing and GIS techniques was proposed in the NOWPAP Mid-term Strategy 2012-2017, and adopted in the 16th NOWPAP Intergovernmental Meeting in 2012. Moreover, the Group on Earth Observation Biodiversity Observation Network (GEO-BON) has established a working group on marine ecosystems, and utilization of remote sensing techniques in habitat mapping of seagrass and seaweed beds and tidal flats are highly expected.

With financial support from the Mitsui and CO., Ltd. Environment Fund, the Northwest Pacific Region Environmental Cooperation Center (NPEC), host organization of NOWPAP CEARAC, has been conducting a research project in the coastal zone of Miyagi Prefecture to assess damage of seagrass and seaweed suffered from the Great East Japan Earthquake and the Tsunami on 11 March 2011 (UNEP/NOWPAP/CEARAC/FPM 11/Ref5). The research project aims to develop a map to assist recovery process of seagrass and seaweed beds with remote sensing techniques. NPEC also initiated another research project to assess distribution of seagrass and seaweed beds with remote sensing techniques in Toyama Bay in 2012.

Based on the NPEC's experience and capacity to analyze high resolution satellite images to study seagrass and seaweed distribution, CEARAC proposes a new activity for the 2014-15 biennium to apply remote sensing techniques for seagrass and seaweed mapping in selected case study areas in the NOWPAP member countries. The proposal was reviewed and supported in principal at the Expert Meeting on Marine Biodiversity and Eutrophication in the Northwest Pacific Region held on 5-6 August 2013.

2. Objective

Objective of this activity is to conduct case studies on the changes of seagrass and seaweed distribution associated with environmental change in the NOWPAP member states by applying remote sensing techniques. A manual to detect spatial distribution of seagrass and seaweed beds will be developed and then validated in selected case study areas.

3. Tasks

3.1 Development of a manual for seagrass and seaweed beds mapping with satellite images

CEARAC will develop a manual for analysis of satellite images to estimate the distribution of seagrass and seaweed beds, which will be applicable among the NOWPAP member states, based on the manual developed by NPEC for use in Japan. In development of the manual, CEARAC will use free software such as BEAM and inexpensive medium-resolution sensor (e.g. ANVIR, RapidEye). The developed manual will be further evaluated and refined based on the results of case study below.

3.2 Mapping seagrass and seaweed distribution in selected case study areas

Case study areas will be selected considering availability of satellite images from past archives with the help of nominated experts by CEARAC FPs. Then, the experts will prepare a seagrass and seaweed distribution map of each case study area with the manual developed in 3.1. When preparing the map, more than two scenes of satellite images (with intervals of several years) should be used in order to show secular changes. Case studies will include the analysis of environmental changes such as temperature, anthropogenic eutrophication, aquaculture, coastal development, and their implications on the change in seagrass and seaweed distribution.

The case study results will be posted on the CEARAC website which may be overlaid on other habitat maps. At the same time, advantage and limitation of developed techniques will be studied to evaluate their applicability to other areas in the NOWPAP region.

(Note) The above activities are based on Budget Option B (US\$ 125,000 for entire CEARAC Activity). A workshop on seagrass and seaweed beds mapping in the Northwest Pacific region may be organized to discuss the results of case studies and possible elaboration of the manual among the experts under Budget Option C (US\$ 147,000).

4. Expected outcomes

Case study results and the developed manual will be shared among coastal managers in the NOWPAP member states to help understand and conserve seagrass and seaweed beds that are important to maintain marine biodiversity in the NOWPAP region. It is also expected that the

developed manual may be used to prepare a seagrass and seaweed beds distribution map on a regional scale in a cost-effective manner. This activity will be the first step for developing habitat maps for coastal ecosystems using remote sensing and GIS techniques proposed in the NOWPAP MTS and the developed techniques are expected to serve as a useful coastal environmental assessment tool in the future.

5. Schedule

The time line of tasks in this activity is shown as follows.

Time	Action	Main body
2013 Aug.	Expert Meeting - Review of the draft proposal	CEARAC Secretariat and Experts of NOWPAP member states
Sep.	CEARAC FPM11 - Review of the proposal	CEARAC Secretariat and FPs
Dec.	NOWPAP IGM18 - Review/approval of CEARAC workplan and budget for 2014-2015	representatives of member states
2014 Q2	CEARAC FPM12 - Review and approval of the implementation plan	CEARAC Secretariat and CEARAC FPs
Q3/Q4	Development of a manual for seagrass and seaweed beds mapping with satellite images	CEARAC Secretariat and Consultants
2015 Q1/Q2	Purchase of archives of satellite images and selection of case study sea areas in each NOWPAP member state	CEARAC Secretariat and Experts of NOWPAP member states
Q3	Case studies on seagrass and seaweed beds mapping with satellite images Refinement of manual and evaluation of developed techniques	CEARAC Secretariat and Experts of NOWPAP member states
Q3	Organization of a workshop on seagrass and seaweed beds mapping in the Northwest Pacific region (depends on budget)	CEARAC Secretariat and Experts of NOWPAP member states
Q4	Preparation of case study report on seagrass and seaweed beds mapping with satellite images	CEARAC and Experts of NOWPAP member states

6. Budget

Task	Timing	Output	To be completed	Main body	Budget (US\$)
Development of a manual for seagrass and seaweed beds distribution with satellite images	2014 Q2	Archive of high-resolution satellite images	2014 Q3	NPEC Consultant	4,000
Purchase of archives of high-resolution satellite images	2014 Q4	Archive of high-resolution satellite images	2014 Q4	CEARAC	4,000
Case studies on seagrass and seaweed mapping in selected sea areas in the NOWPAP member states	2015 Q3	Maps of seagrass and seaweed beds distribution in respective case study sea areas	2015 Q4	Expert in China	3,000
				NPEC Consultant	3,000
				Expert in Korea	3,000
				Expert in Russia	3,000
Organization of a workshop on seagrass and seaweed beds mapping in the Northwest Pacific region	2015 Q3	Report and proceeding of a workshop	2015 Q3	CEARAC	(15,000) Depends on budget
Total					20,000 (35,000)

(Note) Budget amounts in parentheses represent a Budget Option C case.