1. Background

Seagrass and seaweed beds provide various ecosystem services such as habitats, spawning and nursery grounds and places of feed production for aquatic biota. They also function for seawater purification by absorbing nutrients (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 ecosystems (about 2,000 USD/ha/year). In addition, 'Blue Carbon' (CO_2 absorbed by aquatic biota) (2009, UNEP) reports that seagrass and seaweed beds, tidal flats, mangrove forests, and phytoplankton absorb approximately 55% of all CO_2 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 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 Medium-term Strategy (MTS) 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 is 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, Japan 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 the 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 adopted at the Eleventh CEARAC FPM held on 11-12 September 2013 in Toyama.

2. Objective

Objective of this activity is to conduct case studies on the changes of seagrass and seaweed distribution associated with environmental changes 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 the development of the manual, CEARAC will try to 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 the case study below.

3.2 Mapping of 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 the task 3.1. When preparing a 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 changes of seagrass and seaweed distribution.

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.

3.3 Organization of international workshop on mapping of seagrass and seaweed beds distribution in the Northwest Pacific region

An international workshop on mapping seagrass and seaweed beds in the NOWPAP region will be organized. This workshop aims at discussing directions and actions required by the NOWPAP member states to construct an information infrastructure on seagrass and seaweed distribution for their conservation and restoration in the NOWPAP region. Due to budget constraint, this workshop will be organized in collaboration with regional partners such as IOC/WESTPAC by possibly obtaining external funding.

4. Expected outcomes

Case study results and the developed manual will be shared among coastal managers in the NOWPAP member states on CEARAC websites 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
2014 July	CEARAC FPM12 - Review and approval of the work plan and budget	CEARAC Secretariat and CEARAC FPs
Q3-Q4	Development of a manual for seagrass and seaweed beds mapping with satellite images	CEARAC Secretariat and Consultant
2015 Q1	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
Q2-Q3	Case studies on seagrass and seaweed beds mapping with satellite images Refinement of the manual and evaluation of the 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 a 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 Q3-Q4	Archives of high-resolution satellite images	2014 Q4	NPEC Consultant	4,000
Purchase of archives of high-resolution satellite images	2015 Q1	Archives of high-resolution satellite images	2015 Q1	CEARAC	4,000
Case studies on seagrass and seaweed mapping in selected sea areas in the NOWPAP member states	2015 Q2-Q3	Maps of seagrass and seaweed beds distribution in respective case study sea areas	2015 Q3	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)