Report on case studies of estimating seagrass blue carbon in selected sea areas in the NOWPAP region

1. Background

CEARAC has recognized the importance of seagrass beds in coastal areas in terms of conserving marine biodiversity and storing carbon, and developed a manual for seagrass and seaweed beds distribution mapping with satellite images in the 2014-2015 biennium (UNEP/NOWPAP/CEARAC/FPM 13/13 Annex XV). Then, case studies on seagrass mapping were implemented in some selected sea areas in the NOWPAP region to validate the method in the manual. During the following 2016-2017 biennium, CEARAC carried out a feasibility study towards assessment of seagrass distribution in the entire NOWPAP region with satellite images, which provided obstacles and necessary resources and/or tasks in accurate estimation of seagrass beds in the entire NOWPAP region. In the 2018-2019 biennium, CEARAC developed a web-based tool for mapping seagrass distribution by taking advantage of cloud computing, and established a website, "Mapseagrass Project", under the auspices of the Ministry of the Environment of Japan to promote the use of remote sensing techniques in mapping seagrass. In the website, CEARAC started trial operation of cloud-based seagrass mapping tools; Seagrass Mapper built using Google Earth Engine for mapping and Seagrass Trainer to manage field based seagrass information to prepare training data to work with the Seagrass Mapper.

United Nations has also emphasized a critical role of seagrass as blue carbon ecosystems along with mangrove and salt marsh, and developed a global synthesis report, "<u>OUT OF THE BLUE: RECOGNISING THE VALUE OF SEAGRASSES TO THE ENVIRONMENT AND TO PEOPLE</u>" with GRID-Arendal, a Norwegian foundation. They have highly evaluated past and existing CEARAC activities on mapping seagrass distribution in the NOWPAP region and CEARAC contributed to the work by proving some input in the mapping and monitoring chapter of the report. Using these accumulated knowledge and skills on mapping seagrass beds, in the current 2020-2021 biennium, CEARAC has been implementing case studies of estimating seagrass blue carbon in some selected sea areas in the NOWPAP region.

In February 2021, CEARAC held a kick-off meeting with national experts nominated by CEARAC FPs and advisors to discuss how to proceed this project, including revision of the implementation plan in the current situation of COVID-19 pandemic. Then, the meeting decided to cancel organization of the international workshop and allocate that budget to fill up shortened budget for sampling tasks in the field. In June 2021, CEARAC circulated the revised implementation plan of this project to CEARAC FPs and it was adopted by e-mail correspondence.

Table 1 CEARAC Activities on Mapping Seagrass Distribution.

Year	Activity	Output
2014-2015	- Developing a manual for seagrass and seaweed beds distribution mapping with satellite images - Implementing case studies on seagrass mapping in selected sea areas	-Manual for seagrass and seaweed beds distribution mapping with satellite images - Case study reports
2016-2017	- Implementing feasibility study towards assessment of seagrass distribution in the NOWPAP region	- Feasibility study report
2018-2019	- Developing a tool for mapping seagrass distribution in the NOWPAP region	- A tool and web-based service for mapping seagrass distribution

2. Objectives

Objectives of this activity are to carry out case studies of estimating seagrass blue carbon in selected sea areas in each NOWPAP member state and to develop effective information tools to encourage decision-makers and the public to conserve seagrass beds by providing quantitative proof of the importance of seagrass beds.

3. Tasks

3.1 Selecting/nominating case study areas and responsible experts

CEARAC sent a draft Memorandum of Understanding (MoU) to CEARAC FPs for asking to nominate experts to carry out a case study in each member state, and the experts shown in Table 2 were selected. Procedures to estimate blue carbon in seagrass ecosystem in the field was prepared by cooperation of Dr. Milica STANKOVIC of Prince of Songkla University who has expertise.

Table 2 Lists of national experts and advisors for

case studies of estimating seagrass blue carbon in the NOWPAP region

Experts	Organization	Country	Case Study Area
Dr. Qinghui XING	National Marine Environmental Monitoring Center	China	Swan Lake
Dr. Gregory N NISHIHARA	Nagasaki University	Japan	Katagami Bay in Ohmura Bay
Dr. Seung Hyeon KIM	Pusan National University	Korea	Dongdae Bay
Dr. Vasilii ZHARIKOV	Pacific Geographical Institute, FEBRAS, Russia	Russia	Srednyaya Bay

Advisors	Organization	Country
Dr. Milica STANKOVIC	Seaweed and Seagrass Research Unit, Excellence Center for Biodiversity of Peninsular Thailand, Faculty of Science, Prince of Songkla University	Thailand

Dr. Teruhisa KOMATSU	Japan Fisheries Resource Conservation Association	Japan
Dr. Tatsuyuki SAGAWA	Remote Sensing Technology Center of Japan	Japan
Dr. Yegor VOLOVIK	NOWPAP RCU	
Dr. Ning LIU		

3.2 Estimating seagrass blue carbon in selected sea areas

Nominated experts in each member state will carry out case studies for each selected sea area to estimate seagrass blue carbon. The following procedure will be taken:

- Based on the Seagrass Watch Manual (Mackenzie et al, 2001), conduct seagrass quadrat sampling in each seafloor substrate class in a luxuriant growth period (when most seagrass have flowering shoots, typically late spring to summer) and a scanty growth period (winter).

- Weigh the dried seagrass of the Above Ground Biomass (AGB) and Below Ground Biomass (BGB) in each substrate class.

- Collect more than 40 ground truth points of seagrass and non-seagrass, respectively (longitude and latitude measured with GPS equipped with Quasi-Zenith Satellite System (QZSS) or Satellite-Based Augmentation System (SBAS) signal capture system within a precision of several meters) keeping distances more than 90 m between any ground truth points in a case study area during the flowering (luxuriant growth) period for classification of seafloor.

- Calculate the seagrass coverage areas in the luxuriant growth period from 2015 to 2020 using Seagrass Mapper, a cloud-based tool for mapping seagrass developed by CEARAC.

- Estimate the amount of blue carbon captured/stored in seagrass ecosystem in the case study area referring to a manual provided by CEARAC*.

  (*In case it is difficult to carry out quadrat sampling and analysis of obtained samples within the budget, existing survey results including equations generated on the global data sets (Fourqurean et al. 2012) from literatures can be used.)

- Prepare and submit a summary report of the case study in line with the annotated table of contents provided by CEARAC as presented in Annex of this document.

3.3 Organizing an online expert meeting

CEARAC will organize an online expert meeting at the end of 2021 to report case study results, discuss contents of the case study summary report , and prepare for a booklet for seagrass conservation in the NOWPAP region.

3.4 Publication of a booklet for seagrass conservation in the NOWPAP region

CEARAC will publish a booklet for seagrass conservation in the NOWPAP region in English and the four languages of the NOWPAP members. The booklet will be distributed to relevant stakeholders, and the same contents will also be disseminated to the public through various social media networks in cooperation with international groups of seagrass conservation.

4. Expected outcome

By visualizing the value of seagrass blue carbon as a form of booklet through quantitative assessment, this activity can provide information infrastructure to help propelling seagrass conservation in the NOWPAP region by various stakeholders.

5. Schedule

The timeline of this activity is shown below.

Time		Action	Main body
2019	September	Adoption of workplan at CEARAC FPM 17	CEARAC and CEARAC FPs
2020	May	Approval of NOWPAP workplan and budget for the 2020-2021 biennium by the NOWPAP member states	NOWPAP National FPs and CEARAC FPs
	August	Review of the implementation plan at FPM18	CEARAC and Nominated experts
2021	Q1	Selection/nomination of case study areas and experts	CEARAC FPs
		Online meeting with nominated experts	CEARAC and Nominated experts
	Q2 - Q4	Implementation of case studies (estimation of seagrass blue carbon)	Nominated experts
	Q3 or Q4	Organization of online expert meeting	CEARAC and Nominated experts
	Q4	Publication of a booklet	CEARAC and Nominated experts

6. Budget

Task	Time	Output	To be completed	Main body	(US$) Budget
Implementation of case studies of estimating seagrass blue carbon	2021 Q2	Case study reports	2021 Q4	Nominated experts	24,000 (6,000/each)
Organization of the expert meeting (web)	2021 Q4	Meeting report	2021 Q4	CEARAC and Nominated experts	0
Publication of a booklet for seagrass conservation in the NOWPAP region	2021 Q4	A booklet	2021 Q4	CEARAC	3,000
Total					27,000

7. References

Mackenzie. L. J., Campbell, S. J. and Roder, C. A. (2001) Seagrass-Watch: Manual for Mapping & Monitoring Seagrass Resources by Community (citizen) volunteers. (QFS, NFC, Cairns) 100pp

Stankovic M, Tantipisanuh N, Rattanachot E. and Prathep A (2018) Model-based approach for estimating biomass and organic carbon in tropical seagrass ecosystems. Mar Ecol Prog Ser 596:61-70.
https://doi.org/10.3354/meps12597

Annex

Annotated table of contents for the case study summary report

1 Introduction

Information about case study area and seagrass spices will be described.

2 Methodology

2.1 Field information about sea floor substrates

Field information about sea floor substrates to be used to train satellite images for classification will be described.

2.2 Satellite image correction and classification

Satellite images to be used for classification will be described with its correction methods to remove effects of atmosphere, water column, depth and tide. Classification algorithm will also be described.

2.3 Methods for estimating blue carbon

Procedures for estimating blue carbon will be described.

3 Results

3.1 Classification of seafloor and accuracy assessment

Results of seafloor classification with its accuracy will be described.
(Ground truth data will be attached as Annex A)

3.2 Estimating blue carbon

Calculation of organic carbon stock in seagrass ecosystem in the case study areas will be described.
(Raw data concerning organic carbon will be attached as Annex B)

4 Recommendation for mapping seagrass in other part of each NOWPAP member state

Actions required to increase spatial and temporal scale in mapping seagrass in will be described.

Annex A
List of ground truth data

Annex B
Raw data concerning organic carbon