

## Report on development of a tool for mapping seagrass distribution in the NOWPAP region

### 1 Background

Development of a tool for mapping seagrass in the NOWPAP region, was proposed at the 15<sup>th</sup> CEARAC FPM (August 2017, Toyama, Japan) and approved as one of the CEARAC activities for the 2018 – 2019 biennium at the 22<sup>nd</sup> NOWPAP IGM (December 2017, Toyama, Japan). This activity is being carried out based on the adopted workplan and budget at the following 16<sup>th</sup> CEARAC FPM (May 2018, Toyama, Japan).

### 2 Objectives

Objective of this activity is to develop a tool for mapping seagrass distribution in the coastal areas in the NOWPAP region by using satellite images. Depending on availability of external fund, the developed mapping tool will function on a website so that website users can easily and voluntarily update field data/information of seagrass beds for estimation of their distribution in the target area.

### 3 Tasks

#### 3.1 Update of information on seagrass distribution

Through the feasibility study conducted in the 2016-2017 biennium, information of seagrass beds at more than 800 spots was collected through reports and/or publications in the NOWPAP member states (Figure 1). However, there exists gaps in volume of information among the members as well as some inaccurate geographical data. Therefore, CEARAC has been verifying data on each spot.

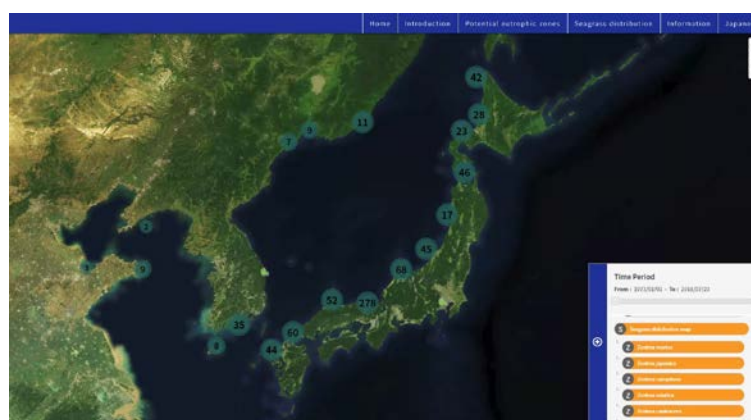
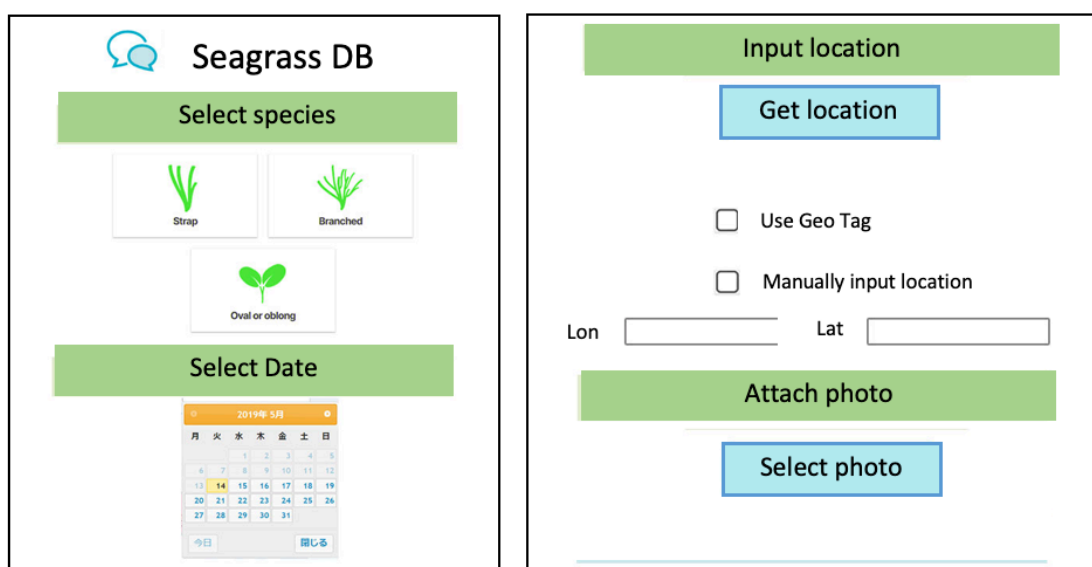


Figure 1 Seagrass distribution database in the NOWPAP members.

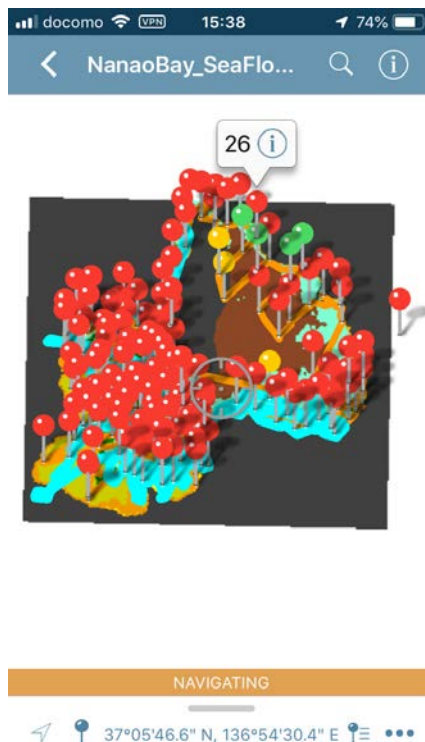
Information on seagrass distribution was collected by the experts of NOWPAP members by conducting literature review (<http://map.nowpwp3.gp.jp/maps/view>)

For practical use of the developed mapping tool in the future, the volume of existing distribution information is not enough to prepare training data for analyzing satellite images, so, CEARAC is developing a new tool to add more filed records of seagrass (Figure 2). The developed application/website can be operated on smart phones with NOWPAP languages so that the tool is introduced to wide range of users including researchers, groups for recovering seagrass, and/or the general public to collect field data. To promote information collection, CEARAC will ask NOWPAP RCU for help with providing small gifts (novelty goods) to the person who input high-quality information. CEARAC will also develop a mechanism in which experts of the NOWPAP members verify information posted by the tool users and register only high-quality data with seagrass distribution database.



**Figure 2 Sample of field seagrass registration tool**

For more efficient field data collection and preparation of training data, NPEC, host organization of CEARAC, has started evaluation of “Avenza Maps,” a mobile map app for offline use developed by a Canadian company, Avenza Systems Inc., for field data in Nanao Bay (West Bay). NPEC has also been developing an original manual, and after its development (Figure 3), English version of the manual will be prepared for wider use among the NOWPAP members.



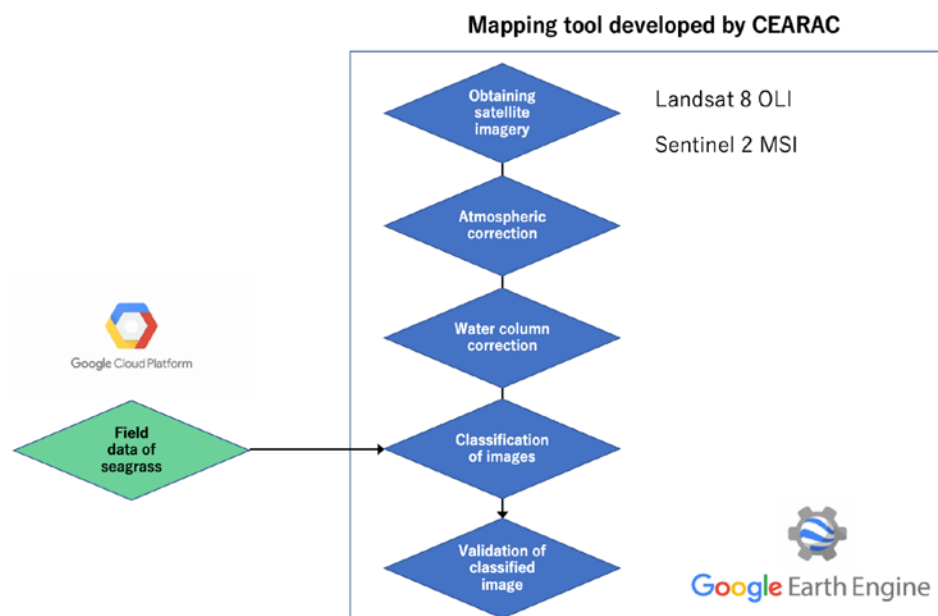
**Figure 3 Avenza Maps under evaluation in field monitoring of Nanao Bay.**  
**With this tool, it is expected to reduce workload and time for constructing training data.**

### **3.2 Development of a tool and webservice for mapping seagrass distribution with satellite images using cloud computing technology**

For mapping seagrass distribution with satellite images, a series of steps is taken: purchasing or obtaining satellite images, applying necessary corrections (e.g. atmospheric correction and water column correction), classification of image with field data, and verifying obtained classification results, in which high-level of technical skills is required. As this is a time-consuming work, the feasibility study implemented in 2016-2017 concluded that it is essential to apply a cloud computing technology to timely detect distribution of seagrass beds in a large scale. It also suggested that CEARAC use only free satellite images such as Landsat and/or Sentinel ones under financial constraint of NOWPAP.

Cloud computing enables users to access Landsat and/or Sentinel images easily, so CEARAC has initiated development of a tool for mapping seagrass distribution in a large-scale using cloud computing technology. Google Earth Engine (GEE) is one of such cloud computing technology suitable of satellite image analysis, and its usefulness for mapping seagrass has been evaluated by Remote Sensing Technology Center of Japan (RESTEC) to detect seagrass distribution. So far, sample codes developed by RESTEC is performing well and CEARAC decided to develop a tool to map seagrass using the cloud computing technology. However, since the GEE is not applicable in China, CEARAC is planning to develop another tool based on Amazon Web Services for China together with development of GEE-based mapping tool by obtaining consensus of CEARAC FPs.

At the 17<sup>th</sup> CEARAC FPM, CEARAC plans to demonstrate the prototype of the mapping tool. GEE-based tool for mapping seagrass distribution will be developed by the end of 2019. Upon completion of the mapping tool, CEARAC will construct a webservice, a website embedding the developed tool.



**Figure 4 Steps in developing a GEE-based tool for mapping seagrass distribution.**

Users of this website can estimate distribution of seagrass beds of the target area by uploading field data of seagrass. Designing, developing and providing such web-based seagrass mapping service along with collecting field data of seagrass in the framework of NOWPAP can help develop a community-based seagrass mapping project with participation of local governments and the general public. Of course, maintaining quality in the seagrass distribution map is necessary, so CEARAC asks relevant experts of the NOWPAP member states to establish criteria for verifying the map. Only the outputs (seagrass distribution maps) which can satisfy established criteria will be uploaded on the website.

Since development of this web-service may cost more than budget allocated from the NOWPAP Trust Fund, it needs to consider mobilization of external resources. In addition to cost for developing the service, running cost of cloud service needs to be considered. CEARAC plans to implement this activity as part of the Marine Environment Watch Project, which has been financially supported by the Ministry of the Environment, Japan.

#### 4 Expected Outcomes

With the use of the developed mapping tool, various stakeholders including governments, citizens, fisheries and/or politicians can share the same knowledge of distribution of seagrass. When the area of seagrass beds in coastal areas is identified, such information can be used for planning policies to conserve and/or recover seagrass beds, and also to estimate the amounts of CO<sub>2</sub> absorbed in the sea.

In addition, this activity can cooperate with a project of Ocean Remote Sensing in IOC/WESTPAC, and can be applied in the Southeast Asian countries as well.

#### 5 Schedule

Time		Action	Mainbody
2018	May	Review/adoption of workplan at FPM16	CEARAC FPs, CEARAC Secretariat
	December	Development of a tool to collect field data of seagrass distribution	CEARAC and Consultant
2019	September		
	Jan.-September.	Evaluation of existing information and addition of new information	CEARAC and Experts
	Jul.-Dec.	Development of a tool and service for mapping seagrass distribution with satellite images using cloud computing technology	CEARAC and Remote Sensing Technology Center of Japan
	Sep. (FPM17)	Review of the prototype of seagrass mapping the tool	CEARAC and CEARAC FPs

**6 Budget**

Task	Time	Deliverables	To be completed	Main body	Budget (US\$)
Update of field data of seagrass distribution	2018 Q2	Updated information of seagrass distribution	2019 Q3	Consultant and Nominated experts	0* (CEARAC)
Development of a tool and webservice for mapping seagrass distribution	2019 Q2	A tool for mapping seagrass distribution	2019 Q4	Remote Sensing Technology Center of Japan (RESTEC)	40,000 (25,000 + 15,000)
					40,000

\*At the beginning of 2018, CEARAC secured 15,000 US dollars from the NOWPAP Trust Fund for updating field data of seagrass distribution; however, the system of such information collection was constructed by NPEC with its budget (FY2018). Therefore, this unspent 15,000 US dollars was decided to add to development of a tool and webservice for mapping seagrass distribution. This change was proposed by CEARAC Secretariat and accepted by CEARAC FPs in correspondence in June 2019.