Report on assessment of the distribution of tidal flats and salt marshes in the NOWPAP Region

1. Background

In 2019, CEARAC developed the CEARAC Medium-Term Strategy for Marine Biodiversity Conservation (hereafter, CEARAC BIO MTS). The basic policies of CEARAC BIO MTS are:

A) CEARAC focuses on activities related to coastal environmental assessment and development of assessment tools for special monitoring programs, as shown in the Memorandum of Understandings (MoU) with the United Nations Environment Programme (UNEP);
B) CEARAC contributes to the development of the NOWPAP Regional Action Plan on marine and coastal biodiversity conservation (RAP BIO), and implements our tasks shown in the RAP BIO to conserve marine biodiversity in the NOWPAP region after the RAP BIO is approved; and
C) Through our monitoring and assessment programs of marine biodiversity, CEARAC contributes to NOWPAP Ecological Quality Objectives (EcoQOs) and their achievements.

In the CEARAC BIO MTS, three highly prioritized topics for future CEARAC activities are shown: 1) conservation of biological habitats including tidal flats, salt marshes and seagrass/seaweed beds in the NOWPAP region; 2) plankton species related to aquaculture and fisheries; and 3) environmental DNA.

For conservation of coastal biological habitats, CEARAC has been implementing a series of activities on seagrass, specifically focusing on mapping its distribution using remote sensing technique. Then, tidal flats and salt marshes are added as new target habitats for CEARAC activities. Through habitat mapping, CEARAC can contribute to conservation of both marine biodiversity and biological habitats.

In order to discuss potential activities for the 2020-2021 biennium, CEARAC organized a workshop on CEARAC BIO MTS in November 2019. Experts on tidal flats and salt marshes of the NOWPAP member states participated in the workshop and shared information on the status of these habitats in each member state. Dr. Nicholas Murray of James Cook University, Australia, participated in the workshop in online and introduced a global tidal flats mapping tool, Global Intertidal Change (GIC) developed by his team (Murray et al. 2019). The meeting participants discussed feasibility/necessity of potential activities for the 2020-2021 biennium and agreed to propose an activity on mapping the distribution of tidal flats and salt marshes in the NOWPAP region using GIC. Based on this agreement, the CEARAC Secretariat prepared a workplan and proposed it to the CEARAC FPs and the 24th NOWPAP IGM.

2. Objective

Objectives of this activity are to map the distribution of tidal flats and salt marshes in the NOWPAP region using GIC, and to understand the status and the historical change of these coastal habitats.

3. Tasks

3.1 Development of the distribution maps of tidal flats/salt marshes in the NOWPAP region

Using the GIC mapping tool, distribution maps of tidal flats/salt marshes are developed. However, it is necessary to arrange GIC for the NOWPAP region to develop highly accurate maps. Therefore, national data provided from the nominated national experts have been used for improvement of GIC.

3.1.1 Collection of information on tidal flats/salt marshes in the NOWPAP member states

To develop highly accurate distribution maps, training data (basic data) on the distribution of tidal flats/salt marshes is necessary. CEARAC Secretariat asked the CEARAC FPs to nominate experts who could collect information on distribution of tidal flats/salt marshes in each member state. Then, the following experts were nominated.

Table 1 Nominated experts for collecting information of tidal flats/salt marshes distribution

Country	Name of expert	Affiliation	Target area
China	Dr. Jie SU	National Marine Environment Monitoring Center	Yellow river delta and north Yellow Sea
Japan	CEARAC Secretariat		Seto Inland Sea and Ariake Sea
Korea	Dr. Jongseo YIM	Korea Maritime Institute	West and south coast of Korea
Russia	Dr. Kirill BAZAROV	Pacific Geographical Institute	Coastal area of Sakhalin

The Nominated experts collected information on tidal flats and salt marshes in the target areas and submitted them to the CEARAC Secretariat by January 2021.

In parallel, the Secretariat contracted with James Cook University (Dr. Nicolas Murray) to improve GIC to be suitable for the NOWPAP region and develop maps using the improved GIC. The provided data from the member states were shared with Dr. Murray for improving the existing GIC.

The first distribution maps in the NOWPAP region including historical changes were prepared in May 2021 (Figure 1-1 to 1-8). There are still some mis-detection of tidal flats and review by the experts is needed. So, Dr. Murray developed an online correction tool using Google Earth Engine, and the CEARAC Secretariat developed a guideline to correct the maps using the developed online tool. CEARAC Secretariat asked the experts to correct the maps by August.

Based on the correction by the experts, the distribution maps will be finalized by October 2021.

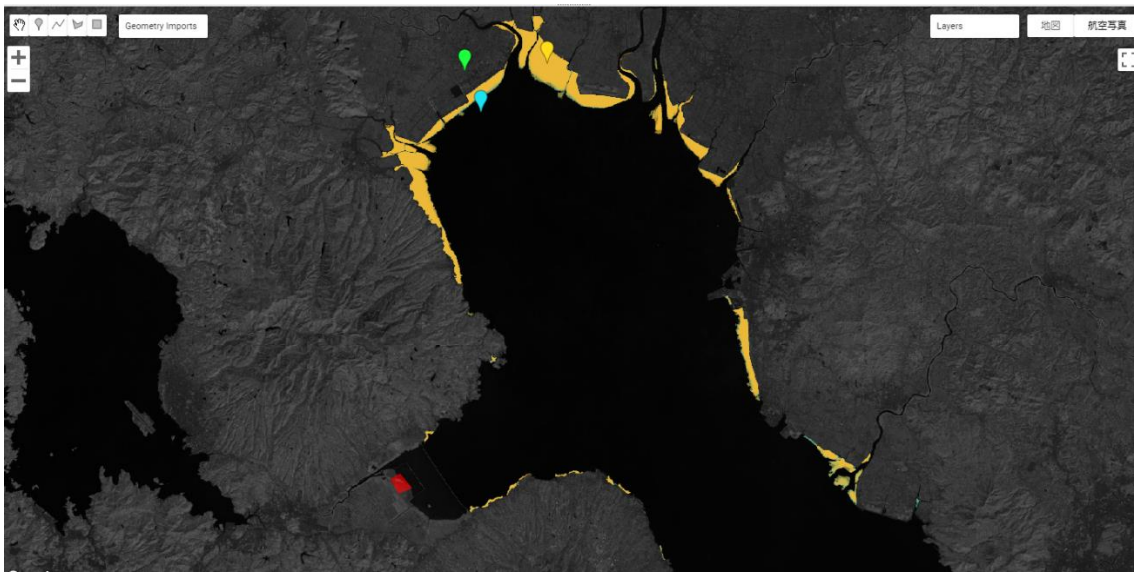

Figure 1-1 The first distribution map in the NOWPAP region (figure shows Ariake Sea)

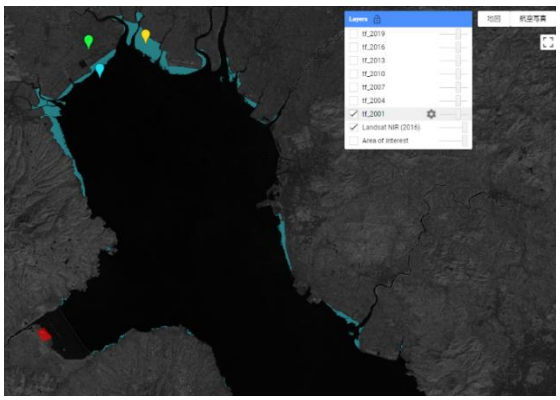

Figure 1-2 Distribution map in 1999-2001

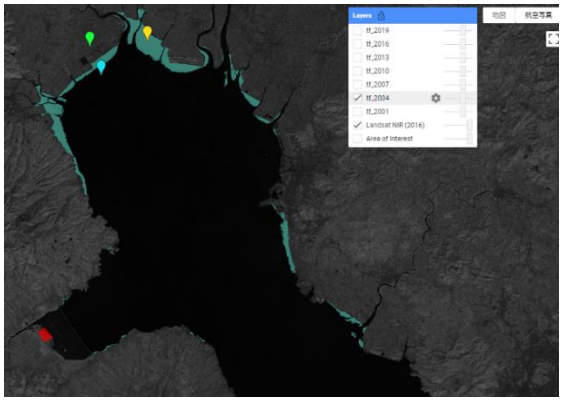

Figure 1-3 Distribution map in 2002-2004

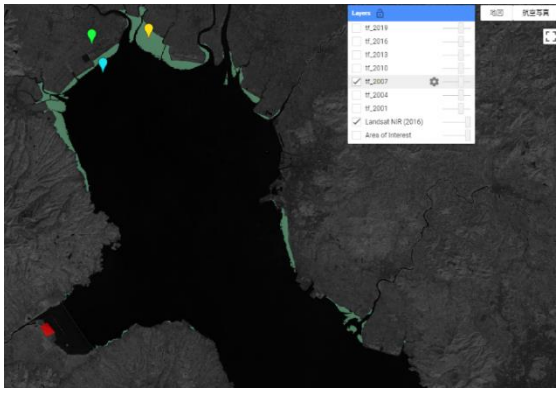

Figure 1-4 Distribution map in 2005-2007

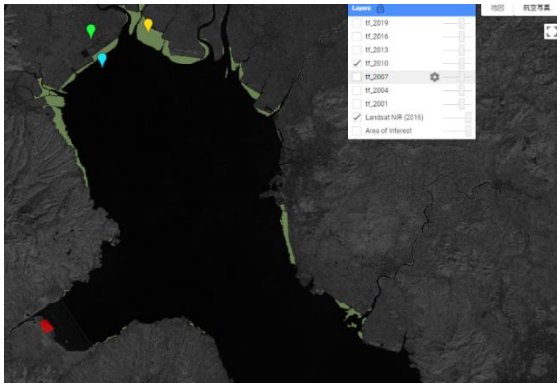

Figure 1-5 Distribution map in 2008-2010

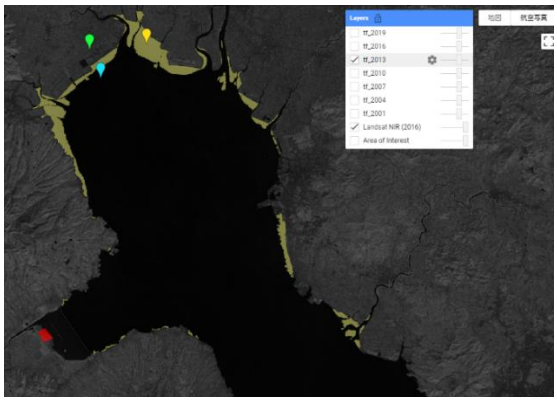

Figure 1-6 Distribution map in 2011-2013

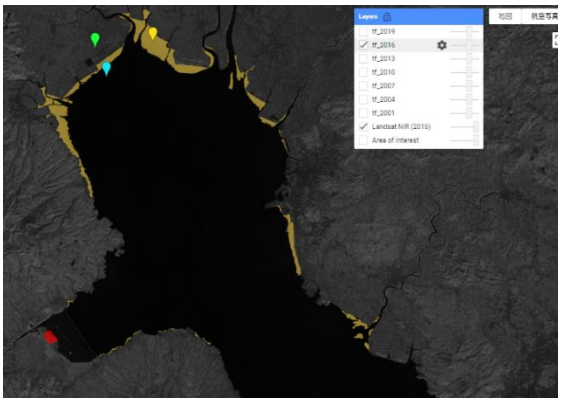

Figure 1-7 Distribution map in 2014-2016

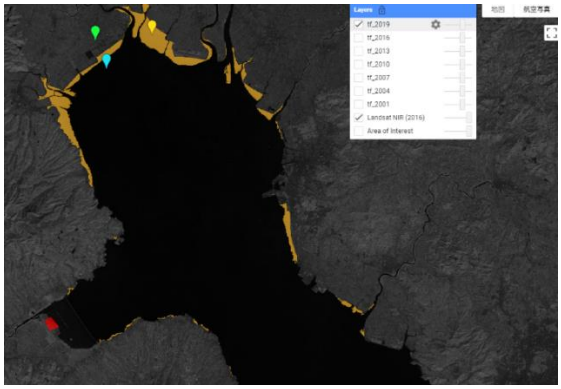

Figure 1-8 Distribution map in 2017-2019

3.2 Error assessment of GIC (Comparison between the original GIC and real distribution)

For this project, the global mapping tool, Global Intertidal Change (GIC) has been used. However, GIC aims to develop a global map and has limitation on mapping in a regional scale. To understand the limitation of GIC, the CEARAC Secretariat conducted an error assessment of GIC by comparing developed maps with provided national data. The brief result is shown in Table 2.

Table 2 Comparison of area of tidal flats of national data and original GIS

Country and area		Area (ha)			Overlapped ratio (%)
		Area shown in provided national data	Area of original GIC	Overlapped area	
Japan	Ariake Sea	18,738.9	4,806.1	4,216.0	87.7
China	Bohai and Yellow Sea	320,653.0	652,598.0	285,791.0	43.8
Korea	West and south coast	251,548.1	181,201.3	141,458.1	78.1
Russia	Coastal area of Sakhalin	2,638.4	4,176.0	1.2	0.03

In Japan and Korea, the original GIC can detect tidal flats with a high degree of accuracy, which is obvious from the overlapped ratio between the area in the provided national data and that detected by GIC. In Russia, on the other hand, the detection rate (overlapped ratio) is quite low because of very little national data on tidal flats in the country. Through this analysis, the limitation of the original GIC was revealed. The details of the analysis will be explained in the summary report shown in 3.3.

In addition, the CEARAC Secretariat is conducting another accuracy analysis of the new GIC. The ratio of mis-detection is decreased by the improved GIC. The detailed results will also be shown in the report as well.

3.3 Publication of a summary report on distribution of tidal flats/salt marshes distribution in the NOWPAP region

For this project, Global Intertidal Change (GIC) is used. To introduce what the GIC mapping tool is and the limitation of the tool and the improved GIC, a summary report will be published. The draft table of contents is as follows;

Chapter 1: Background and objectives
- Importance of tidal flats/salt marshes in the NOWPAP region
- Priority of habitat conservation in the NOWPAP MTS, RAP BIO and EcoQOs

Chapter 2: Methodology
- Introduction of GIC, Error assessment

Chapter 3: Development of distribution maps of tidal flats/salt marshes in the NOWPAP region
- Maps developed by the improved GIC, accuracy of the improved GIC

Chapter 4: Historical changes of tidal flats/salt marshes distribution and their factors
- Past coastal developments in the NOWPAP member states

Chapter 5: Summary
- Limitation of the current mapping tool

4. Expected outputs

Through the past and current work of CEARAC, enhanced coastal habitat maps in the NOWPAP region will be developed with information not only on seagrass distribution but also on tidal flats/salt marshes distribution of the member states, which can be part of solid scientific base for decision-making.

Then, it is expected that conservation of tidal flats and salt marshes can contribute to conservation of endangered migratory birds that use coastal habitats in this region as feeding/nursery sites. NOWPAP DINRAC implements an activity to collect information on endangered species in each member state. So, future collaboration with DINRAC will be expected.

In the past biennia, NOWPAP didn't start discussion on the Marine Protected Area Network. Mapping of coastal habitats can promote discussion on development of the MPA network in the NOWPAP region. It will also contribute to the implementation of the NOWPAP Regional Action Plan for Marine and Coastal Biodiversity Conservation (RAP BIO).

5. Budget

Tasks	Budget	Main body
- Collecting information/data on tidal flats/salt marshes distribution in each member state - Reviewing developed draft tidal flats/salt marshes distribution maps for the NOWPAP region using GIC	9,000 USD (3,000x3)	3 nominated experts
- Conducting error assessment of GIC - Conducting accuracy assessment of the developed GIC maps - Development of a summary report	3,000 USD + in-kind	CEARAC Secretariat
- Arranging GIC for the NOWPAP region - Developing the distribution maps of tidal flats/salt marshes with historical changes in the NOWPAP region	8,000 USD	International consultant (Dr. Nicholas Murray)
Total	20,000 USD	

6. Schedule

Year		Tasks	Main body
2020	Q3	- Approval of implementation plan by email communication	FPs, CEARAC Secretariat
	Q3-Q4	- Collection of information/data on tidal flats/salt marshes distribution	FPs/Nominated experts
	Q3-Q4	- Error assessment of GIC (comparison between GIC distribution and real distribution of tidal flats/salt marshes)	CEARAC Secretariat
	Q3-2021Q2	- Arrangement of GIC for the NOWPAP region - Development of distribution maps of tidal flats/salt marshes with historical changes in the NOWPAP region	Dr. Murray
2021	Q3	- Review of the developed maps - Finalization of the distribution map(s)	Nominated experts, CEARAC Secretariat Dr. Murray, CEARAC Secretariat
	Q3-Q4	- Preparation of the first draft of a summary report	CEARAC Secretariat
2022	Q1	- Review/refinement of the summary report	CEARAC FPs
	Q2	- Publication of the summary report (in digital format)	CEARAC Secretariat