

Greeting from Director of CEARAC

Ms. Rika HAYASHI



Hello, readers. I am Rika Hayashi, serving as CEARAC Director since July 2023.

United Nations Environment Programme (UNEP) has promoted concerted conservational actions on the marine environment which is shared by relevant nations, namely Regional Seas Programme (RSP). Northwest Pacific Action Plan (NOWPAP) is one of the RSPs and started in 1994 by China, Japan, Korea and Russia, aiming at conservation of the marine and coastal environment of the northwest Pacific Ocean.

Each member state has a regional activity centre (RAC) which is the main body to implement respective activities of NOWPAP. Northwest Pacific Region Environmental Cooperation Center (NPEC) in Toyama, Japan was designated as a host organization of the Special Monitoring and Coastal Environmental Assessment Regional Activity Centre (CEARAC), RAC in Japan upon the decision of the NOWPAP intergovernmental meeting in 1999. Since then, CEARAC has conducted various activities to mainly monitor/assess the marine and coastal environment by using remote sensing techniques.

All of NOWPAP activities are conducted by the adoption of their workplan and budget by the member states. However, the political uncertainty in the world from February 2022, suspended the adoption of the 2022-2023 activities, resulting in strong influence on CEARAC activities. Under such a circumstance, CEARAC continued implementing its planned activities for the extended period of 2020-2021 until June 2024. From July on, we have been preparing to initiate our full-scale activities for the next biennium with the support of the Ministry of the Environment, Japan and Toyama Prefectural government. We strongly wish to separate environmental issues from political ones and to resume NOWPAP activities fully.

In 2024, we worked on developing an English version of the revised Environmental DNA Sampling and Experiment Manual, upgrading the CEARAC website, and sharing information and disseminating CEARAC's outputs, including CEARAC's original monitoring and assessment tools at international conferences through presentations and/or training courses. Please see more details in the following pages.

CEARAC will catch up with the recent rapid advancement of remote sensing and eDNA techniques to lead the world in their application to the marine environment researches and will contribute to the conservation of the NOWPAP region and other oceans around

the world, while paying close attention to the latest trends in global issues such as marine litter, biodiversity, and climate change, which many countries have addressed in a collaborated manner.

I hope CEARAC and its activities will be well-known around the world and trigger more interest in the environmental conservation of Toyama Bay and the NOWPAP region. I also expect CEARAC activities can help promotion of actions on marine environmental conservation by cooperation and collaboration among related organizations and institutions in global, regional and national levels.

-Contents -

Cover: Greeting from Director of CEARAC

1. Activity Report 2024
(Continuation of main projects for 2020-2021 biennium)2
2. Cooperation with NOWPAP Partners and Organizations 4



Nanao Bay and Notojima Island
(Ishikawa Pref.)

1. Activity Report 2024 (Continuation of main projects for 2020-2021)

1-1. Dissemination of eDNA analysis technology

CEARAC developed an English version of the Environmental DNA Sampling and Experiment Manual in 2019 with support of the eDNA Society, Japan. Japanese experts are pioneers in monitoring and studies with eDNA technologies, so they are very useful globally. However, the original manual by the eDNA Society is written in Japanese, and because of a newly developed monitoring technology, unfortunately, the methodology of eDNA has not been standardized yet. So, to help share such latest useful techniques in the NOWPAP member states and especially promote their application among young researchers, as a starter, CEARAC translated the manual into English and developed video manuals in English and the four NOWPAP member states' languages, in which how to conduct the experiment is demonstrated. The video manuals are available on NOWPAP CEARAC YouTube channel as follows:

English: https://youtu.be/I4K00_ysCtc, Chinese: <https://youtu.be/KhjWrASBr3A>,
Japanese: <https://youtu.be/97v-77G5I6w>, Korean: <https://youtu.be/V3wZ4XGeRLc>,
Russian: <https://youtu.be/VrVSEwz2oJw>

Evolution of technology in eDNA analysis is quite fast, and new techniques are developed day by day. Therefore, the eDNA Society updated their manual in 2024. CEARAC is now translating the new version into English, which will be available in

1-2. Upgrading CEARAC Website



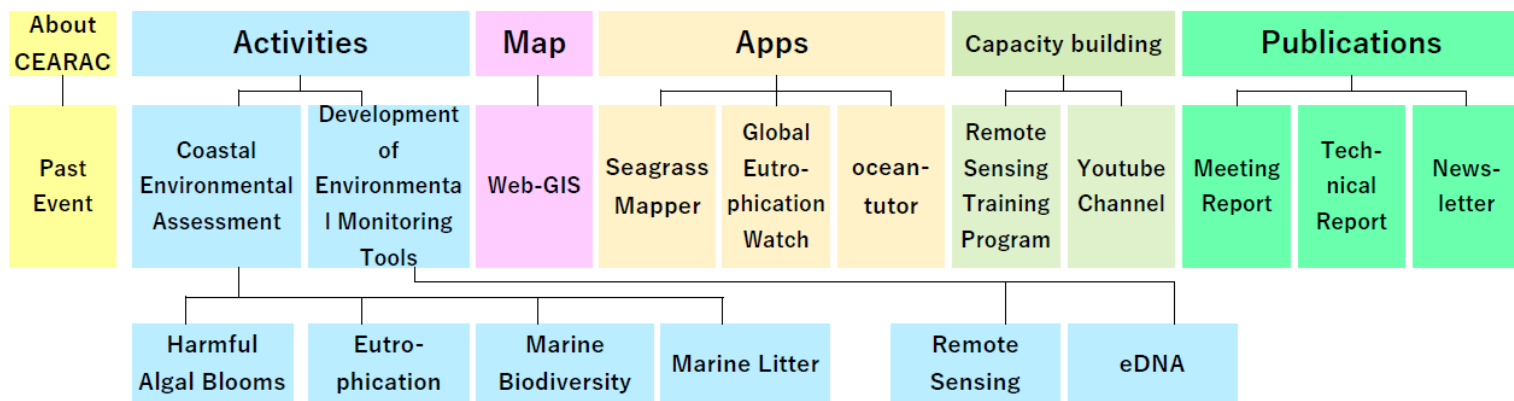
renewed CERACA Website

CEARAC has completed the overall renewal of its website (<https://cearac.nowpap.org>). Since the opening of the previous website, more than 20 years had passed, and during those years, as CEARAC expanded its working areas, the structure of the website became complicated with various additional pages. Therefore, CEARAC reorganized and integrated its web pages and enhanced the contents with new designs to improve user-friendliness.

The renewed website introduces two major activities of CEARAC: Coastal Environment Assessment targeting at harmful algal blooms (HABs), eutrophication, marine biodiversity and marine litter; and Development of Environmental Monitoring Tools with remote sensing techniques and environmental DNA method. Users can also find information on CEARAC's events, a variety of reports and annual newsletters.

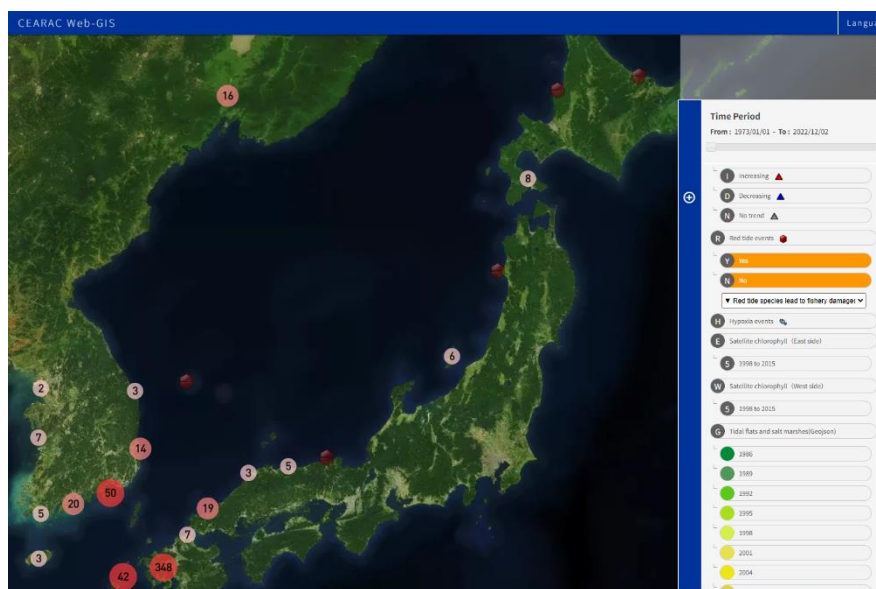
Almost all information on CEARAC website is delivered in English and the four languages of the NOWPAP member states (Chinese, Japanese, Korean and Russian) to attract more people to CEARAC activities.

<Structure of the new CEARAC website>



Then, the new site has a special section of applications, as shown below, which CEARAC has developed and/or helped development. There are brief explanations and step-by-step instructions on how to use them:

- *CEARAC Web-GIS*: visualizing the state of the marine environment
- *Seagrass Mapper*: mapping seagrass beds
- *Global Eutrophication Watch*: identifying potential eutrophic zones
- *ocean-tutor*; understanding temporal changes of the marine and coastal environment
- *Marine Environmental Watch* : processing, visualizing and analyzing data on the marine environment observed by satellite sensors
- *HAB reference database*: searching for literatures on harmful algal blooms (HABs) in the NOWPAP region



Web-GIS: <https://cearac.nowpap.org/map-webgis/>
(The image above is “Red Tide Information”)

In addition, to contribute to one of CEARAC’s essential roles, regional capacity building, CEARAC has opened its YouTube channel (<https://www.youtube.com/@nowpapcearac2286>) and uploaded webinar series of remote sensing data analysis and the Environmental DNA sampling and experiment video manuals. With these videos, any interested person can learn how to use CEARAC’s tool in their studies without having to worry about time and place. CERAC will continue providing information on our activities and their outputs, promoting raising public awareness on the marine and coastal environment and contribute to environmental conservation of the northwest Pacific region.



Environmental DNA Sampling and Experiment Manual (left) and Webinar on Seagrass Mapper (right)

2. Cooperation with NOWPAP partners and organizations

2-1. 2nd UN Ocean Decade Regional Conference and the 11th WESTPAC International Marine Science Conference

Dr. Genki Terauchi, senior researcher of CEARAC participated in the 2nd UN Ocean Decade Regional Conference in conjunction with the 11th WESTPAC International Marine Science Conference organized on 22-25 April, 2024 in Bangkok, Thailand. International Marine Science Conference of the IOC Sub-Commission for the Western Pacific (IOC/WESTPAC) is held every three years; however, due to COVID-19 pandemic, it has not been organized in recent years. The 11th conference was the largest event ever with participation of about 1,200 people.

During the events, Dr. Terauchi presented the past and current CEARAC activities on eutrophication assessment and seagrass mapping as well as discussed possible collaborative activities in the future with relevant scientists.

<Presentations on Eutrophication assessment>

While oligotrophication has been a recent problem in Japan, water quality degradation in coastal areas by eutrophication is continuously reported around the world. Along with the keynote speech by Dr. Denise Breitbur (Smithsonian Environmental Research Center, USA) "The Ocean is Losing its Breath: Declining Oxygen in Coastal Waters and the Open Sea," there were several presentations on the eutrophication status in the Gulf of Thailand, Jakarta Bay, and Manila Bay. So, it was obvious that presentations and speeches in the conferences reflected the fact that excessive nutrient is still introduced into marine and coastal areas globally.

On 24 April, Dr. Terauchi joined the Workshop 7 (GEMS Ocean: Upscaling ocean observation, monitoring, and modelling for early warning in the East Asian Seas), co-organized by the Global Estuaries Monitoring System (GEMS) programme and Coordinating Body on the Seas of East Asia (COBSEA) of the United Nations Environment Programme (UNEP), as a panelist and introduced the CEARAC's eutrophication assessment tool, the Global Eutrophication Watch, with a CEARAC's plan to implement a high-resolution dataset (SGLI data) into the tool, which has extremely high demand in the southeastern Asia. At an interactive forum, Incubator 6, held on 25 April, he emphasized the need for multilateral cooperation to improve the Global Eutrophication Watch at a regional level. During the Q&A session, there was a question whether it would be possible to develop a citizen participatory program on satellite data validation. Dr. Terauchi talked about a possibility of using smartphone apps to take ocean photos to measure turbidity and/or chlorophyll-a density. Through these sessions, he reconfirmed the importance of enhancement of the Global Eutrophication Watch to tackle worsened eutrophication in the southeastern countries.



Panelists for the Workshop 7

<Presentations on Seagrass Mapping>

Ocean Remote Sensing for Coastal Habitat Mapping Project (ORSP) of IOC/WESTPAC aims at integrated coastal area management with remote sensing technologies and has carried out activities while focusing on seagrass mapping. The ORSP has shared the methods and experiences with CEARAC in mapping seagrass by remote sensing since 2011.

In fact, the members of ORSP include researchers who have worked for CEARAC projects. The ORSP leader is associate prof. Tatsuyuki Sagawa of Tottori University of Environmental Studies, an expert in mapping of shallow water seafloor beds with remote sensing techniques. Dr. Sagawa developed the grand design of the seagrass mapping tool using Google Earth Engine in CEARAC's Mapseagrass project. Dr. Milica Stankovic of Prince of Songkla University is also a ORSP member. Her team developed the quantification methodology of blue carbon in seagrass ecosystems and it was applied in CEARAC's case studies of estimating seagrass blue carbon in selected sea areas in the NOWPAP region. Then, Dr. Terauchi has joined as an observer/advisor of ORSP this year. Based on these existing collaborative experiences, it is expected for CEARAC to strengthen cooperation with IOC/WESTPAC as well as the southeast Asian countries and promote our seagrass mapping activities.

In addition, Dr. Terauchi introduced CEARAC's blue carbon estimation project at Session D3 (22 April), the marine environment remote sensing project at the ORSP meeting (24 April), as well as upgraded Seagrass Mapper, CEARAC's seagrass mapping application, in Incubator 5 (25 April).

From now on, Dr. Terauchi plans to more actively participate in relevant events by IOC/WESTPAC to introduce and promote marine environment assessment tools of CEARAC.

2-2. Korea-Japan / Asian Workshop on Ocean Color (KJWOC /AWOC)

The 21th Korea-Japan Workshop on Ocean Color (KJWOC) and the 12th Asian Workshop on Ocean Color (AWOC) were organized on 21-24 October at Udayana University, Bali, Indonesia. CEARAC staff has participated in almost all workshops in the past, and in 2024, Dr. Terauchi gave two training sessions to the event participants.

On 21 October, he gave a training on monitoring and assessment of water quality by ocean color remote sensing. Following introduction by Dr. Terauchi of CEARAC's activity for preliminary assessment of the eutrophication status, the trainees used Google Colab, which CEARAC developed with support from Dr. Robel A. Milashu of Soka University, Japan, and worked on temporal analysis of ocean color data by using data from the Marine Environment Watch Project and validation of satellite-derived data against in-situ data. After the session, some trainees asked Dr. Terauchi to enrich the datasets and add more functions such as extraction of temporal data to the Global Eutrophication Watch. 57 people from seven countries in Asia including Japan participated in this training.

On 22 October, Dr. Terauchi gave another training on mapping seagrass beds with the revised Seagrass Mapper. He received a positive response from the trainees when they asked for more refinement of the new application. Especially the students of Gadjah Mada University, Indonesia, who are working on seagrass mapping by themselves with Google Earth Engine, highly appreciated Seagrass Mapper. 58 people from seven countries attended this training.

Beside the trainings, Dr. Terauchi made an oral presentation on development of the regional target for coastal eutrophication indicator on 23 October.



Seagrass Mapper Training at Udayana University

During the Q&A session, there were voices for enhanced datasets outside of the NOWPAP region again. Through the practical hands-on trainings, CEARAC expects that training participants will fully utilize acquired knowledge on how to use ocean color data and latest technologies for their current and future studies and their daily work as well.

2-3. Organization of Training Course on Remote Sensing Data Analysis

One of the responsibilities of CEARAC is contributing to capacity building in the field of marine remote sensing to use the techniques in monitoring the marine and coastal environment in the NOWPAP region. When Dr. Terauchi attended the conferences of IOC/WESTPAC, one of NOWPAP partner organizations, in April 2024 and had an opportunity to demonstrate Seagrass Mapper, CEARAC's seagrass mapping application, he was requested to give a training of the tool to the students in the faculty of marine science and fisheries, Hasanuddin University, Indonesia. In response to this request, he gave two hands-on sessions: one on seagrass mapping with Seagrass Mapper; and the other on monitoring and assessment of water quality by ocean color remote sensing on 27 October at the university. 25 students and government officials participated in the sessions. After the training, the participants provided feedback with some suggestions, such as simplifying the procedure of uploading training data, how to save image analysis parameters and a refined output procedure of classified images to QGIS (free and open-sourced geographic information system software).

Based on their feedback, CEARAC will improve Seagrass Mapper to be more user-friendly.

In addition, Dr. Nurjannah Nurdin from Hasanuddin University, once a trainee of the CEARAC's training course on remote sensing data analysis, proposed a future collaboration with CEARAC for further improvement of Seagrass Mapper.



Seagrass Mapper Training at Hasanuddin University

2-4. Geo for Good Mini Summit Dublin

Developing monitoring and assessment tools for the marine and coastal environment of the NOWPAP region by applying remote sensing technologies is another responsibility of CEARAC. To keep up with the global trend of remote sensing technologies, Mr. Akira Kozuka, senior researcher of NPEC, a parental organization of CEARAC, attended Geo for Good Mini Summit Dublin held on 23-26 September 2024 in Ireland.

Geo for Good Summit is an annual conference by Google to introduce the latest features and best practices of Google Earth Engine (GEE), planetary-scale geospatial analysis tool by Google. The Summit has been held in the Google HQ in USA; however, one Mini Summit was held at Dublin this year. Because of the first Summit in Europe, there were many European attendees. Mr. Kozuka was one of some 100 invited scientists, companies, change-makers, and so on around the world.



Participants of Geo for Good Mini Summit Dublin

Just before the application of EU Deforestation Regulation (EUDR) in December 2024, attendees' attention was mainly on monitoring forests and farmlands with satellite imageries to reveal temporal changes of the earth. Many of the presentations were on terrestrial changes as well, yet, some ideas (e.g. classification of land use by seasonal produce without training data) seemed to be applicable to seagrass mapping using satellite imageries. In addition, near-real-time monitoring system of phytoplankton in dam lakes in the U.S. had some similarities to CEARAC's Global Eutrophication Watch, and Mr. Kozuka exchanged information with a researcher of the US Geological Survey.

While Google continues offering free use of its services of GEE to research institutions, the company started charging for commercial use. This action may increase users with business purposes, including the EUDR case, and profitable application of GEE enables its operation to be more stable and enhances its presence in satellite monitoring activities. Both CEARAC and NPEC will continue emphasizing usefulness of satellite imagery in monitoring and assessment activities by demonstrating our satellite-based eutrophication and seagrass monitoring/mapping tools, and at the same time, strengthening ties in the marine environment monitoring community using satellite remote sensing.

2-5. CREAMS 30th Anniversary

Dr. Takafumi Yoshida, Senior Researcher of CEARAC participated in the CREAMS 30th Anniversary held in the Seoul National University, Korea on 25-26 July 2024.

As the target marine area is same, CREAMS (Circulation Research in the East Asian Marginal Seas) is an important partner for NOWPAP, and CREAMS and CEARAC have a long history of collaboration including joint organization of the Remote Sensing Data Analysis Training Courses. Based on such a long-term partnership, NOWPAP was invited to the Anniversary Ceremony of CREAMS and Dr. Yoshida gave a presentation on the future collaboration.

CREAMS was established by scientists of Japan, Korea and Russia in 1990s to understand physical environment in the East Asian Marginal Seas. In 2006, CREAMS became one of the advisory panels of PICES, and members from China and USA officially joined the group. At the beginning, CREAMS focused on physical and chemical oceanography. Then, biological scientists participated in the group and it expanded working themes. In recent years, CREAMS's members have strengthened their collaboration with socio-economic scientists and tried to contribute to addressing regional environmental issues in the East Asian seas.

CREAMS has long historical physical/chemical/biological data in the northwest Pacific region, and they plan to develop a database to provide such valuable data to the world. On the other hand, NOWPAP is not a monitoring organization and we don't have our own data. Thus, CREAMS and NOWPAP should develop another partnership as a data provider and a data user for better understanding of the marine environment in East Asia. Through a presentation and a panel discussion, Dr. Yoshida emphasized the strong collaboration between CREAMS and NOWPAP on data sharing in the future.

During the event, a Flash Talk session by early career ocean professionals (ECOPs) was organized. PICES and CREAMS place the importance on educating ECOPs and provide them with opportunities to participate in and/or contribute to international events. As for NOWPAP, however, we haven't had ECOP participation in the past activities and/or meetings. So, it is necessary that NOWPAP also creates capacity building opportunities for ECOPs so that they can take on the role of environmental conservation in the future.



CREAMS 30th Anniversary Event

2-6. PICES 2024 Annual Meeting

2024 Annual Meeting of the North Pacific Marine Science Organization (PICES) was held on 26 October – 1 November in Honolulu, USA, and Dr. Takafumi Yoshida participated in the meeting to strengthen the cooperation in activities between NOWPAP and PICES.

On a rotational basis, the venue of the 2024 Annual Meeting was Russia. However, due to the current political reason, the meeting was held in USA, same as last year, which caused missing Russian participants again. During the meeting, Dr. Yoshida participated in the Business Meetings, Workshops and Sessions which were organized by the Expert Groups (EGs) related to CEARAC.

- S-HAB: Section on Ecology of Harmful Algal Blooms in the North Pacific

On 27 October, at the business meeting of the Section on Ecology of Harmful Algal Blooms in the North Pacific (S-HAB), a proposal of organizing a workshop at the next PICES Annual Meeting was discussed. Through the COVID-19 pandemic experience, development and application of early detection methods/tools made rapid progress. These new technologies are being applied into the early detection of shellfish poisoning. To prevent human health damage, such methodology and tools are very useful as well.

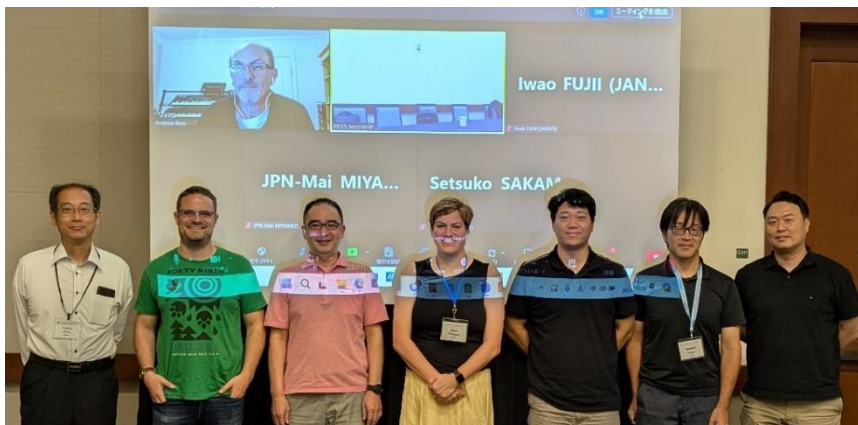
Therefore, S-HAB proposed a workshop on new rapid detection technologies. S-HAB plans to collaborate with IOC/WESTPAC to share the latest technologies through training courses and/or other opportunities. Such information is useful for the NOWPAP Member States, and it is expected for NOWPAP to support capacity development events in the future together with these partner organizations.



S-HAB Business Meeting members

- MEQ: Marine Environmental Quality Committee

On 27 October, establishment of a new EG on marine plastic pollution was discussed during the meeting of the Marine Environmental Quality Committee (MEQ). WG42 (Working Group on Indicators of Marine Plastic Pollution) completed all planned tasks and proposed to establish a new EG which aims to accumulate monitoring data in the North Pacific and standardize monitoring methodologies. A new UN Treaty on plastic pollution was expected to be formulated by the end of 2024, but it was decided to continue considering the matter. The world will need more information and data on plastic pollution for further discussion; therefore, MEQ thinks PICES should continue contributing to this global issue. The meeting participants strongly supported the MEQ's proposal to establish a new EG on marine plastic litter. When its projects on RAP MALI resume, NOWPAP should develop a close alliance with this new EG.



MEQ Business Meeting members

- Session 10 (S10): East meets West and West meets East: Past, current and future implication of non-indigenous species (NIS) in the North Pacific)

On 29 October, researchers in Hawaii introduced impact of invasive macro algae on the local ecosystem at Session 10. In their reports, coral reef was covered by macro algae and died in a wide area. One of the potential pathways of this invasive macro algae is Tsunami debris caused by 2011 Great East Japan Earthquake. From 2014 to 2017, the Japanese Ministry of the Environment conducted one PICES Special Project: Assessing the Debris-Related Impacts From Tsunami (ADRIFT) to understand the movement of tsunami debris and transportation of species on the debris. Over 10 years have passed since the earthquake, and tsunami debris has accumulated in the Great Pacific Garbage Patch (GPGP). All garbage generated in the surrounding countries eventually accumulates in this area, so impacts of NIS may increase in the GPGP. A follow-up project of ADRIFT may be an interesting topic for PICES member countries.

- Session 9 (S9): Recent advances in plastic pollution in the North Pacific)

On 30 October, there were many presentations by Early Career Ocean Professionals (ECOPs) at Session 9. Marine plastic pollution is one of the popular topics among young scientists. Actually, many studies on marine litter are actively underway. Prof. Takahashi from the University of Tokyo, Japan, reported that long-term plankton samplings showed a historical increase trend of microplastic in the coastal areas of Japan. Mr. Egami, master course student of the University of Tokyo, presented a unique sampling methodology of marine microplastics using salp, filter feeding zoo plankton. Dr. Lynch of the Hawaii Pacific University Center for Marine Debris Research, USA, introduced great effort of the local government and stakeholders to remove and treat marine plastic litter. The Hawaiian islands are located inside the GPGP and a huge volume of marine litter drifts ashore along the coastline. Socio-economic impact by marine plastic litter is also an important topic for the new EG on marine plastic pollution.

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