

# Ocean Newsletter

Selected Papers

No. **27**  
March 2022

# President's Message

As mankind moves through the 21st century, integrated policies of ocean governance are increasingly necessary for the sustainable development and use of our oceans and their resources and for the protection of the marine environment.

Towards this end, Ocean Policy Research Institute (OPRI) of the Sasakawa Peace Foundation orients its research on ocean issues in line with the mission statement "Living in Harmony with the Oceans."

OPRI aims to conduct cross-sectoral research in ocean related issues in order to initiate debate on marine topics and to formulate both domestic and international policy proposals.

We publish a Japanese-language newsletter titled the "Ocean Newsletter" (previously known as "Ship & Ocean Newsletter") twice a month. "Ocean Newsletter Selected Papers No.27" contains English-language versions of papers from the Japanese Newsletter edition, published from No.491 (2021.1.20) to No.510 (2021.11.5). The Ocean Newsletter seeks to provide people of diverse viewpoints and backgrounds with a forum for discussion and to contribute to the formulation of maritime policies conducive to coexistence between mankind and the ocean.

Our Institute believes that the Newsletter can expand effective communication on these issues by introducing timely research abroad to an informed readership. It also welcomes responses from readers, some of which appear in the Newsletter.

It is our sincere hope that these Selected Papers will provide useful insights on policy debate in Japan and help to foster global policy dialogue on various ocean issues.

**Atsushi SUNAMI**  
President, the Sasakawa Peace Foundation

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# Acquiring the World's First MSC Certification for Atlantic Bluefin Tuna

[KEYWORDS] sustainable fisheries / Atlantic bluefin tuna / fishery certification system

## USUI Sotaro

CEO of Usufuku Honten Co., Ltd.

(Ocean Newsletter No.492, 5 February 2021)

**Believing that the realization of sustainable fisheries is the only way for pelagic fisheries to survive in Japan, Usufuku Honten, a company specializing in pelagic tuna fishing, has acquired certification from the Marine Stewardship Council (MSC), an international system for fishery certification. We are convinced that eliminating marine products of IUU (Illegal, Unreported, and Unregulated) origin from markets and encouraging sustainable practices among those in fisheries are necessary in order to transform Japan's fisheries into a globally competitive industry.**

## Motivations for Obtaining MSC Certification and the Certification Process

Usufuku Honten Co., Ltd.'s head office is based in Kesennuma City, Miyagi Prefecture. We were founded in 1882 as a fish wholesaler. The third generation of our family then entered the fishing industry and began offshore and pelagic fishing, with our family's fourth generation focusing solely on pelagic tuna fishing. Since I took over as the fifth-generation head in 2012, we have continued to specialize in this area. We currently have seven fishing vessels operating in Kesennuma, Indonesia, South Africa, and Spain's Canary Islands, delivering seafood products from the world's oceans to consumers in Japan and abroad. Our experience during the Great East Japan Earthquake in 2011 made us realize just how important food is. After the disaster, we launched the "Association for Providing Fish from Kesennuma for School Meals" to contribute to society at large and promote the use of local fish in school lunches.

However, the environment surrounding the Japanese fishing industry is becoming increasingly harsh every year due to soaring oil prices, stagnant fish prices, lack of successors, and the introduction of catch quotas based on international regulations. In Japan, inspectors from the Fisheries Agency are present when catches are landed, providing careful monitoring. However, tuna from Asian countries, which lacks catch information, is imported into Japan at low prices. This tuna is then distributed at cheaper prices than tuna caught by Japanese vessels. Adhering to international rules and maintaining marine resources are essential not only for current consumers but also for future consumers, ensuring them to enjoy fish meals and utilizing it as a source of food. We believe that sustainable fishing is the best way for Japan's pelagic fishing industries to survive. We also believe in the importance of enabling sustainable fishing worldwide. This led us to apply for MSC certification<sup>1)</sup>, an international fishery certification program. The primary assessment of our application began in August 2018.

Usufuku Honten's catch of Atlantic bluefin tuna accounts



Author with a MSC certification placard

for only about 0.2% of the world's total allowable catch. Of the 2 MSC certifications for Atlantic bluefin tuna granted so far, Usufuku Honten became the world's first to achieve MSC certification, followed by a French fixed-net fishing operator. At the 2010 meeting of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the government of Monaco proposed a ban on the trade of Atlantic bluefin tuna. The proposal was rejected with 20 votes in favor, 68 against, and 30 abstentions. Whereas the International Commission for the Conservation of Atlantic Tunas (ICCAT) has set quotas and allocations for each country, its thorough implementation has enabled fishery resources to recover, and quotas have been gradually raised since the late 2000s. We followed ICCAT's policy of scientifically demonstrating stock recovery for our MSC application, persevering in our efforts to become certified. The application review, which began in August 2018, culminated in arbitration proceedings. On July 30, 2020, two years after the commencement of these proceedings, an arbitrary decision was rendered. Objections were ultimately overruled, and our application was upheld. The application documents were then revised, and on August 10, it was announced that Usufuku Honten would receive the world's first MSC for Atlantic bluefin tuna.

MSC is one of the most effective ways to achieve sustainable fisheries. There needs to be a clear distinction

between tuna catches. Tuna caught by sustainable fishing should be classified as white, tuna from IUU fishing as black, and tuna from questionable sources as gray. We also need to form a market (business practices) in which non-white fish are not traded, and consumers do not buy them. Obtaining MSC certification means we can make a more convincing case for the importance of resource management. We believe that revitalizing Japan's fishing industry into one that is globally competitive will require removing IUU (illegal, unregulated, unreported) seafood from the market and nurturing fishermen who are engaged in sustainable fishing.

### The Meaning of the Certification and Future Prospects

We could not have achieved MSC certification without the support of many different people. Mr. Makoto Suzuki, the representative of Nihon Gyogyo Ninsho Support (Japan Fishery Certification Support), encouraged and cooperated with us over an extended period, patiently preparing documents for certification and handling arbitration procedures. In addition, researchers at the University of Washington in the U.S. agreed that Atlantic bluefin tuna stocks have recovered to 1970s' levels and that Usufuku Honten's application for MSC certification, considering the small catch numbers, is a progressive step toward sustainable resource management. They published these comments on their website, which was of great encouragement to us. The support and cooperation we received from the Fisheries Agency and other related parties, and many of our colleagues, also helped us obtain this certification. Our MSC certification has been picked up by many media outlets, which has been a boost for publicity. However, the acquisition cost us about 30 million yen, which was a considerable expense. While the certification has provided us with opportunities to connect with sympathetic domestic and overseas consumers and eager hotel and restaurant personnel, as we have yet to attract the attention of major domestic retailers, we have not been able to conduct large transactions at premium prices even after attaining MSC.

Currently, we are working to obtain the Marine Eco-Label (MEL) certification, a Japanese marine product certification system. Although MEL is not as internationally recognized as MSC, we hope our participation in these programs will help support efforts to realize sustainable fisheries, including through seafood certification systems. Collection of import information under the Tuna Act (Act



Author with Atlantic bluefin tuna

Atlantic bluefin tuna to be sold with MSC certification

on Special Measures for Enhancement of the Conservation and Management of Tuna Resources) and total allowable catch (TAC) under the Act on Preservation and Control of Living Marine Resources, are already in place. In December 2020, the revised Fisheries Act was enacted, and the Act on Ensuring the Proper Domestic Distribution and Importation of Specified Aquatic Animals and Plants was also enacted in the same month. Realizing sustainable fisheries requires understanding not only from fishery operators and government, but also from consumers and distributors. I hope that these legal reforms will lead to the realization of sustainable fisheries and the revitalization of Japan's fishing industry.

Usufuku Honten will continue to engage in a variety of activities with the aim of passing on Japan's tuna fishery to future generations and transforming the Japanese fishing industry into a growth industry once more. ■

1) MSC certification: An international program to certify sustainable, well-managed, and environmentally friendly wild caught fisheries.

"Considering "International Resource Management Certifications" from a Producer's Point of View", by Reiko Omoto. See: Ocean Newsletter No. 406 (July 05, 2017) for more information.

# 10 Years After the Great East Japan Earthquake: Our Experiences and Lessons to be Passed Down

[KEYWORDS] major earthquakes and tsunamis / new interdisciplinary research / passing on lessons

## IMAMURA Fumihiko

Director, International Research Institute of Disaster Science, Tohoku University  
(Ocean Newsletter No.494, 5 March 2021)

I would like to examine the wide-spread damage caused by the massive tsunami during the 2011 Great East Japan Earthquake as well as introduce unprecedented forms of damage such as the black tsunamis. Academic studies aiming for future disaster preparedness based on practical research have commenced and are producing results. As memories and experiences fade away in the 10 years after the earthquake and tsunami, I would like to introduce activities to pass on experiences and lessons by networking the affected areas.

## The Great East Japan Earthquake

The earthquake that struck off the Pacific coast of the Tohoku region (at around 14:46 on March 11, 2011) was named the “2011 off the Pacific coast of Tohoku Earthquake” by the Japan Meteorological Agency, and eventually became known as the Great East Japan Earthquake. It was the largest earthquake in Japan’s recorded history. The tsunami that struck immediately afterward impacted a vast area, causing tremendous damage to the coast and other areas. It was a widespread, complex event involving a chain of disasters which followed the earthquake itself, including the tsunami, liquefaction, landslides, fires, and the nuclear power plant accident, which resulted in damage never before experienced by humankind. It was given various names in Japan in its aftermath, such as the Great Tohoku-Kanto Earthquake, the Massive East Japan Earthquake, and the Great 3.11 Earthquake. However, the convention most commonly used in Japan is the Great East Japan Earthquake, or *Higashi Nihon Daishinsai*. This paper will focus on the actual conditions of the damage caused by the tsunami, as well as the initiatives to ensure that the experiences and lessons learned from the disaster are passed on.

## Damages Caused by the Megatsunami: Unprecedented Type of Damage

The megatsunami and the damages recorded on pictures and videos at that time were overwhelming. The damage it caused was more extensive and complex than we can imagine. However, this damage can be categorized into triggers and predisposing factors, which are useful for producing effective countermeasures and responses to future disasters.

Although tsunamis in and of themselves are just seawater, their impacts are diverse, with more pronounced damage seen in coastal areas. Typically, triggers are natural forces that cause disasters (the damage and impact). Predisposing factors are classified into natural factors related to the earth’s surface, such as topography and ground conditions, and social factors related to people and society, such as population, buildings, and facilities.

Table 1: Tsunami triggers, predisposing factors, and impact/damage

Triggers	Predisposing Factors	Examples of Impact/Damage
Inundation/Flooding	Seafloor and Coastal Topography, Combustibles, Land Use Patterns, Protection Level, Awareness of Evacuation	Human Casualties (Primarily Drowning), Dry Vegetation due to Sea Water, Agricultural Damage, Tsunami-Related Fires (Ignited by Power Lines, Batteries, etc.)
Current and Wave Force (Tractive Force)	Coastal Topography, Soil and Sediment, Debris, Infrastructure, Land Use Patterns	Damage to Houses/Facilities, Infrastructure Damage, Flooding and Inundation of Buildings/Structures, Erosion/Sedimentation (Topographical Changes), Environmental/Ecological Destruction



The black tsunami as witnessed in Miyako City

As summarized in Table 1, triggering factors for tsunamis include inundation and flooding, as well as currents and wave forces. Predisposing factors are the seafloor and land topography, land use patterns, and protective facilities. This table also summarizes significant impacts and damage reported after the earthquake. Damage caused by seawater inundation has been seen in the past. However, the increased destructive power of the current was accompanied by the production of floating debris, which increased the scale of damage and topographical changes.

The earthquake produced a black tsunami (containing pollution). There have been reports of building damage and health problems related to this event, with the damage being especially pronounced in coastal urban areas. This is because mud and sand from the seafloor were swept up by the tsunami and deposited onto the land as sediment. The seawater became viscous when the mud was incorporated, increasing the gradient of the wave’s leading edge, and

increasing the wave force as a result.

This phenomenon also caused health effects such as tracheal obstruction from swallowing the muddy water, and tsunami lung from the inhalation of dust after the mud dried. Future measures are necessary in order to cope with these new types of damage.

### **Interdisciplinary Research to Produce Practical Benefits: Preventing Another 3.11**

Tohoku University launched the International Research Institute of Disaster Science just one year after the Great East Japan Earthquake. The institute combines wisdom from the humanities, science, and medicine, thereby aiming to solve the challenges experienced after the disaster. It has been established as an organization that strongly promotes world-leading scientific research related to natural disaster science. Here, they have developed a system for utilizing the lessons learned from the disaster by treating series of responses to the disaster as a single cycle, organizing examples and issues into pre-disaster, during, and recovery/reconstruction phases. New forms of collaborative, interdisciplinary research have also produced results. These results do not stop at recovery and reconstruction support in the affected areas; they also help promote practical methods of preparing for future disasters. The disaster was both complex and unprecedented, and as its effects are still ongoing, there is some uncertainty about precisely what the final impact will be. However, interdisciplinary research reveals precisely what we don't know while exploring factors essential for future disaster risk reduction and mitigation.

Researchers from different fields come together at the institute to combine their disciplines. This fusion resulted from promoting practical research; it wasn't one of the institute's original aims. The idea of combining research into tsunamis, earthquakes, and landslides as natural phenomena while exploring past earthquakes and tsunamis through examining ancient documents and collaborating with historical experts is not new. However, significant changes have occurred since the earthquake. A unified examination of aspects such as historical background, topography, and land use, in addition to historical documents, has provided more clarity regarding the actual damage that occurred. Experts from other fields are also being brought together to provide various perspectives. These actions have enabled quantitative scientific evaluations of these past disasters.

### **The Network's Role in Bringing Together Geographically Separate Facilities**

The experiences and lessons learned from the Great East

Japan Earthquake must not be forgotten. For this purpose, it is vital to draw attention to the various kinds of information and initiatives related to disaster risk reduction, recovery, and reconstruction. This goal can be achieved by utilizing networks of memorial facilities and activities related to the earthquake. Memorial facilities include building remains and exhibition facilities that teach people about the actual situation and lessons learned from the disaster. However, it isn't easy to visit all of these facilities and gather information from them in a limited amount of time, as they are scattered over a vast area that spans several prefectures. It is, therefore, necessary to categorize these facilities and their information, creating a network between them by installing guide maps and signs. This action ensures visitors can efficiently visit and tour the facilities depending on their aims and available time. One of the organizations formed in response is the 3.11 Densho Road Promotion Organization (<https://www.311densho.or.jp/en/>), which is developing maps and signs to create a network of registered memorial facilities<sup>1)</sup>. The facilities and networks will serve as a base for various initiatives that are being planned on learning and preparedness related to disaster risk reduction and mitigation, as well as tsunamis. These activities are expected to contribute to the formation of a disaster-resilient society and the revitalization of local communities by improving knowledge and awareness of disaster risk reduction and promoting exchange between people across different regions and nations. ■

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1) Map of 3.11 Densho Road <https://www.311densho.or.jp/en/introduction/index.html?no=0>

# Thinking of the Arctic through the Board Game, The Arctic

[KEYWORDS] Arctic research / Learning tools / Integration of natural and social sciences

## WATANABE Eiji

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(Ocean Newsletter No.496, 5 April 2021)

**A role-playing board game has been produced under the framework of the Arctic Challenge for Sustainability (ArCS) project. In the learning tool on the Arctic science, The Arctic, players assume the role of an oceanographer, indigenous personnel, fisher, cultural anthropologist, industry personnel, or diplomat, and aim to maintain a certain level of environment, culture, and economy in the context of rapidly decreasing sea ice in the Arctic region. Aside from holding many trial sessions both domestically and abroad up until now, we are also loaning the game to research, educational, and government organizations.**

## Production Details

*The Arctic*<sup>1)</sup> is a role-playing board game used as a research and learning tool. It was produced within the framework of the Arctic Challenge for Sustainability (ArCS) (2015 - 2020) through funding by the Ministry of Education, Culture, Sports, Science and Technology. The ArCS project has been promoted primarily by the National Institute of Polar Research (NIPR), the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), and Hokkaido University. ArCS has helped enhance cooperation between the natural sciences, the humanities, and the social sciences while providing information to society at large. As part of the project, an event for the general public was held at the National Museum of Emerging Science and Innovation (Miraikan) in Odaiba, Tokyo, in January 2018.

Along with three lectures by ArCS researchers, the event featured displays of sea ice collected during an Arctic voyage by the ocean research vessel *Mirai* and indigenous tools. Participants were delighted with the event. However, a one-day event can only convey the situation in the Arctic to the actual participants. We therefore decided to create a hands-on learning tool that could be used more sustainably and broadly. Incidentally, while the author of this paper is a researcher of natural phenomena in the Arctic Ocean, the game was produced by a team headed by Dr. Hajime Kimura, a specialist in international law who worked at JAMSTEC until March 2020. We collaborated with researchers from several institutions who specialize in cultural anthropology, biological oceanography, glaciology, and international politics. We also worked with the National Museum of Emerging Science and Innovation (Miraikan) and professional game companies.

Developing this new learning method involved trial and error, such as trying existing learning tools, examining the advantages and disadvantages of different prototypes (one prototype was similar to backgammon), and adjusting the balance between gameplay, education, and convenience. There were a variety of situations and research topics that

we wanted to introduce through the game. However, we had to choose the most vital areas due to a concern that if we included too many detailed and specialized items, the game would not be interesting. The original Japanese version was released in August 2019, about a year and a half after its conception.

## Overview of the Board Game

Players participate in one of the following roles: oceanographer, indigenous personnel, fisher, cultural anthropologist, industry personnel, or diplomat. The aim is to maintain a certain level of environmental, cultural, and economic sustainability in the Arctic in the face of rapidly declining sea ice. The game was designed for high school students and older, but we found that even upper elementary school students could understand and play the game during trials. If one person plays each role, only six people can play at a time. However, it can be played by as few as four players or as many as 18 if each role is assigned to a group of three. The standard game time is about 45 minutes, but it can be finished within 30 minutes by adjusting the time for commentary and discussion. In a university lecture, it is possible to use a whole 90 minutes for one session, including a 5-minute intro video and a mini-lecture providing basic knowledge of the Arctic's environment.

The main game board features an above-view map of the Arctic. It begins with 35 tiles on top of the map that mimic the actual distribution of sea ice. During a turn, players flip over a sea ice tile, and various events that could happen in the Arctic region are revealed. Players respond to these events based on the explanations and instructions written on the corresponding page of the Event Book. For example, an ocean acidification event causes changes to environmental, cultural, and economic levels. The game also features choice-based events such as "Will you promote plankton research?" or voting events such as "Will you invest in fossil fuel extraction?" Players then need to decide, using the limited available budget whether those are necessary.



Players are also encouraged to influence each other's decisions by making arguments based on their role in the game. The game ends when the sea ice tiles near the North Pole have been flipped over. The winner is determined according to the environment, culture, and economy levels at the end. There are also scenarios where everyone can win, and everyone can lose.

The game has numerous educational features. First, the actual sea ice distribution is represented by the thickness of the tiles (2mm, 4mm, and 6mm), with the Canadian side being thicker than the Russian side. The number of tiles decreases as the game progresses, allowing players to gain a true feeling for how Arctic sea ice is decreasing. Clever design reveals Northern Sea Routes on the map as the sea ice tiles decrease. Researchers from a wide variety of fields were involved in the game's production and operation. The content provides a comprehensive picture of what Arctic research is all about. The explanations in the Event Book can also be used as a reference textbook. Winning requires implementing necessary measures with a limited budget and maintaining a balance between the environment, culture, and economy. In addition, the fact that individual players may find that aiming to win produces an undesirable outcome, which prompts realistic discussions regarding the complexities of the situation in the Arctic. There is no right or wrong answer for each decision. Instead, it is more

important to consider what caused specific outcomes than winning or losing.



English version of The Arctic, an Arctic research learning tool. If a Voting Event occurs, players refer to the description in the Event Book and submit a Yes/No card.



Players take on one of six roles to maintain certain environmental, cultural, and economic levels in the Arctic as sea ice rapidly declines.

### Operational Status

Since the Japanese version's release, our team has been actively promoting The Arctic at the institutions to which our members belong. The game has also been promoted at events conferences and general lectures in Japan and abroad. We have also produced an English version and a Children's Event Book with explanatory text rewritten in simpler terms in response to requests. Our group has also visited large numbers of schools. Unfortunately, these visits were mostly canceled from February 2020 onwards due to COVID-19 as schools were closed and people refrained from going out. Due to the current difficulties around face-to-face play, we also created an online version that can be conducted remotely, enabling the game's use in online lectures at universities. As well as the hands-on sessions, we also lend our products to schools, research institutes, government agencies, and indigenous groups in Japan and abroad (the standard lending period is about one month, but this is negotiable). We've also participated in online events organized by Miraikan, which were broadcast on the museum's YouTube channel<sup>2)</sup>. Applications for hands-on sessions or to borrow the game can be made through The Arctic's website. Since there are many other phenomena and studies in the Arctic that have not been introduced in the current version, future developments could include making a newer version while maintaining the current basics of the game. Producing a browser or smartphone app version of the game may lead to even wider usage, although there are technical and cost challenges related to this. ■

1) The Arctic website <https://www.nipr.ac.jp/arcs/boardgame/en/>

2) Online Event: Talking with Researchers about the Arctic's Present and Future (in Japanese) [https://www.youtube.com/watch?v=mAl6dqu\\_N9c](https://www.youtube.com/watch?v=mAl6dqu_N9c)

# The Marine Products Industry's Reliance on Foreign Workers and the Issue of Continuity

[KEYWORDS] Foreign technical interns / Shortage of licensed mariners / COVID-19

## SASAKI Takafumi

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(Ocean Newsletter No.497, 20 April 2021)

Japan's marine products industries are experiencing a dearth of workers. The fishing villages that used to function as suppliers of workers are struggling and failing to nurture successors. In these circumstances, foreign laborers are seen as an immediately available workforce and are considerably growing in number. However, this risks becoming a warning sign for the continuity of Japan's marine products industries. In this article I would like to analyze the current situation, as well as examine issues such as the shortage of licensed mariners and the COVID-19 restrictions on immigration and their "side effects".

### Marine Products Industries Face a Growing Labor Force Problem

Japan's marine products industries are made up of fishing, including aquaculture, and fish processing, in which the resources provided by the fishing industry are processed into food and related products. All of these fields are currently seeing increasingly severe labor shortages.

In coastal and set net fisheries, a slump in fishing income has created a shortage of successors. There is also a growing shortage of labor for land-based work related to cultivating shellfish such as oysters and scallops in the aquaculture industry. Primary factors include aging and emptying out of fishing villages (fishing communities around ports) against a backdrop of declining birthrates and an outflow of young people to urban areas. As of 2019, the proportion of elderly in fishing villages reached 39.7%.

The offshore fishing industry is suffering from a shortage of human resources as well, due to the harsh working environments. These industries are struggling to secure young and mid-career crew members, casting a dark shadow on the industry's sustainability. In pelagic fisheries, the deterioration of the business environment under the 200 nautical mile EEZ system has also meant a reduction in labor costs in the interest of cutting overall costs.

The harsh realities of the fishing industry are seen in the decline in fishery worker numbers, which dropped by 53.3% in just a quarter of a century. As of 2018, personnel numbers fell to 151,701.

The fish processing industry is also vulnerable to this increasingly severe situation. Many fish processing plants are located in coastal areas, and their main labor force was from residents of communities around fishing villages and fishermen's family members. However, it has become difficult to secure stability in the labor force due to the aforementioned issues, the impoverishment of fishing villages and aging of the population. According to trends in the number of workers in the seafood manufacturing industry, as revealed by the national census, workers decreased by

more than 25%, from 221,537 in 2000 to 165,390 in 2015. During this period, the percentage of employees aged 65 years or older has increased from 8.3% to 14.7%.

### The Growing Dependence on Foreign Labor

As the labor situation becomes increasingly severe, the fishing industry is relying more and more on foreign labor. In the coastal and offshore fisheries, labor is mainly secured through the foreign technical intern training system, while in the pelagic fisheries it is through the maru ship system<sup>1)</sup>. The fish processing industry relies greatly on the technical intern training system for foreign personnel while also employing foreigners with a "specified skill" residence status and people of Japanese descent.

As of 2018, the number of technical interns in the fishing industry included 4,628 maru ship crew members aboard pelagic fishing vessels and 1,600 technical interns aboard offshore fishing vessels. There were also 138 technical interns working in set net fishing and 1,851 technical interns engaged in oyster and scallop cultivation.

The number of maru ship crew members is shrinking due to declines in the number of pelagic fishing vessels, falling from 5,255 in 2013 to 4,628 in 2018. The number of technical interns working in offshore fisheries expanded 1.6 times, from 1,000 to 1,600 over the same period. This was driven by the increased numbers of interns being used in the seine and purse seine net fisheries. There were also significant increases in the set net fisheries, from 42 to 138 individuals.

The introduction of technical interns into the aquaculture industry was first seen in oyster cultivation, which requires manual labor for shucking. In recent years interns are also being used in scallop cultivation, which has increased their total numbers. In 2013 just 677 interns were working in oyster cultivation and 11 in scallop cultivation, for a total of 688. In 2018 this had increased 2.7 times, to 1,471 in oyster cultivation and 380 in scallop cultivation, for a total of 1,851 (see figure).

However, the numbers of foreign workers in the fish

processing industry far exceed that of cultivation. According to the fisheries census, numbers expanded from 11,629 individuals in 2008 to 13,458 in 2013 and the numbers increased to 17,339 in 2018. The increase in the ratio of foreign to Japanese workers in this period also can't be overlooked. Japanese workers decreased by almost 20%, while the foreign worker ratio went from 5.5% in 2008 to 7.1% in 2013, reaching a double-digit mark of 10.1% in 2018.



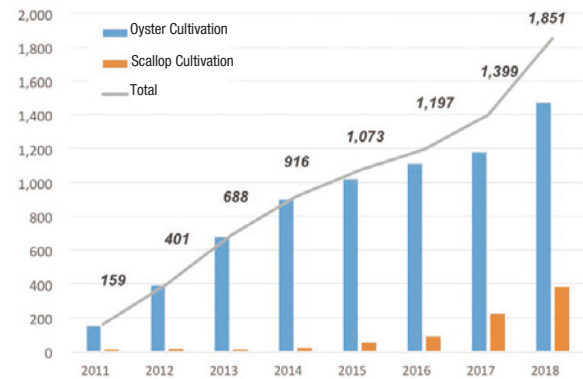
Maru ship crew working on an offshore tuna longline fishing vessel.

### Side effects of dependence on foreign labor

At present, Japan's fishing industry has no choice but to rely on foreign labor to maintain its scale. The industry attempted to find a way to survive by employing more foreign workers, but this was not without its risks. In the case of offshore and pelagic fisheries, which supply large quantities of food, the side effects of dependence on foreign workers became apparent in the form of a shortage of licensed mariners, who act as senior crew members. As of 2017, most fishing vessels' licensed mariners were aged between 60-64, with 48.8% aged 55 or older. One of the factors behind this issue is that fishing vessels have actively recruited foreign personnel as part of their younger workforce. This change has resulted in reductions in the numbers of young Japanese employees, with fewer individuals building up experience working on ships and obtaining licensed mariner certifications.

However, this is not the only factor. Young Japanese people who have obtained a licensed mariner certification in fisheries high schools have instead begun working on merchant ships, which offer better working conditions and wages than fishing vessels. Regardless, it should be remembered that it is the decreased strength in company manage-

Figure: Trends in employment of foreign technical interns in the shellfish cultivation industry (Units: People) (Source: Data from the Fisheries Agency)



ment has created a dependence on foreign personnel as well as working environments and wage levels that Japanese people try to avoid.

In the aquaculture and fish processing industries, this heavy reliance on foreign workers in itself has become a risk. Unless they can secure a stable workforce for the long term, it will be difficult for these industries to survive.

COVID-19 has also highlighted the risks of relying excessively on foreign personnel. Entry restrictions were imposed on a wide range of countries from which many technical interns are sourced, including Vietnam and China. Some factories in the fish processing industry were unable to fill vacancies because of this issue, and more than a few were forced to downsize their production lines.

Foreign labor has indeed been a blessing for the weakening fishing industry. However, an over-reliance on this source of labor may result in disaster. To ensure that Japan's fishing industry can reestablish itself as one capable of sustainable development, it will require a reassessment of the risks of relying on foreign labor and a big picture view of the industry's labor force composition. ■

1) A method in which a Japanese ship owned by a Japanese corporation is temporarily leased to a foreign corporation. Foreign crew members are boarded in that country, and chartered by the same Japanese corporation. This concept is referred to as the "maru ship system" because the convention of having Japanese ships named with the character "maru" at the end remains unchanged.

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# Kaisou Oshiba's 30-Year Journey: Welcome to the Forest of the Ocean

[KEYWORDS] environmental education / pressed leaves / biodiversity

## NODA Michiyo

President, Kaisou Oshiba Society

(Ocean Newsletter No.498, 5 May 2021)

Seaweed, the "Forest of the Ocean" that nurtures life, has a rich diversity of colors and shapes as a result of adapting to environments at various depths. *Kaisou Oshiba*, where you can learn about this diversity and enjoy gaining hands-on experience, began over 30 years ago at the University of Tsukuba's Shimoda Marine Research Center. Environmental learning workshops are now being held at many different locations for a wide range of age groups.

### My First Encounter with Seaweed Specimens

The University of Tsukuba's Shimoda Marine Research Center is located in a small emerald green inlet in Nabeta Bay, Shimoda City, at the tip of the Izu Peninsula. I first visited Dr. Yasutsugu Yokohama's laboratory more than 30 years ago. At the time, he was an assistant professor of seaweed physiology and ecology. The meeting was held at the request of my former workplace, the Design Division of the Industrial Research Institute of Shizuoka Prefecture (now the Industrial Research Institute of Shizuoka Prefecture), to discuss drawings for a photosynthesis measuring instrument called "Product Meter."

We were on the second floor of the research building closest to the ocean, in a laboratory with a reception area. A small plaque hanging on the wall caught my attention, so after we finished our business, I asked, "What's the red thing in the plaque?" He replied, "It's a variety of seaweed called *habutaenori* (*Marionella schmitziana*). I've collected some other samples as well." He then took some samples out from a specimen shelf in the next room and showed them to me. Some of the seaweed had sand still stuck to it, and there was a faint scent of the ocean. "The seaweed is stuck to the paper! There are so many different colors and shapes! I never knew there were so many kinds!" Seeing so many seaweed specimens for the first time made quite an impact on me.

Perhaps due to my surprised delight, Dr. Yokohama asked me, "I know it's a bit far, but would you be willing to help me with my seaweed research one day a week, or even help me from home?" I was above all deeply curious about the "Forests of the Ocean." This was how my "dialogue with seaweed" began, together with the seasonal changes of fresh greenery and autumn leaves of Amagi Pass as I commuted from my home in Shuzenji.

### Improvements to Help Produce Beautiful Specimens

After the arrival of Admiral Perry's black ships in 1853, several specimens of seaweed that his fleet collected in Shimoda Bay were introduced to the world. Although seaweed

#### ■ Points improved upon during the development of *kaisou oshiba*

Improved plant specimen dryer to suit seaweed specimens	A blower motor was attached to the side of the box to allow for airflow through the holes in the cardboard used for pressing to be evenly applied.
Improved green algae color fixing process	Green algae are boiled briefly in a 0.1% copper sulfate solution in an enamel or glass pot (traditionally, green algae have been preserved in copper sulfate solution).
Laminated processing (mainly for display purposes)	Laminated film reflects light, delays fading, and is moisture resistant.
Seaweed freezing and storage	Freezing and storing when collecting large amounts of seaweed in the spring enables making specimens at any time. After removing the salt, water is carefully wiped off the seaweed. A label with data such as the species name, collection site, date, and collector are attached. The sample is then wrapped in a plastic bag or plastic wrap, ensuring air is removed before being frozen.

specimens had been created in various parts of Japan before his arrival, I have heard that the Yokohama Laboratory has improved on the traditional methods (see table).

The key to creating beautiful specimens is to dry the seaweed, which contains a lot of water, quickly. Color fixing is also essential. Chlorophyll is green because magnesium is bound to it. However, the chemical bonds are weak, and the magnesium is easily dislodged, causing the green to fade away quickly. When seaweed is boiled in a solution of copper sulfate, the magnesium in the chlorophyll is substituted by copper, which preserves the green color longer. Seaweed specimens that are beautifully preserved can be identified relatively easily so that species names can be determined quickly. These specimens are also suitable for display.

### The Spread of *Kaisou Oshiba*

After producing the specimens, the remaining seaweed is frozen for storage, but many samples are incomplete in shape. Attempting to combine torn seaweed samples was the beginning of *kaisou oshiba* art (Fig.1). Thirty years have passed since the University of Tsukuba's Biology Degree Program first incorporated seaweed pressing into its 4-night, 5-day plant field training program at the Shimoda Marine Research Center. After creating specimens, students at the training program use them to produce their own postcards and bookmarks. They become completely engrossed in producing this art, which features unique colors and forms. On the last day of the field training, we give them the finished products, which are dried and laminated. Many of the students comment how much they enjoyed



Figure 1: Michiyo Noda, *Square* Figure 2: Forests of the Ocean (Underwater forest)

seaweed pressing, with it becoming a good memory of their visit to Shimoda. Eventually, seaweed pressing was incorporated into classes at elementary, junior high, and high schools around the country. It also became a popular program as part of lifelong learning efforts for the general public in Shimoda City and other municipalities in the Izu Peninsula. As a result, the circle of people creating these beautiful works of art has spread nationwide. This increase in popularity meant that instructors needed to be trained, so we established the Kaisou Oshiba Society. Study sessions are now held twice a year thanks to the support of Dr. Yokohama and other advisors, all of whom specialize in algae. The sessions include a hands-on practical class in the spring and a lecture in the fall. Currently, about 30 certified instructors are teaching this topic at facilities and schools across the country.

### Kaisou Oshiba as a Form of Environmental Education

The current seaweed pressing class consists of two hours of lectures and hands-on practical training. The venues are lined with various panels of seaweed specimens, including familiar large varieties such as *wakame* and *hijiki*, to elicit reactions from participants as they enter the venue. Seeing these beautiful and fun works of art helps change the rather plain image people have of seaweed. Seeing examples of past participants' work also raises participants' expectations for the class.

First, a DVD called "Welcome to the Forests of the Ocean!" (11 min.) is shown to provide an introduction to the topic (Fig.2). It uses easy-to-understand language to introduce the critical role of underwater forests and seaweed beds in various parts of Japan and their connection to the land. For many participants, this is their first introduction to the underwater forests. Participants then make pressed seaweed postcards. The classroom and the large hall become quiet as everyone focuses on this hands-on activity. During one class, a teacher murmured, "I wish my students were this enthusiastic about my classes." A middle-aged participant in the general hall commented, "I've never concen-

trated so hard in my life!" All of the participants become absorbed in seaweed pressing.

Most of the seaweed used to make the postcards is collected from the beach. If you go to the beach the day after a tidal surge in spring, you can pick up a wide variety of colorful seaweed. We choose nine types of seaweed consisting of green, brown, and red algae for the classes. We then freeze them for year-round use.

Some seaweed is so delicate that their forms would be impossible on land, while others are colorful even though they only have leaves and no flowers. The shapes and colors of seaweed result from their adaptations to living underwater. The reason that *wakame* and kelp are brown and that *yukari* (*Plocamium telfairiae*), which grows in deep water, is bright red is because they contain red pigment. This red color is complementary to green, allowing it to capture and utilize the green light that reaches the deepest parts of the ocean. Sunlight, which is vital for seaweed, has a hard time reaching the deeper levels of the ocean when the water is cloudy. Dr. Yokohama even invented a catchphrase: "Light is food. Don't pollute the ocean!"

Dr. Yokohama passed away in 2018, but in 2020, 32 classes, five exhibitions, and one lecture were held on pressed seaweed, which he first invented at the Shimoda Marine Research Center. The *kaisou oshiba* art has become an accessible introduction to the beauty of seaweed (Fig.3). Thanks to this success, we received requests from an Australian aquatic plant society a few years ago and from a Korean pressed flower organization in 2020, meaning the project has spread overseas. Recently, we have been holding annual exhibitions of pressed seaweed at museums and art galleries in Japan, and we want to focus on creating new works in the future. Our society hopes to work with certified instructors to expand our classes as a form of environmental education in Japan and overseas. ■



Figure 3: *Kaisou oshiba* class at the Tokyo Bay Festival held every year at the Yokohama Red Brick Warehouse

● Kaisou Oshiba Society Website <http://kaisou048.jp/>

● Michiyo Noda was awarded the Okamura Prize, a special prize from the Japanese Society of Phycology, on March 17, 2021.

# The Large Survey Vessels “Heiyo” and “Koyo” Come into Service: Current Status on the Enhancements of the JCG’s Survey Resources

[KEYWORDS] Maritime interest / Hydrographic survey / Ocean observation / Ocean research / Survey vessels

## TAKASAKA Hisao

Director, Administration and Planning Division, Hydrographic and Oceanographic Department, Japan Coast Guard  
(Ocean Newsletter No.499, 20 May 2021)

Two large hydrographic survey vessels, “Heiyo” and “Koyo”, were commissioned by the Japan Coast Guard in January 2020 and March 2021 respectively for the first time in almost 20 years. The background of the commission, as well as the current status on the Enhancement of the JCG’s survey facilities, starting with the new hydrographic survey vessels that have state-of-the-art research equipment are presented.

### Overview of work performed with the survey vessels and the background to their development

Survey vessels of the JCG Hydrographic and Oceanographic Department (JHOD) perform oceanographic researches in the waters surrounding Japan. The results are used for various purposes, including ensuring navigational safety, conservation of the marine environment, disaster risk reduction, and securing maritime interests.

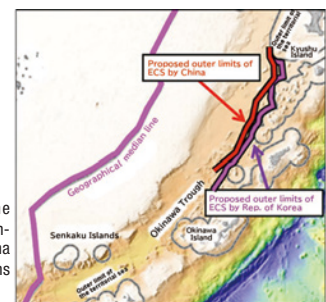
Among these purposes, to secure Japan’s maritime rights and interests, the JHOD had conducted continental shelf surveys from 1983 to 2008 to extend the continental shelf beyond 200 nautical miles from the baselines of Japan. This action contributed to the establishment of the Japan’s extended continental shelf (ECS).

Amid this situation, China and Republic of Korea argued that the boundary demarcation in the East China Sea be based on the Sea’s geological characteristics. China even argued that the continental crust end at the Okinawa Trough. Therefore, in December 2012, they applied to the Commission on the Limits of the Continental Shelf to extend their shelf into the Okinawa Trough.

The Commission examines applications in the reception order. However, the Commission will defer consideration of these applications, even when their turns have come around. Regardless, China and Republic of Korea are strengthening their oceanographic research facilities, and Japan must collect and maintain more scientific research data.

This situation led to the Policy on Strengthening the Maritime Security System decided at the Ministerial Council on the Strengthening of the Maritime Security System, held in December 2016. Based on this policy, the JHOD decided to strengthen the oceanographic research facilities, primarily through the construction of the survey vessels “Heiyo” and “Koyo”, with the aim to properly assert Japan’s position against other countries’ applications for ECSs and claims of maritime boundaries beyond the median line.

Alongside the construction of “Heiyo” and “Koyo”, the JCG introduced its first survey airplane (Aobazuku, belonging to the 2nd Regional Coast Guard Headquarters)



■ Figure1: Location map of the proposed outer limits of extended continental shelf (ECS) in the East China Sea submitted to the United Nations by China and Republic of Korea

and autonomous ocean vehicles (AOVs) required to survey the low-tide line, which serves as a baseline for maritime boundaries with other countries. In addition, to optimize the operation of this expanded oceanographic research system, the JCG also enlarged the Survey Ship Operation Office, part of the JHOD’s Administration and Planning Division to establish the Survey Operations Office in April 2020 to operate survey vessels, survey airplane, and AOVs around the clock.

### Performance of the survey vessels and onboard observation equipment

The new survey vessels, “Heiyo” and “Koyo”, are designed to conduct high-precision, wide-area hydrographic surveys. Their basic features include noise and vibration control to minimize the impact on precision surveying instruments, low-speed and long-duration navigation capability, and a fixed-point holding capability.

Specifically, these survey vessels employ a combination of four generators and electric propulsion, as well as strengthened soundproofing and anti-vibration measures for the generator motors. Their observation and living areas are separated from noise sources, and they also feature the first use of azimuth propulsion amongst JCG’s survey vessels<sup>1)</sup>.

With regards to observation equipment, both survey vessels are equipped with three types of multibeam echo sounders with different frequencies and beam angles for shallow water, archibenthic, and the deep sea. The echo sounders can determine water depths up to about 11,000 meters (the deepest part of the world’s oceans is the Mariana Trench, at 10,920 meters, making it possible for these echo sounders to survey any part of the world’s oceans).

## The Large Survey Vessels “Heiyo” and “Koyo” Come into Service: Current Status on the Enhancements of the JCG’s Survey Resources

■ Table 1: Comparison of primary equipment installed on newly built survey vessels

Heiyo (seafloor topographical surveys)		Koyo (seafloor geological surveys)	
Device name	Overview	Device name	Overview
Autonomous Underwater Vehicle (AUV)	Equipped with a multibeam echo sounder and side-scan sonar, AUVs allow for unmanned surveys of seafloor topography using pre-programmed routes.	Multi-channel seismic reflection system	Consists of an air gun array that generates elastic waves that travel deep underground through the instantaneous release of large volumes of ultra-high-pressure air into the ocean and a streamer cable to receive the reflected waves.
Autonomous Surface Vehicle (ASV)			
Remotely Operated Vehicle (ROV)	A video camera that can be remotely controlled underwater	Bottom sampler (sampling corer, rock sampler)	Two types of bottom samplers that can collect seabed sediments without destroying seafloor structures.

They are also equipped with an acoustic Doppler current profiler that uses ultrasound waves to measure the direction and velocity of water currents in the surveyed area and a sub-bottom profiling system to survey the geological structures of sub-surface layers.

In terms of onboard equipment, the “Heiyo” is equipped with cutting-edge equipment for seafloor topographic surveys, while the “Koyo” is equipped with similarly advanced equipment for seafloor geological surveys. The specific contrasts between shipboard equipment are shown in Table 1.

The names of the vessels were chosen from among many candidates submitted by the general public. “Heiyo” reflects a wish for “a calm and peaceful sea through oceanographic research,” and “Koyo” for “promoting oceanographic research to elucidate the shining sea by casting a light on parts of the sea that are not yet fully understood.” The ships’ hulls were inscribed with the name “Heiyo” by former Minister of Land, Infrastructure, Transport and Tourism ISHII Keiichi and Koyo by current Minister AKABA Kazuyoshi.

The existing large survey vessels “Shoyo” and “Takuyo” were also upgraded with high-performance surveying equipment. These upgrades were made due to the necessity for surveys to be conducted in the East China Sea and to hasten the development of essential information that will help secure maritime rights and interests.



Heiyo (left, commissioned in January 2020, 4,000 tons) and Koyo (right, commissioned in March 2021, 4,000 tons)

### Future expectations and prospects

The situation in the seas surrounding Japan is becoming more severe. Therefore, the whole JCG needs to steadily promote the enhancement of its systems, including maintenance of patrol vessels, survey vessels, and aircraft, in accordance with the 2016 Policy on Strengthening the Maritime Security System.

The “Heiyo” and “Koyo”, which are core to strengthening the oceanographic research system, will engage in conducting surveys on the topography and geology of the seafloor in the Sea of Japan, the East China Sea, and other sea areas, making full use of the cutting-edge equipment and technologies that have been introduced in this article. These survey vessels will play an essential role in securing Japan's maritime interests over the long term.

Furthermore, it is also expected that the information obtained from the surveys is used as base information for future marine utilization and disaster risk reduction. For example, in the past, a survey vessel found a number of chimney-like formations off Kume Island in Okinawa Prefecture, which led to the discovery of high-grade hydrothermal deposits with high metal content<sup>2)</sup>.

This year marks the 150th anniversary of the establishment of the Hydrographic Bureau, the former JHOD, in 1871, and the start of Japan's first full-scale hydrographic services, which used modern technologies to perform everything from hydrographic surveys to nautical charts.

Over the years, the specifics of hydrographic services have changed dramatically through incorporating various leading marine technologies. However, the promotion of oceanographic researches and the development of marine information remain indispensable for the navigational safety of vessels and for securing Japan's maritime interests. The JCG will continue to focus on these as a major pillar of its maritime security operations. ■

1) An azimuth propulsion system is a ship propulsion system. The rudder and screw are integrated into a single unit, making it possible to direct the propulsive force 360 degrees in any direction. The “Shoyo” and “Takuyo”, which entered service in the 1980s and 1990s, use a propeller propulsion system.

2) The tip of the chimney-like terrain discovered by the survey vessel showed upwellings and a rapid increase in water temperature, indicating that it was a cluster of chimneys ejecting hydrothermal water. Subsequent investigations by the Japan Oil, Gas and Metals National Corporation confirmed that the site is a large-scale, high-grade hydrothermal deposit (nicknamed the “Gondo Site”).

# Let's Strengthen the Ties Between Ocean Science and Policy

[KEYWORDS] United Nations Decade of Ocean Science for Sustainable Development / International Decade of Ocean Exploration / Basic Act on Ocean Policy

## YAMAGATA Toshio

Project Principal Researcher, Japan Agency for Marine-Earth Science and Technology (JAMSTEC); Professor Emeritus, The University of Tokyo (Ocean Newsletter No.500, 5 June 2021)

**The United Nations (UN) Decade of Ocean Science for Sustainable Development has begun. In Japan as well, a national committee has been launched as a platform for all interested parties to collaborate in realizing a clean, healthy, productive, predictable, safe, accessible ocean, and most of all, an ocean which brings hope and inspiration into our everyday lives.**

## Mother Sea

My nostalgia flies like a butterfly! The butterfly crosses over woven fences and sees the sea from the street corner in the afternoon... I listen to the sea at the wall... close my book. I lean against the wall. Two o'clock strikes in the next room. "Sea, the far sea! I write on a piece of paper—Sea, Chinese character of you embraces mother. Mother, French word of you embraces the sea." (*Kyoshu* (Nostalgia) by Tatsuji Miyoshi)

The scent of the tide, the lapping waves, the setting sun beyond the horizon - when I look at the sea close by, and when I think about it far away, I feel nostalgic for some reason. Perhaps it is because the ocean brings back memories of the rhythms of the natural world that we have experienced since the birth of life on this planet.

Due to its delicately balanced location in the solar system, the Earth has produced a rich and life-giving ecosystem through being a water-covered planet with an optimal temperature and atmospheric pressure. However, civilization has exceeded the limits of our planet, even threatening our coexistence with our irreplaceable Earth and all living things. Our mother ocean also faces many serious problems such as global warming, acidification, pollution, garbage, and noise in the ocean.

This sense of crisis led to the launch of the UN Decade of Ocean Science for Sustainable Development, a resolution passed by the United Nations based on a proposal by the Intergovernmental Oceanographic Commission of UNESCO (IOC-UNESCO). In February, a Japanese national committee was established through the efforts of the Japan Society of Ocean Policy and the Sasakawa Peace Foundation's Ocean Policy Research Institute. The committee is expected to serve as a platform for all stakeholders, including academia, business and industry, government, and citizens' groups, to work together. This action will help us realize a clean, healthy, productive, predictable, safe, accessible ocean, and most of all, an ocean which brings hope and inspiration into our everyday lives.

## Advances in Marine Science

Actually, the UN General Assembly passed a resolution on the oceans based on a proposal by the IOC as long as half a century ago. The resolution was for the International Decade of Ocean Exploration (IDOE), which began in 1971. In the 1960s, the rapid development of electronic devices, measuring instruments, remote sensing technology, and computers raised expectations for the future of society. At the same time, marine science was facing a significant turning point due to growing awareness of environmental destruction caused by pollution and other factors. A new possibility was also emerging: the long-term deployment of buoys in coastal areas and the world's deep-seas to acquire regional data chronologically. New technology also made it possible to link basic research to applied research through combining wide-area oceanographic observations, including satellite observations, with numerical simulations to predict changes in the ocean. At that time, Professor Koji Hidaka of the University of Tokyo commented, "Research in the natural sciences cannot be expected to be effective unless basic research and applied research constantly proceed in step with each other. Since applied research is directly relevant to human life, basic research tends to be neglected. However, it is obvious that the development of applied research will not progress without a solid foundation."<sup>1)</sup> What were the goals of the International Decade of Ocean Exploration (IDOE)? The IDOE was an attempt to understand the nature of fluctuating phenomena in a way that transcended conventional discrete descriptions of phenomena by routine shipboard observations. Around the time I entered graduate school, Professor Kozo Yoshida of the University of Tokyo, who laid the foundation for ocean physics in the postwar era, was working to gain the understanding of the Science Council of Japan and the Ministry of Education (at the time) to participate in this large-scale international project. The professor, who had made world-first discoveries in upwelling theory, had high hopes for the program's Coastal Upwelling Experiment. Dr. Kwon Higu, an acquaintance of Professor Yoshida, sympathized with his idea and launched the journal *Gekkan Kaiyo Kagaku*



(Marine Sciences Monthly)<sup>2)</sup>. New forms of marine science were emerging to help our understanding of the changing and fluctuating oceans.

However, global trends in marine science were not fully understood in Japan. Instead, the emphasis was placed on developing the ocean. This focus may have been natural for Japan, whose heavy industries had developed remarkably, and which was gaining momentum as an industrial nation. There was an incident when Professor Yoshida grew angry because someone mistook the word “exploration” for “exploitation.” I still remember it like it was yesterday. The Science Council of Japan only recommended implementing the International Decade of Ocean Exploration (IDOE) to the government in 1974, when the international plan was almost halfway finished. In the end, however, this recommendation was not accepted by the government.

Looking back at that time from half a century later, I can see another side to the story. The global movement that led to the UN General Assembly's resolution was undoubtedly impacting the world of politics and business in Japan. In 1968, the government consulted the Council for Ocean Science and Technology regarding the Development Plan for Science and Technology for Ocean Development. The council's report in response to the consultation resulted in bringing about a successful outcome, and in May of 1971, the Japan Marine Science and Technology Center Act was promulgated. In October of the same year, the Japan Marine Science and Technology Center (now the Japan Agency for Marine-Earth Science and Technology) was established with the support of the Japan Business Federation. This year marks the 50th anniversary of this event. Its principles state that emphasis should be placed not only on science and technology for the development of marine resources, but also on science and technology for the prevention of marine pollution, to contribute broadly to improving the welfare of Japan's citizens<sup>3)</sup>. At that time, courses on marine science at universities were newly established one after another, significantly strengthening the foundations of human resource development. The 1981 issue of the *Journal of Oceanography*, entitled “Nihon ni okeru kaiyogaku saikin 10-nen no ayumi: Kaiyo butsurei gaku” (Oceanic Study in Japan - Its Progress in the Last Decade: Physical Oceanography), reported a significant increase in the number of doctoral students at the University of Tokyo and at Kyoto University. Professor Nobuo Suginothara of the University of Tokyo summed up the situation by saying,

“Even if we had participated in the IDOE in the 1970s, we could not have made any special contributions. The fact that we spent the 1970s steadily carrying out numerical calculations, establishing mooring system technologies, and training researchers may, in fact, work positively for the progress of research in the 1980s and beyond.”<sup>4)</sup> The subsequent development of marine science in Japan shows that human resource development has been critical.



Japan's city lights with atmospheric light on the horizon. A photo taken from the International Space Station 260 miles above the Philippine Sea. (NASA, February 24, 2021)

### Advances in Marine Science

Marine science and technology are particularly interdisciplinary fields. To contribute to people's welfare, comprehensive efforts, including efforts related to policy, are required. This requirement for comprehensive actions means it is vital to have places where ocean stakeholders can express their opinions and share their future visions of the ocean. At the invitation of Hiroshi Terashima, then Executive Director of the Ship and Ocean Foundation, I was involved in editing this Ocean Newsletter for more than 12 years, from 2004, together with Dr. Tomoya Akimichi, Professor Emeritus at the Research Institute for Humanity and Nature. The Ocean Newsletter, compiled of voices of those who work with the ocean, is virtually an anthology of poetry, like the old Japanese “Collection of Ten Thousand Leaves (Manyoshu)”, about the sea. These voices from people who care about the ocean became a great current, and the Basic Act on Ocean Policy was enacted on July 20, 2007, Ocean Day. The enactment was a breakthrough on an international scale. With the publication of our 500th issue, we hope that the Ocean Newsletter will continue to play an increasingly valuable role in helping to realize the UN Decade of Ocean Science's goal of “The Ocean We Want.”



1) Koji Hidaka, *Kaiyogaku Tono 40-nen* (Forty Years of Oceanography), 1968, NHK Publishing Inc.

2) *Gekkan Kaiyo Kagaku* (Marine Sciences Monthly) (1969-1988), published by Kaiyo Shuppan Co., Ltd., succeeded by Kaiyo Monthly (1989 onwards)

3) Annual Report of the Japan Marine Science and Technology Center, 1971 edition

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# Aiming for a “Sea of Fertility”: The Engineering Academy of Japan’s Proposal for Ocean Terroirs

[KEYWORDS] Ocean Terroirs / Sea of Fertility / Democratization of the Oceans

## FUJII Teruo

President of the University of Tokyo, Leader of the Project for Strategic Promotion of Ocean Research, The Engineering Academy of Japan (Ocean Newsletter No.503, 20 July 2021)

**What kind of approach is necessary in order to use the ocean, one of the global commons for those of us living on planet Earth, in sustainable ways in the future? Based on such an awareness of the issue, The Engineering Academy of Japan prepared an Ocean Terroirs Proposal in March 2021. This article outlines the “Sea of Fertility”, a future vision for the ocean based on the proposal’s underlying philosophy, and also introduces approaches for developing the technology needed for creating high added value as mankind endeavors to coexist sustainably with nature.**

## The Ocean Terroirs Proposal

The oceans have blessed humanity for eons. However, our healthy coexistence with this common is in danger due to global warming, environmental degradation caused by the inflow of plastic and other wastes into the ocean, and the decrease in the number of fishery workers in Japan. On the other hand, modern technologies - especially digital technologies - have significantly advanced. They have now placed us on the verge of realizing Society 5.0, a new form of society that will provide both abundance and improved quality of life. Amid this situation, as we go about our life on earth, how can we utilize the technologies of today and tomorrow to ensure our continued use of the ocean, one of the global commons, in a sustainable manner? What kind of approach do we need to implement to these technologies in society to realize a rich and healthy ocean? Based on a recognition of these issues, in 2017 The Engineering Academy of Japan commenced its first project to draft a proposal in the field of oceanography. A message acting as the basis of the project was then prepared in October 2018, and based on this, five working groups (WGs) were formed and examined each issue. Ocean-related stakeholders from various areas participated in the discussion, enabling the Ocean Terroirs Proposal to be compiled in March 2021. The Academy’s proposal set out a new philosophy in the “ocean terroirs” concept, which originated from an article in this journal<sup>1)</sup>, as the starting point of these discussions, presented the core ideas of the ocean terroirs, and a vision for the technologies needed to realize them.

## Democratization of the Oceans and the Sea of Fertility

Terroir is a concept originating in French wine production. It is a philosophy that integrates nature, culture, and society within a particular region, placing values on natural environments, including climate and soil, the land, and the winemaking methods traditionally practiced in vineyards. Vineyards are seen not just as places for harvesting grapes but as actors in a terroir, in which people and nature try to



Members of the Ocean Monitoring Network Initiative (OMNI) project, Institute of Industrial Science, The University of Tokyo, aim to develop an ocean observation system with public participation, which is designed to be built and operated at low cost (photo taken during a field test in Hiratsuka, Kanagawa Prefecture; the author is in the center).

live in sustainable symbiosis and create high added value. Similarly, ocean terroirs which can be described as the marine version of terroir, are also a philosophy that integrates people’s lives and culture with the productive power of the sea in a sustainable manner. Unlike traditional terroirs, which are based on empirical and tacit knowledge, we defined the ocean terroirs as a democratized and open forum where all citizens can participate in decision-making. The intention is to seek participation from all stakeholders and let them make decisions together as concerned parties.

The realization of ocean terroirs requires the technology development based on the following four ideas: firstly, marine data and information sharing as a foundation for marine activities based on advanced evidence; secondly, democratization of marine observation, which encourages personalization of the ocean by the general public, connecting them to marine spaces through the aforementioned data and information; thirdly, systems that create bounties from the ocean through sustainable production systems without depleting nature; and finally, full-digitalization, remotization, and automation of marine systems. Specifically, it is needed to enhance real-world observation and investigation capabilities as well as cyberspace-based data accumulation and analysis capabilities in an integrated manner. In addition, the crucial issues to be considered include achieving

net zero emissions, which is one of the goals for addressing climate change, and pursuing sustainability by establishing recycling systems that do not deplete nature. The latter issue in particular is a core action necessary for mankind to continuously benefit from the sea's bounties. It aims to build a future-oriented fisheries system that combines advanced data-driven ecosystem monitoring, management technologies, and high value-added marine product creation.

The Academy's proposal suggests the term "Sea of Fertility" for its future vision of the sea based on its philosophy of ocean terroirs. New technologies, including digital technologies, will help realize this vision. As a symbol of its vision, the proposal presented Innovative Aqua Farm, a next-generation fish farming facility that minimizes environmental burdens, and the Offshore Floating City, a coastal or offshore-based installation. The former entirely breaks away from the traditional capture-based fishing industry and acts as a center for creating a futuristic marine ecosystem that can sustainably produce high value-added marine products while maintaining rich biodiversity. The latter acts as a base camp for the realization of the ocean terroirs. It is a center of activity supporting the sea of fertility, promoting coexistence with it and regeneration of ecosystems and urban environments through unique features such as being friendly to the global environment and resilient to natural disasters.

### Towards the Realization of Ocean Terroirs

The Ocean Terroirs proposal was put together by members of the engineering, science, and fisheries science communities. To realize our concepts of Innovative Aqua Farm and Offshore Floating City, we also need to consider this project's business potential and sociological aspects. It is also essential to gain sympathetic understanding from society in general for such new attempts.

New ideas and technologies are needed to realize the philosophy of ocean terroirs, while at the same time it is also essential to consciously nurture the human resources that will support this philosophy. Nurturing the diverse human resources that represent the future of the marine industry requires the provision of a systematic marine education package, from the primary and secondary level to higher and recurrent education, while establishing career paths for them. It also requires the perspective of the "marinization" of human resources through marine education that facilitates connections with different fields.

The world is now seeing a wave of ESG investment—a movement where companies select investment destinations from the perspectives of the environment (E), society (S),



Images of Plug and Play FLOAT (top), a coastal city, and Integrated Ecofriendly FLOAT (bottom), an offshore floating city.

and governance (G). There is also an increased emphasis on solving global environmental problems and social issues such as food and population problems. Along with this emphasis, the launch of the United Nations Decade of Ocean Science for Sustainable Development in 2021, which aims to use ocean science to help solve these problems, is consistent with the realization of ocean terroirs, and may also act as a tailwind for this concept.

This proposal's mission does not end up with its publication—it must be used as a springboard for even broader discussions. We must respond flexibly to future societal changes while preserving the concept of the ocean terroirs.



1) Ken Takai: "Towards a "Revolution in Marine Microorganisms," Originating in Japan," Issue 354 of Ocean Newsletter (May 5, 2015)

# Liquefied Hydrogen Carrier Paving the Way to a Decarbonized Society

[KEYWORDS] CO<sub>2</sub>-free Hydrogen Supply Chain / Marine Transportation / Commercialization

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(Ocean Newsletter No.505, 20 August 2021)

Momentum is rising in Japan and abroad towards hydrogen energy as a trump card for achieving a decarbonized society. In order to further society's adoption of hydrogen energy, Kawasaki Heavy Industries is aiming to commercialize the international CO<sub>2</sub>-free hydrogen supply chain, for which it is now launching its pilot demonstration. The results of this demonstration, which involves the long-distance marine transport of liquefied hydrogen using the world's first liquefied hydrogen carrier, will be the cornerstone of the future of decarbonized society and hydrogen provision.

## Moves Toward Decarbonization and Use of Hydrogen

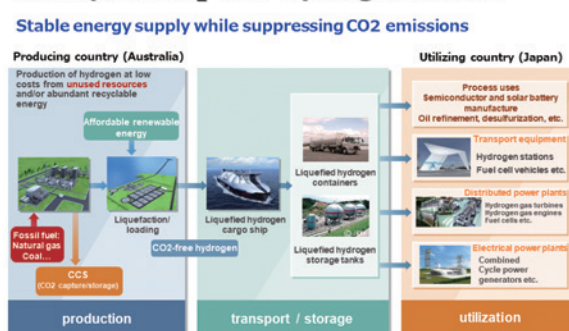
In recent years, Japan and other countries worldwide have been experiencing frequent extreme weather events and disasters. These phenomena are believed to be caused by global warming. Therefore, reducing greenhouse gas, which are thought to cause global warming, have become a pressing societal issue for all mankind. The Paris Agreement, an international framework for combating global warming, came into effect in November 2016. As a result, France, the United Kingdom, and other countries have legislated net zero emissions by 2050. By comparison, Japan has set a greenhouse gas reduction target for FY2030 of 46% below FY2013 level, intending to become carbon neutral by 2050. Clearly, this goal cannot be achieved by energy conservation alone, and promoting the introduction of renewable energy (RE) is essential. However, since Japan is already one of the world's top countries for RE installation density (annual RE power generation divided by inhabitable area), there are issues surrounding locations for further installation and cost reduction. Additionally, Japan has one of the highest energy consumption densities in the world. Given these facts, there are significant constraints in supplying the large amounts of energy required by introduction of large-scale RE and its expansion in such a limited land area.

Against this background, there is a need for a new type of zero-emission energy. This energy must be able to be introduced at scale at low cost, helping realize a carbon-free society while satisfying the future energy selection criteria of Energy Security, Economic Efficiency, and Environment in a Safe manner (3E+S). This situation has brought attention to the concept of producing hydrogen overseas from inexpensive unused resources and RE for importation into Japan.

## Development of a CO<sub>2</sub>-free Hydrogen Supply Chain

Realizing a hydrogen society—where hydrogen is commonly used as energy in the same way as oil and natural gas—requires a stable hydrogen supply. However, it is

## Concept of CO<sub>2</sub>-free Hydrogen Chains



difficult to produce large amounts of hydrogen stably and economically in Japan, where resources are scarce and land area is limited. Being an island nation, it is also impractical to import hydrogen through gas pipelines. Thus, one promising option is the importation of hydrogen produced overseas using marine transportation. Given these circumstances, in 2010 our company announced a CO<sub>2</sub>-free hydrogen supply chain concept in which hydrogen is produced by the gasification of lignite coal, an unused resource from the Latrobe Valley in Victoria, Australia, refined and liquefied. The liquefied hydrogen is transported to Japan by sea on a dedicated carrier (see figure).

This concept aims to realize the production and transportation of CO<sub>2</sub>-free hydrogen with sequestering CO<sub>2</sub> produced during the hydrogen production process from the lignite coal into geological formations through CCS (CO<sub>2</sub> capture and storage), thereby realizing a hydrogen and decarbonized society. To realize this concept, a pilot demonstration project (project) was launched in fiscal 2015 using a liquefied hydrogen carrier with a transport capacity of about 1/120 of the commercial scale. The carrier was built with support from the New Energy and Industrial Technology Development Organization (NEDO), a national research and development agency. To proceed with the demonstration, the CO<sub>2</sub>-free Hydrogen Energy Supply-chain Technology Research Association "HySTRA"<sup>(1)</sup> was formed in February 2016 with Iwatani Corporation,

Shell Japan Ltd., and Electric Power Development Co., Ltd. (Marubeni Corporation, ENEOS Corporation, and Kawasaki Kisen Kaisha, Ltd. have since joined).

The project aims to establish and demonstrate technologies for gasification of lignite coal, as well as the long-distance mass marine transportation of liquefied hydrogen and its cargo handling system (loading/unloading) between cargo tanks on ships and tanks on land which require a high level of technological development. Among these technologies, the world's first liquefied hydrogen carrier will connect Australia and Japan as a form of long-distance mass marine transport. In December 2019, a naming and launching ceremony was held at our Kobe Works, with 4,000 people in attendance, for the vessel named "Suiso Frontier." This name is based on the hope that we will be able to pioneer a hydrogen society, set sail to new frontiers (new worlds and cutting-edge technologies), and make the Japanese word for hydrogen – *suiso* - known to people around the world.

### The world's first liquefied hydrogen carrier "Suiso Frontier"

The International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (commonly known as the IGC Code), adopted by the International Maritime Organization (IMO), covers LPG and LNG, but not liquefied hydrogen. In response, the maritime authorities of Japan and Australia started discussions on safety requirements for the operation of bulk liquefied hydrogen carriers (such as the pilot ship) in 2014. In November 2016, the IMO adopted the interim recommendations for carriage of liquefied hydrogen in bulk jointly proposed by these two countries. At present, the ship designed and built applying this interim recommendation is the Suiso Frontier only. It is hoped the vessel will contribute to future revisions of international regulations through international operations of bulk liquefied hydrogen transportation.

The Suiso Frontier is 116.0 meters long, 19.0 meters wide (molded width), 10.6 meters deep (molded depth), has a carrying capacity of 25 people and is equipped with one cargo tank. The tank requires extremely high insulation performance to store the liquefied hydrogen at minus 253 degrees Celsius and a rational design that is sufficiently robust to withstand rough seas and yet easy to maintain. For this reason, the tank uses a vacuum-insulated double-shell structure and glass-fiber reinforced plastic for the components supporting the inner tank. These choices make it resistant to heat transfer and provide excellent strength. The

tank has a capacity of 1,250 m<sup>3</sup> and is capable of transporting 75 tons of liquefied hydrogen. When developing and designing the vessel, we utilized LNG carrier technologies and onshore liquefied hydrogen transportation and storage technologies that our group had built up over many years, thus demonstrating the synergy to be found among the Kawasaki Group.

Sea trial operations were completed in October 2020, and final equipment adjustments and preparations for delivery are currently underway. The vessel will be handed over to HySTRA, the primary implementer of the demonstration project. It will then be used to demonstrate handling liquefied hydrogen as cargo at the Kobe LH2 Terminal on Kobe Airport Island. In the second half of FY 2021, the vessel will be loaded with liquefied hydrogen and make a 9,000-km round-trip voyage between Kobe and the Port of Hastings in Australia.



Liquefied hydrogen carrier "Suiso Frontier"

### Toward Full-Scale Commercialization

In addition to the pilot demonstration, we have also been working on developing large scale equipment for the supply chain. For example, in April 2021, our company developed a cargo containment system (CCS) offering the world's largest capacity (40,000 m<sup>3</sup> class per tank), for installation on a large-scale liquefied hydrogen carrier and obtained the Approval in Principle (AiP) from Nippon Kaiji Kyokai (ClassNK). We are currently developing a 160,000m<sup>3</sup> liquefied hydrogen carrier equipped with four of these CCS tanks, with the aim of starting demonstration operation in mid-2020s. Liquefied hydrogen carriers are essential for Japan, a nation surrounded by the ocean, to achieve both energy security and decarbonization. We hope to build a supply chain that can supply hydrogen from overseas at low cost and in a stable manner, while leading the world in working towards its practical application. ■

1) CO<sub>2</sub>-free Hydrogen Energy Supply-chain Technology Research Association (HySTRA) <http://www.hystra.or.jp/>

# A New Approach for a Fertile Seto Inland Sea

[KEYWORDS] wastewater regulation / biological productivity / nutrient management

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(Ocean Newsletter No.506, 5 September 2021)

**Improvements are being made to the water quality of the Seto Inland Sea, once called the “Dying Sea,” through a variety of water quality conservation measures such as wastewater regulations. However, as new issues such as declining fish catches and frequent occurrences of color-fading in nori (dried seaweed) have come to the forefront, special measures have been approved for the management of nutrients to ensure the diversity and productivity of estuarine ecosystems. It can be said that this large shift in the water environment administration is completely different from wastewater regulations to date, namely, the simple reduction of pollutants such as nutrients.**

## Improvements to Water Quality in the Seto Inland Sea

The Seto Inland Sea became increasingly polluted during Japan's period of rapid economic growth, at one point deteriorating to the point that it became known as a "dying sea." Measures to combat this situation included effluent regulations and total loading reductions under the Water Pollution Control Law and the Law concerning Special Measures for Conservation of the Environment of the Seto Inland Sea<sup>1)</sup> (hereinafter referred to as the Seto Law), which resulted in improvements to the quality of the water. However, in recent years, new issues have come to light, such as declining fish catches and frequent color fading in *nori* (dried seaweed). This article will introduce the history of the various efforts to restore the Seto Inland Sea and the new system enacted this year, which aims to create a more fertile sea through a focus on nutrient management.

## Water Quality Targets for Environmental Conservation and Their Achievement

When conserving and restoring any environment, it is essential to define the desired state of the environment, i.e., the goals being aimed for. For example, the first Seto Law aimed to conserve water quality and natural landscape in response to rapidly worsening water pollution in the Seto Inland Sea between 1965 and 1974. The first measure to improve water quality involved using chemical oxygen demand (COD) as a parameter for environmental water quality standards (EWQS) to prevent organic pollution<sup>2)</sup>. To achieve these standards or targets, various effluent regulations based around COD have been implemented. However, it became clear that COD alone was not enough to prevent eutrophication like the outbreaks of red tide. Therefore, nutrients (total nitrogen and total phosphorus), which are the limiting factors of eutrophication, were added to EWQS, and their effluent has also been regulated.

So, what happened to the water quality as a result? According to the Results of the FY 2019 Water Quality Survey of Public Water Areas, the compliance rate for EWQS in COD in the Seto Inland Sea excluding Osaka Bay

— as well as Osaka Bay itself — were still low at 77% and 66.7%, respectively. However, the EWQS compliance rates for total nitrogen and total phosphorus were extremely high at 98% and 100%, respectively. Compared to the compliance rates of 0% and 60% for total nitrogen and total phosphorus, respectively, when the standards were introduced (1995-1996), these results indicate that effluent control and other measures have been successful.

## From Conserving Water Quality to Restoring the Seto Inland Sea

Despite EWQS having been largely achieved, biological productivity is stagnant, as revealed through declines in fish catches and frequent color fading in *nori*. There is a growing awareness that water quality conservation alone will not restore the once bountiful Seto Inland Sea.

Alongside the previous notion of focusing on water quality conservation, the 2015 revision to the Seto Law also includes the concept of "making the sea rich in biodiversity and productivity, and maximizing its diverse values and functions." It additionally mentions that measures for environmental conservation in the Sea "shall be implemented in accordance with the respective conditions of bays and other open sea areas." The two previous goals of conserving water quality and natural landscape were replaced by four new goals: "conservation, restoration and creation of the coastal environment," "conservation and management of water quality," "conservation of natural and cultural landscape," and "ensuring sustainable use of fishery resources." In particular, the revision clarifies conservation, regeneration, and creation of the coastal environment, including the conservation of submerged aquatic vegetation (SAV) and tidal flats, as new goals for restoring a bountiful Seto Inland Sea. At the same time, the perspective of managing water quality in accordance with regional and seasonal characteristics was also added. Additionally, a new major goal was set to ensure the sustainable use of fishery resources by promoting the growth of aquatic plants and animals while considering the perspective of biodiversity and harmony

with the environment.

Since these changes were made, it was pointed out that the impact on fishery resources due to nutrient deficiencies such as nitrogen and phosphorus, which were reduced through past efforts, and the decrease in SAV and tidal flats due to development, may worsen further. This situation has also been coupled with environmental changes such as the increase in water temperatures due to climate change. Furthermore, there has been increasing concern about the adverse effects of marine debris, including plastic litter, on the marine environment and its ecosystems.

In response, a further amendment to the Seto Law was enacted on June 3, 2021<sup>3)</sup>. The change adds a new objective: conserving the environment of the Seto Inland Sea by adding special measures for nutrient management in order to ensure biological diversity and productivity. Additionally, the law's basic principles now include the notion that the environmental conservation of the Sea must account for increases in water temperature and other environmental impacts due to climate change, and that these impacts may continue for a long time.

In particular, under the new nutrient management system, new special provisions have been established to allow for appropriate increases in nutrients in specific sea areas, such as through the direct release of nutrients and changes in wastewater treatment processes. Although the law makes it mandatory to ensure harmony and compatibility between nutrient management and conserving the surrounding environment, this change is a significant shift in the water environmental administration that is entirely unlike the previous regulations, which were based around one-way reductions.

However, the change manages nutrients essential for plant growth; excessive nutrients can lead to eutrophication problems such as red tides, while deficient nutrients can lead to reduced biological productivity. It can be said this regulation is unique in controlling substances that can have both positive and negative effects.

In the initial Law concerning Special Measures for Conservation of the Environment of the Seto Inland Sea, the entire Sea was treated as a single body of water. However, as water quality recovered, the Seto Inland Sea and Osaka Bay began to be treated as separate sea areas. In the previous revision in 2015, the Seto Inland Sea was managed according to the respective conditions of bay, and other open sea areas to achieve a more bountiful marine environment. In the 2021 revision, it can be said that the sea areas under the management were more precisely defined.



Areas covered by the Law concerning Special Measures for Conservation of the Environment of the Seto Inland Sea (Source: Ministry of Land, Infrastructure, Transport and Tourism)

### Aiming for a Newly Restored Seto Inland Sea

In this way, instead of managing the Seto Inland Sea as a homogeneous area, it has become possible to manage bays and even some specific areas of the Sea independently with targets that differ from those of the surrounding areas, enabling the restoration of the highly diverse Seto Inland Sea. To achieve this, biodiversity and biological productivity targets will need to be set for each marine area, and management methods will have to be extremely diverse.

However, each area of the Seto Inland Sea, its bays and specific marine areas are also interconnected. Therefore, target setting and nutrient management in one area should be consistent with other areas and the Sea as a whole. As the unique role of each area become even more critical, ensuring consistency in how the Seto Inland Sea as a whole is managed without conflicts will pose a significant challenge in the future.

It should be noted that nutrient management is only one aspect of ensuring biological productivity and diversity. There is no guarantee that nutrient management alone will achieve these goals. We must not forget that the conservation, restoration, and creation of SAV and tidal flats, as well as improvements to bottom sediment quality, must be implemented simultaneously. ■

1) When first enacted in 1973, it was called the Law Concerning Temporary Measures for Conservation of the Environment of the Seto Inland Sea, and followed in 1978 by the present act.

2) The amount of oxygen required to oxidize organic matter in water chemically. Acts as a metric for organic pollution in ocean regions. The higher the value, the more organic matter is in the water and the greater the degree of pollution.

3) An overview of the draft law to partially revise the Law concerning Special Measures for Conservation of the Environment of the Seto Inland Sea: <https://www.env.go.jp/press/109207.html>

# The Growth of Coast Guard Agencies Worldwide and the Current Situation on Their Cooperation

[KEYWORDS] Coast Guard / Rule of Law / Coast Guard Global Summit

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(Ocean Newsletter No.507, 20 September 2021)

In recent years, there has been an expansion and universalization of Coast Guard agencies against the background of expanding sea areas under the jurisdiction of coastal states and various changes occurring in the marine environment. The circumstances leading to each Coast Guard agency's establishment and organizational structure are diverse, but standardization can also be seen, for example, in the naming of agencies. As border-straddling threats and fears of large-scale disasters at sea increase, a new level of cooperation and coordination among Coast Guard agencies is hoped for.

### Background to the Expansion of Coast Guard Agencies

The oceans are not only a border for coastal countries; they are also a transportation route for the majority of international logistics, a treasure trove of marine resources such as fish, energy, and minerals, and a place for various activities, including leisure activities. Therefore, ensuring maritime safety and security and preserving marine environments is fundamental to the peace, stability, and development of coastal countries, regions and the international community. In the past, these duties were often performed by various pre-existing agencies in each country, such as navies, border guard agencies, and police agencies. However, there has been a rapid increase in the number of countries that have established coast guard agencies in recent years. These agencies carry out maritime operations such as maritime safety/security and environmental protection in either a comprehensive manner or a dedicated manner in specific areas. It has also become more common that these operations are referred to as coast guard functions.

The following factors may have led coast guard agencies to expand and become more universal in recent years:

- The expansion of coastal states' jurisdiction over a wider area of the sea under the United Nations Convention on the Law of the Sea.
- An increase in maritime activities due to the expansion of economic activities and globalization.
- Expansions in maritime safety and security issues such as maritime terrorism, piracy, and large-scale accidents.
- Frequent disputes and conflicts among nations over maritime domains and interests.

In fact, the establishment of coast guard agencies has become more noticeable since the 1970s when considerations surrounding the United Nations Convention on the Law of the Sea commenced. This trend towards establishing coast guards has accelerated since the 2000s when the maritime safety and security situation changed significantly. These changes included terrorist attacks in the United States, increased maritime crimes such as piracy, drug

smuggling, and poaching, a rapid increase in the number of refugees at sea, and the occurrence of large-scale disasters at sea. Continuing this trend, since 2010, new or reorganized coast guard agencies have been established in the Union of Comoros, Djibouti, Sri Lanka, China, Indonesia, Kenya, and other countries. Existing coast guard agencies are also being strengthened in their respective countries. In 2016, the European Union (EU), which is facing migration and refugee issues, strengthened and expanded the authority of the European Agency for the Management of Operational Cooperation at the External Borders of the Member States of the European Union (FRONTEX), reorganizing it into the European Border and Coast Guard Agency. In January 2021, the European Border and Coast Guard standing corps was established as the EU's first operational force.



Group photo of the Second Coast Guard Global Summit

### Diversity and Standardization of Coast Guard Agencies

Compared to navies, the history of coast guard systems is relatively short, and their development and organizational forms vary from country to country. In November 2019, the Japan Coast Guard and the Nippon Foundation co-hosted the second Coast Guard Global Summit (CGGS) in Tokyo. The event was attended by 84 organizations from 75 countries with coast guard duties. Alongside independent organizations dedicated to coast guard duties, there were various



## The Growth of Coast Guard Agencies Worldwide and the Current Situation on Their Cooperation



Top row, from left: Argentine Coast Guard, Djibouti Coast Guard (Source: JICA's ODA Visualization Website), Indian Coast Guard, Italian Coast Guard, U.S. Coast Guard, Japan Coast Guard

types of organizations, including military, border guard, security, and police agencies that are either dedicated to coast guard duties, have agencies under their umbrella dedicated to coast guard duties or are agencies that coordinate the coast guard duties of domestic agencies (see references below). Some coast guard agencies that fall under military organizations have military functions as well.

The way these agencies were formed is as diverse as their organizational structures. Some were newly established coast guard agencies; others were existing organizations reorganized into coast guard agencies, while others were part of pre-existing organizations for which dedicated coast guard duties were assigned. Yet others were coordinating agencies, which were reorganized into actual coast guard agencies. Globally, it appears as though coast guard systems are still changing.

However, standardization of names and hull markings for coast guard agencies is progressing. Increasingly, agencies dedicated to coast guard operations, whether independent or under the umbrella of another major agency, are using the English title of "Coast Guard" to refer to themselves. Additionally, many vessels owned by coast guard agencies of various countries have diagonal paint (racing stripes) on the front of their hulls. These external standards are not prescribed by international regulations but have naturally taken root as coast guard agencies become universalized. In addition to external standards, there has been a gradual standardization of maritime law enforcement methods such as warning and stopping measures.

### Cooperation among Coast Guard Agencies and Future Challenges

As a result of these expansions, cooperation amongst agencies has been developing at a regional level. Japan has been leading the way in multilateral cooperation among coast guard agencies. The Japan Coast Guard and the Nippon Foundation have cooperated to hold the North Pacific

Coast Guard Forum (NPCGF) since 2000, the Head of Asia Coast Guard Forum (HACGAM) since 2004 (successor to the Regional Conference on Combating Piracy and Armed Robbery against Ships held in 2000), and the Coast Guard Global Summit\* since 2017. In response, multilateral meetings by coast guard agencies are now being held in various regions, such as the "Black Sea Littoral States Border/Coast Guard Agencies Cooperation Forum (BSCF)," the "North Atlantic Coast Guard Forum (NACGF)," the "European Coast Guard Functions Forum (ECGFF)," the "Mediterranean Coast Guard Functions Forum (MCGFF)," and the "Arctic Coast Guard Forum (ACGF)." There has been an increase in various transnational threats at sea, such as the expansion of international organized crime, piracy, terrorism, and other crimes, influxes of refugees, and illegal fishing operations, as well as the recent increase in maritime activities and concerns about large-scale disasters at sea due to environmental changes such as climate change. Thus, it is becoming increasingly important to strengthen cooperation and dialogue among the world's coast guard agencies, transcending regional frameworks to address these worldwide challenges. Coordination and cooperation among coast guard agencies that conduct maritime law enforcement activities under national and international laws, not only in territorial waters but also on the high seas, will act as a foundation for regional and global peace and stability based on the rule of law at sea. Having said that, cooperation among coast guard agencies has just started and is still a new concept. Many issues need to be addressed in the future, such as methods of information sharing, capacity-building support for newly established coast guard agencies, and human resource development for coast guard operations. While addressing these issues, it is hoped that coordination and cooperation among coast guard agencies will be further developed at both the regional level and a worldwide level through the Coast Guard Global Summit. ■

\* See "Hosting of the Coast Guard Global Summit (CGGS)—Towards the Maintenance of International Maritime Order—" by Kentaro Furuya, in issue No. 416. [https://www.spf.org/opri/newsletter/416\\_2.html](https://www.spf.org/opri/newsletter/416_2.html)

Reference: "Research on the Current State of the Coast Guard Agencies of the World," Japan Coast Guard Foundation (March 2021), URL: <https://www.jcga.or.jp/pdf/wcgr.pdf>

# Aiming for a New Form of Medical Care for Remote Islands

[KEYWORDS] Kamishima / remote island medical care / telemedicine

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(Ocean Newsletter No.508, 5 October 2021)

As population decline and population aging continues, the medical care issue of remote islands, where there is an increasing difficulty of permanently placing doctors, is shifting from a problem of “assigning doctors” to “methods of delivering medical care”. In Toba City, Mie Prefecture, medical care on Toba’s remote islands is being conducted virtually thanks to the introduction of a platform which supports remote medical services, a development I consider highly useful. As there are unforeseen situations such as the spread of infectious diseases, I hope that new styles of remote medical care will continue to be provided, allowing residents of remote islands to lead long lives in peace and comfort.

### Working as Kamishima's Doctor

"Currently, I have come to an isolated island called Kamishima located at the mouth of Ise Bay. It has a population of 1,200 to 1,300 and around 200 houses. It does not have any trappings of modern society like movie theaters, pachinko parlors, drinking establishments, or coffee shops. Even a person like myself has become immediately purified and started to get up at 6:30 every morning. There seems to be a real human life on this island."

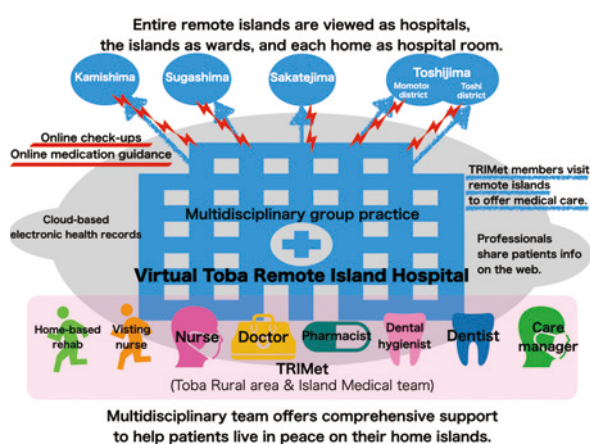
The above is an excerpt from a letter written by Yukio Mishima to Yasunari Kawabata while staying on the island to write his novel, *The Sound of Waves*. Even today, Kamishima is a place where "real human life," as Mishima put it, lives on. I was so captivated by this island that even after leaving once, I came back to work again. I have now been Kamishima's doctor for a total of 11 years. Kamishima is a small island with a circumference of only about 4 km. It takes about 30 minutes to get there from Toba City in Mie Prefecture, and there are four regular boat services a day. The current population is less than 300, of whom 48.0% are elderly, with almost half of the population being older than 65. There is almost no flat land on Kamishima; it is full of stairs and slopes, making it difficult for the elderly to live there. Nevertheless, the local people enjoy their daily lives. The richness of their lives more than makes up for any inconveniences, something which sparked great envy in me. Since I was assigned to Kamishima, I have provided end-of-life care for several people. Seeing the process in which the islanders watch over the dying gave me an experience I never had before: seeing the warmth of death. It significantly changed my view of life and death as well as my awareness of my work. It was truly beautiful to see. As there are no nursing homes for the elderly on Kamishima, they have to leave the island if it becomes difficult for them to live there. Being born there, being raised there, growing old there, and dying there. Now that realizing this expectation is becoming harder, I think it is my job as Kamishima's doctor to do my best to meet the wishes of those who want to spend their final days surrounded by fellow residents and

to make sure that they can live in this beautiful place for as long as possible.

### Telemedicine and Implementing a Group Practice

However, the island's population continues to decline, and excess expenditure due to declining patient numbers cannot be ignored. The same is true for the other remote islands of Toba City. Toba City has four inhabited islands: Toshijima, Sugashima, Kamishima, and Sakatejima. Unfortunately, the population of these outlying islands has decreased by 27% in the past ten years. Furthermore, though there is a system in place to assign one doctor to a clinic on each island, we are just barely able to secure enough doctors through assigning graduates from Jichi Medical University and public recruitment. Therefore, it will likely be challenging to maintain the current medical system, as it will take time to recruit new doctors when vacancies occur. To address the issues of (1) a declining and aging population, (2) a decrease in patients and an increase in excess expenditure at clinics, and (3) difficulties in securing doctors for clinics, we have been considering a system that provides efficient clinic management while maintaining necessary healthcare services. First, after considering geographical conditions, we aimed to shift to a group practice (medical care services provided in coordination with multiple doctors) in which a small number of doctors are in charge of multiple clinics. However, having one doctor in charge of multiple islands means that the medical clinics are not always staffed. In addition, doctors may not be able to come to the remote islands due to unforeseen circumstances such as bad weather or infectious disease outbreaks, in which case residents cannot receive medical care and prescriptions as scheduled.

Given the situation, we thought that by introducing cloud-based electronic medical records and remote medical care as complementary technologies to address the issue, doctors could treat patients from anywhere and alleviate their concerns. Furthermore, in accordance with the revised



How the TRIMet Virtual Toba Remote Island Hospital Works



Online medical care in the absence of a doctor on a remote island

guidelines for online medical care, if telemedicine is conducted while nurses offer assistance to patients in person (D to P with N), then doctors will be able to order tests and prescriptions, enabling them to provide more appropriate medical care.

We also envisioned that our medical care team, TRIMet (Toba Rural area & Island Medical team), would work in coordination on the basis of treating local residents' homes as hospital rooms, each island as a hospital ward, and all the remote islands of Toba as a hospital (Virtual Toba Remote Island Hospital). By building a relationship among multiple professions, as if we were working in one hospital, we believed that we could effectively utilize limited human medical resources to provide medical care, nursing care, health issue prevention, and lifestyle support in an integrated manner. Through combining group practice and multi-professional cooperation, we aimed to establish a unique, comprehensive regional care system that is able to respond to medical personnel shortages and the declining population flexibly, while also realizing sustainable remote island medical care that could provide islanders with a safe and secure life on their home islands.

In 2020, the TRIMet Virtual Toba Remote Island Hospital Demonstration Project was adopted as part of the Ministry of Land, Infrastructure, Transport and Tourism's Smart Island Promotion Demonstration Study. As part of the project, we introduced OWEL, a cloud-based electronic medical record system and telemedicine support platform from Secom Medical System Co., Ltd. The introduction of OWEL allows for integrated management of patient infor-

mation. PCs (electronic medical record terminals) have been installed in seven clinics, including on the mainland, and tablets have been provided for each doctor, enabling patient information to be immediately confirmed and updated even outside clinics.

We have introduced Secom Vitalook as the telemedicine support platform. For example, connecting a blood pressure monitor or other devices to a dedicated tablet terminal enables remote medical treatment through transmitting the patient's vital information (pulse, blood pressure, respiration, body temperature, etc.) to the doctor in real-time, even if a patient is visiting the clinic when the doctor is absent or when a nurse is visiting a patient's home. Through this service, we can now provide almost the same level of medical care remotely even when doctors are not available in person, such as due to bad weather conditions. We no longer run out of regular medications, can respond to patients who have unusual symptoms, and can understand the patient's condition quite precisely even in the event of an emergency. I feel that this significantly reduces anxiety for both doctors and patients.

### A New Form of Medical Care for Remote Islands

Populations will continue to decrease, but as long as people live on these islands, we need to provide ongoing medical care. Patients may be sparse, but the scope of medical care must remain the same. As populations decline, the medical care issue of remote islands, where there is an increasing difficulty of permanently placing doctors, is shifting from a problem of "assigning doctors" to "methods of delivering medical care". More priority should be placed on remote island medical care so that it can receive the benefits of new technologies. We would be grateful if companies with new technologies and ideas could take even a slight interest in the realities we face when providing medical care to remote islands, and work together to address these issues going forward.

In the future, we hope to further develop online medical treatments and medication guidance, home delivery of medications, drones to transport supplies and people, and the use of remote or autonomous ships to transport doctors and patients. My goal is to provide a new form of remote island medical care that combines new technologies with the warmth of these remote islands so that people can live long lives in peace and comfort in familiar environments. I also want the people of these islands to continue to live wonderful lives surrounded by the rich culture and human relationships that exist there, without feeling anxious just because they live on a remote island. ■