– Selections –

White Paper on the Oceans and Ocean Policy in Japan

2019

Ocean Policy Research Institute,
Sasakawa Peace Foundation

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2019 White Paper on the Oceans and Ocean Policy in Japan
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Ocean Policy Research Institute of the Sasakawa Peace Foundation
1-15-16, Toranomon, Minato-ku, Tokyo,
105-8524 Japan
TEL 03-5157-5210 FAX 03-5157-5230
http://www.spf.org/en/

FOREWORD

The Ocean Policy Research Institute of the Sasakawa Peace Foundation publishes its *White Paper on the Oceans and Ocean Policy* every year in an effort to support comprehensive and interdisciplinary initiatives on Japan's ocean issues.

In the inaugural issue published 15 years ago, in January 2004, we recognized the fact that human activity was having a measurable impact on the marine environment and ocean resources, threatening our own existence. We identified sustainable development and comprehensive ocean management as serious and important policy challenges of the 21st Century. The issues identified at that time are still ongoing and accelerating. Global warming is causing problems such as melting of sea ice in the Arctic region, extreme weather events, and coral bleaching on a global scale. Depletion of fishery resources and the effect of sea level rise on island nations are also of great concern. With the newly emerging issues of ocean acidification and microplastics, now is the time to address these challenges.

The *White Paper* has evolved together with Japan's ocean policy. In the early days of the *White Paper* we called for establishment of a national ocean policy. Since the Basic Act on Ocean Policy was enacted and the framework of ocean policy was established in 2007, we have been a supporter and proponent of Japan's ocean policy. As a proponent of ocean policy, we advocated measures to address ever-increasing ocean problems through informing the Japanese government about international development, and showcasing international initiatives such as the SDGs and the Paris Agreement from the perspective of ocean policy. Last year, the Third Basic Plan on Ocean Policy was formulated by the Japanese government and we published the first English edition of the *White Paper*, "Selections : White Paper on the Oceans and Ocean Policy in Japan 2018." We are looking forward to becoming a two-way communication bridge to disseminate information on Japan's prominent initiatives to the international community and to contributing to the promotion of international ocean policy through publishing English editions.

In light of these new developments, we have redesigned the book's cover. We also introduced an opening feature article for the first time. The feature article, entitled "Why is plastic an ocean issue?" presents the history of marine plastic stretching back to the 1930s and outlines discussions and initiatives at home and abroad. The issue will be addressed at the G20 to be held in Osaka in June 2019, where Japan is expected to assert leadership to solve the issue.

In March 2019 a summit of the national academies of the G20 countries (S20) was held in Tokyo in advance of the G20 and a joint statement covering such themes as conservation of the marine environment with special attention to marine plastic debris was delivered personally to Prime Minister Shinzo Abe. There remain many issues such as ocean plastics that are not fully understood scientifically, and initiatives on science and technology aspects are essential. Therefore, Chapter 1 focuses on science and technology in light of the UN Decade of Ocean Science, which will start in 2021. In this chapter the latest marine science and technology are covered, including innovations such as ocean observation using data obtained via satellites.

Chapter 2, "Conservation of the Ocean Environment" outlines Japan's initiatives for conservation of the ocean environment in light of the formulation of the Third Basic Plan. It also includes extensive discussion on the Blue Economy that has recently

come under the world's spotlight. Chapter 3, "New Ocean Industries," discusses the drastic reform of Japan's 70 year-old fishery management regulations. These chapters focus on recent domestic and international developments in 2018.

The 2019 *White Paper* features column articles and easy-to-understand graphic illustrations of ocean monitoring as visual aids. Section 2 follows developments in ocean policies in Japan and the world over the last year and Section 3 contains reference materials and data on the developments and activities discussed in the previous sections.

For our children and our children's children to enjoy the benefits of the diversity and richness of the oceans, the common heritage of mankind, it requires cross-sector efforts, participation, and coordination by various stakeholders, including not just national and local governments and international agencies, but also all people in civil society, the business/private sector and scientists/academia. Nothing would please us more than to know that the *White Paper* is helping to raise awareness of the oceans as well as providing the latest information, knowledge, and ideas to those who cherish, think about, and work with the oceans.

June 2019

Atsushi Sunami

President, Ocean Policy Research Institute of the Sasakawa Peace Foundation

Why is plastic an ocean issue?

Why is plastic an ocean issue ?

If you look it up in dictionaries, it says trash is anything worthless, useless or discarded. The moment we consider it worthless, it becomes trash. Then what do we trash? One of the answers is the oceans. Eighty percent of marine debris originates from on land where we live.

Plastic was invented as an "inexpensive, light-weight and durable" material. Housewares traditionally made of wood, bamboo, cotton, silk, mineral and seashells were replaced with plastics. Plastics hardly ever decompose in nature. Against a backdrop of world population explosion and the economic growth of developing countries, global production of plastics has dramatically increased. They have ultimately found their way into the oceans as trash, causing various problems. On the other hand, heralded as the greatest invention of the 20th century, plastic has pervaded every aspect of human life and contributed a great deal to society after World War II. It is our responsibility to find ways to live with this material in the 21st century.

This article provides an overview of awareness about this issue over the past several decades. Recent discussions and efforts that focus on plastics as marine debris in the global community and in Japan are also highlighted.

1 The Origin of the Marine Debris Issue

The history of plastic dates back to 1910 when American chemist Leo Baekeland commercialized Bakelite, a phenolic resin synthesized from components other than plant material. Numerous plastic materials have since been developed, one after another.

The first known case of modern marine debris was reported in the 1930s[1]. At that time, incidents of injured marine mammals entangled in artificial materials were discovered.

(1) Marine Debris in Early Days

In the early 1940s, several fur seals were observed with rubber bands of unknown origin caught around their necks in Alaska. While officers of

[1] Marine debris and northern fur seals : A case study, Charles W.Fowler, Marine Pollution Bulletin, Volume 18, Issue 6, Supplement. B, June 1987, Pages 326-335.

the US Fish and Wildlife Service suspected them to be tracking tags attached to the animals by either Japanese or Russian biologists, the origin of the rubber bands remained unclear, but it continued to be a matter of debate. Later, after examination by a U.S. military expert, it was concluded that they were probably broken pieces separated from the numerous parachutes dropped from the air above the Aleutian Islands by the Japanese military to replenish supplies.

In the 1950s, highly durable fishing nets and gear made of synthetic fiber were introduced and they replaced those made of cotton and hemp on a large scale. As a result, in the 1960s, reports of incidents of animal entanglement in derelict fishing nets started to increase. It was also reported that plastic pieces were found in the stomachs of Laysan albatrosses living on remote uninhabited islands and Longnose lancet fishes living in the deep-sea. Reflecting the change in materials, technologies

and lifestyles, the problem of marine debris had become more and more visible.

⑵ Burgeoning Awareness of Marine Debris

In the 1980s, rapidly growing concern over ever-increasing marine plastic trash among scientists, fishermen and environmental protectionists led to efforts to share awareness and address the issue. In 1984, the US National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service Southwest Fisheries Center Honolulu Laboratory organized a workshop to address the scientific and technical aspects of marine debris and its impact on marine resources and held the world's first international workshop, the Fate and Impact of Marine Debris (FIMD) Workshop in Honolulu, Hawaii. Four U.S. universities receiving grants under NOAA's Sea Grant College Programs contributed funds for the workshop. Participants included officials of the governments of Japan, the Republic of Korea, and Taiwan, as well as scientists and representatives of several conservation groups and others from many countries. A recommendation was made for the Pacific-rim countries to ratify MARPOL[2] and implement the Annex V protocol (regulation for the prevention of pollution by garbage from ships), which added momentum to the marine debris discussion at the International Maritime Organization (IMO). Moreover, NOAA secured funding from Congress for its Marine Debris Program set to be launched in 1985.

[2] The International Convention for the Prevention of Pollution from Ships, which was adopted at International Maritime Organization (IMO) in 1973

Figure 1 The illustration of entanglement of marine life in the proceedings of the 1st International Workshop(FIMD)

Discussions and efforts during the three international workshops subsequently held by 2000 greatly contributed to the enactment of the United States Marine Debris Research, Prevention and Reduction Act in 2006. Under the Act, NOAA established the International Marine Debris Coordinating Committee, which laid out the framework for the federal government to take a coordinated and structured approach.

The workshop was renamed the International Marine Debris Conference (IMDC) from the second gathering and laid the groundwork

Table 1 Summary of International Marine Debris Conference (IMDC)

		Host City	Major topics	Organizer/sponsor
1.	Jan 1984	Honolulu, Hawaii, USA	· Debris entanglement of marine life and birds. · Volume of fishing nets and plastic debris · Derelict fishing gear	(organizer) NOAA
2.	Apr 1989	Honolulu, Hawaii, USA	· Ingestion by marine life · Amount of fishing nets and plastic trash · Derelict fishing gear · Economic loss, solution by technologies, policy and education	(organizer) NOAA
3.	May 1994	Miami, Florida, USA	· Ocean garbage from ships and leisure activities · Ocean garbage originated in cities and agricultural and fishing communities.	(organizer) NOAA
4.	August 2000	Honolulu, Hawaii, USA	· Problems caused by derelict fishing gear and control measures	(sponsor) NOAA National Marine Sanctuaries
5.	March 2011	Honolulu, Hawaii, USA	· Prevention, reduction and management of land-based sources of marine debris · Microplastics · Impact of derelict fishing gear and entanglement of animals · Garbage from maritime vessels · Education · Monitoring and modeling of movement of marine debris · Regulatory measures including bans on plastic grocery bags	(sponsor) NOAA UNEP
6.	March 2018	San Diego, California, USA	· Microplastics and microfibers · Derelict fishing gear · Monitoring and citizen science · Private sector collaboration · Education and communication · Single-use product policies · Prevention and removal · Innovative Case Studies	(sponsor) NOAA UNEP Federal Ministry for the Environment of Germany

* Note : the first International Conference was held as FIMD.

for subsequent and ongoing discussions (See Table 1). The Fifth International Conference was held on a large scale in 2011, co-organized by NOAA and the United Nations Environment Program (UNEP) and sponsored by private businesses such as the Coca Cola Company and the American Chemistry Council, as well as environmental NGOs. At the 5th IMDC, the problem of "microplastics" facing the international community was discussed for the first time. The 6th Conference was held in 2018, where the latest trends were discussed.

2 Marine Debris as an Important Theme for the World

In 2015, biologists on a research trip off the coast of Costa Rica found an endangered olive ridley turtle with a plastic straw lodged in its nostril. The disturbing video of the sea turtle, among others, has prompted gov-

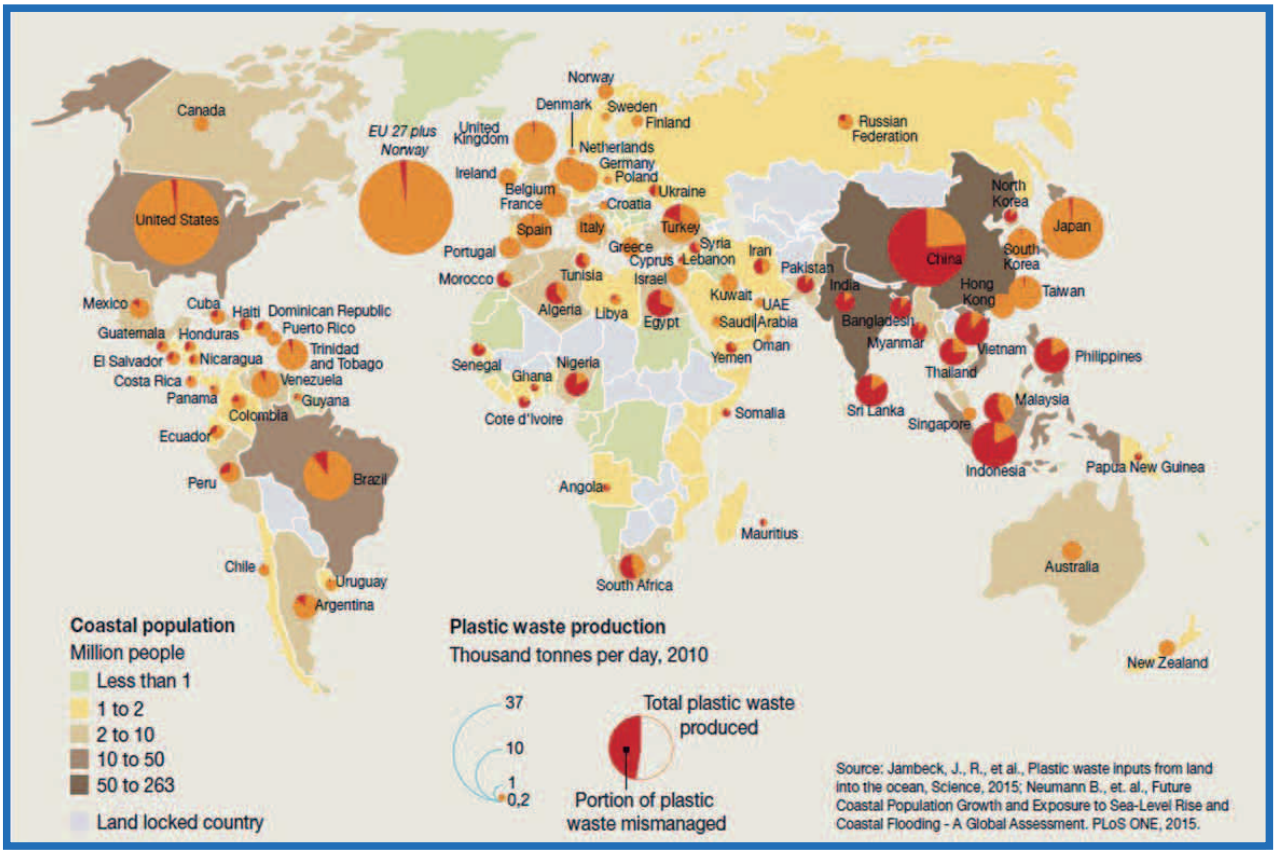


Figure 2　Estimated volume of plastic waste inputs from land into the ocean without being properly disposed (2010).

(Source : UNEP/AHEG/2018/1/INF/3, "Combating marine plastic litter and microplastics", p.56. https : //papersmart.unon.org/resolution/uploads/unep_aheg_2018_inf3_full_assessment_en.pdf)

ernments and the international community to address the issue of marine debris. In 2016, the World Economic Forum reported that if production of plastics continues to increase and the amount of plastic in the oceans continues to accumulate, there might be more plastic than fish in the ocean in weight by 2050. The report created a shock wave.[3]

For example, it is estimated that 275 million tons of plastic waste were produced in 192 countries in 2010, of which 4.8–12.7 million tons (1.7–4.6% of the total) ended up in the oceans. Global plastic production has increased over the years. It is believed that the volume of plastic waste escaping into the oceans has increased year by year (Figure 2)[4]. It is estimated that China and South East Asian countries are the top contributors (Table 2).

Aligning with the movement already in progress to promote a recycling-oriented society, the "Plastic Free Movement" to reduce the use of plastics has accelerated under rising pressure from the public over recent

[3] https://jp.weforum.org/reports/the-new-plastics-economy-rethinking-the-future-of-plastics

[4] Improving Markets for Recycled Plastics: Trends, prospects and policy responses, OECD (2018)

Table 2 Top 20 countries by estimated volume of plastic waste inputs from land to the ocean without being properly disposed (2010)

1	China	11	South Africa
2	Indonesia	12	India
3	The Philippines	13	Algeria
4	Vietnam	14	Turkey
5	Sri Lanka	15	Pakistan
6	Thailand	16	Brazil
7	Egypt	17	Myanmar
8	Malaysia	18	Morocco
9	Nigeria	19	North Korea
10	Bangladesh	20	United States

＊Aggregated volume of EU member nations (23 countries excluding landlocked states) brings its rank to 18th.
＊Adopted from Jambeck et al., 2015

years. One after another, national, local and municipal governments as well as the private sector have announced measures to reduce marine plastic waste. In Japan, news reports on these topics increased rapidly in 2018 and brought heightened attention to the issue of marine debris.

(1) Microplastics

Another reason the issue of marine plastic waste has come under the spotlight could be the significant increase of microplastics, which are very small pieces of plastic. The issue that used to be considered exclusively a problem for wildlife is suddenly recognized to be a problem for human beings.

In addition to fragments of plastic, microbeads were used in personal care products such as face wash and toothpastes. In 2015, the United States enacted a law to prohibit the use of microbeads in cosmetics and toothpastes. It prompted two major Japanese cosmetic companies, Shiseido and Kao, to voluntarily stop using them. In 2016, the Japan Cosmetic Industry Association called for voluntary restraint and so the production of microbeads has been declining. However, cosmetics containing plastic foils as glitters are still distributed in large quantities.

Even if we eliminate plastic grocery bags and single-use plastic containers from our daily life, microplastics escape into wastewater when we use melamine sponges to clean or wash clothes made of fleece. Even in Japan

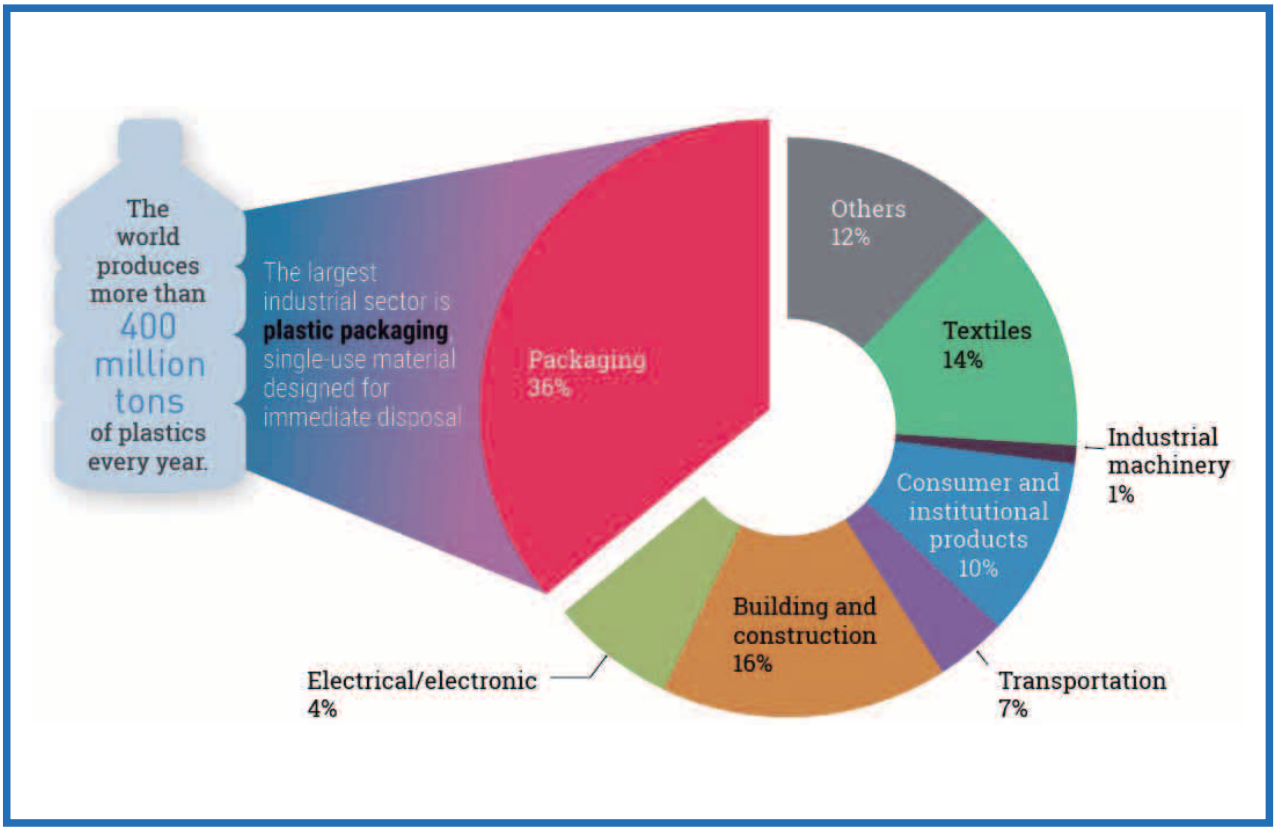


Figure 3 Global plastic production by industrial sector, 2015. Plastic packaging is the largest source of plastic waste in the world. The volume of plastic textile waste is almost equal to that of building and construction waste. Familiar consumer products such as plastic bags, food packaging trays, and synthetic clothes could generate microplastics.

(Source : UNEP (2018). SINGLE-USE PLASTICS : A Roadmap for Sustainability, p.4. https : //wedocs.unep.org/bitstream/handle/20.500.11822/25496/singleUsePlastic_sustainability.pdf?isAllowed=y&sequence=1)

with its well-developed wastewater treatment facilities, microplastics in stormwater runoff find their way from rivers to the oceans.

Of great concern is the effect of toxic chemical substances adhering to microplastics while drifting in the ocean in addition to their inherent toxicity. The contaminated particles could accumulate through the food chain. Harmful substances no longer in production such as PCBs are still drifting in the ocean and lipophilic plastics adhere to those chemicals in the water. Instances of translocation of pollutants derived from plastics have been confirmed in the tissue of seabirds and clams.

The impact of those miniscule particles on the aquatic ecosystem is not yet fully understood scientifically. In 2010, the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), jointly sponsored by eight United Nations organizations including the International Maritime Organization (IMO), the Food and Agriculture Organi-

zation (FAO), the UN Environment Programme (UNEP), and the Intergovernmental Oceanographic Commission (UNESCO-IOC), held an international workshop and published a report on microplastics. In Japan, the Japan Society for Environmental Chemistry, industry groups, and other researchers are conducting scientific research and analysis.[5]

While damage to human health has not been determined, many countries and regions are now changing course, based on the precautionary principle, toward regulating the use of plastics without waiting for the scientific conclusions.

[5] https : //jp. weforum. org/reports/the-new-plastics-economy-re-thinking-the-future-of-plastics

(2) Progress in the United Nations and International Organizations

In response to these conditions, various efforts are underway at the global, national, and regional levels. At the United Nations Conference on Sustainable Development (Rio+20) in 2012, the commitment was outlined, to "...take action to reduce the incidence and impacts of such pollution on marine ecosystems" and "... to take action to, by 2025, based on collected scientific data, achieve significant reductions in marine debris to prevent harm to the coastal and marine environment" in paragraph 163 of the outcome document, *The Future We Want.*

In 2015, the Sustainable Development Goals (SDGs) were adopted by all the member states of the United Nations. Goal 14 included a target to prevent and significantly reduce marine pollution of all kinds by 2025. "Marine debris" was included as a pollutant, and "floating plastic debris density" was identified as an indicator. Goal 12 ("ensure sustainable consumption and production patterns") also includes a target directly relevant

Table 3 Summary of G7 Ocean Plastics Charter

Summary of the Ocean Plastics Charter
■ Working with industry towards 100% reusable, recyclable, or recoverable plastics by 2030.
■ Working with industry towards increasing recycled content by at least 50% in plastic products where applicable by 2030.
■ Significantly reducing the unnecessary use of single-use plastics.
■ Recycling and reusing at least 55% of plastic packaging by 2030 and recover 100% of all plastics by 2040.
■ Encouraging the application of a whole supply chain approach to plastic production toward greater responsibility.
■ Accelerating international action and catalyzing investments to address marine litter.
■ Accelerating implementation of the 2015 G7 Leaders' Action Plan to Combat Marine Litter through the Regional Sea Programs, and targeted investments for clean-up activities in particular on abandoned, lost or otherwise discarded fishing gears

(Source : Adopted from https : //g7.gc.ca/wp-content/uploads/2018/06/OceanPlasticsCharter.pdf)

to the issue of marine debris.

In June 2017, the United Nations Ocean Conference was held to mobilize action for the implementation of SDG Goal 14 and the statement, "Call for Action" was unanimously adopted. In its paragraph 13, commitments were outlined to implement long-term and robust strategies to reduce the use of plastics and microplastics, particularly plastic bags and single use plastics, to promote waste prevention and minimization, and to adopt the 3Rs (reduce, reuse and recycle).

In July 2017, the G20 Hamburg summit was held just after the UN Ocean Conference. For the first time, marine debris was addressed in the Leaders' Declaration and an agreement was made to implement the G20 Marine Litter Action Plan.

In June 2018, the G7 Summit held in Charlevoix, Canada took up the issue of marine debris as one of its major issues and the Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities was endorsed. In addition, the G7 Ocean Plastics Charter was drawn up and agreed to by the leaders of Canada, France, the United Kingdom, Germany, Italy and the European Union, recognizing that the current approach to producing, using, managing and disposing of plastics poses a significant threat to the environment, to livelihoods and potentially to human health, and agreeing to commit to move toward a more resource-efficient and sustainable approach to the management of plastics. The United States and Japan declined to sign the Charter.

In October 2018, at the Marine Environment Protection Committee (MEPC) session at IMO, discussion was held about Annex V (Regulations for the Prevention of Pollution by Garbage from Ships) of the International Convention for the Prevention of Pollution from Ships (MARPOL). Measures such as making mandatory the marking of fishing gear with the IMO Ship Identification Number, and expanding the application of Garbage Record Book rule, were considered and an Action Plan to be achieved by 2025 was adopted.

⑶ Actions of Leading Countries

In 2015, the European Commission, the executive body of the European Union (EU), announced an action plan, the Circular Economy Package. To develop "a sustainable, low carbon, resource efficient and competitive economy," quantified objectives were set to reduce municipal and packaging waste, and an EU directive "as regards reducing the consumption of lightweight plastic carrier bags" was issued to phase out the use of plastic bags. Moreover, China, Taiwan, India, Bangladesh, Kenya, South Africa,

Table 4 Policy measures to reduce plastic grocery bags in EU member nations

Policy Measures	Country
Levy on Suppliers	Bulgaria, Croatia, Hungary
Levy on Consumers (Charge for single-use plastic bags)	Belgium, Czech Republic, Denmark, Estonia, Greece, Italy, Ireland, Latvia, Lithuania, Malta, Holland, Portugal, Rumania, Slovakia, Cyprus
Bans	Italy (ban on non-biodegradable plastic bags), France

(Source : Adopted from UNEP, Single Use Plastics (2018))

Palau and others have implemented policy measures to reduce the use of plastic bags.

The regulatory efforts by governments to ban the use of plastic products are being extended from plastic bags to include single-use plastic packaging in general. In January 2018, the European Commission adopted "a European Strategy for Plastics in a Circular Economy" to ensure all plastic packaging is recyclable by 2030. In May 2018, the Commission proposed a "Single-Use Plastics Directive," which would set measures such as a use ban, consumption reduction, extended producer responsibility, etc., for each of the identified single-use plastic items. It is based on the findings that the 10 most found single-use plastic items represents 43% of all marine litter items found on European beaches, and fishing gear accounts for another 27%. By focusing on those most found items, therefore, 70% of marine litter items could be addressed. It is estimated that by halving the amount of the 10 items discarded, 22 billion euros in environmental damages (by marine litter) could be avoided.

As for Member State law in the EU, in Germany all businesses must register plastic containers before distribution from 2019 ; France prohibits in principle the use of single-use plastic containers from 2020 ; Italy is planning to ban the manufacturing and sales of cosmetics containing microplastics from 2020 ; and England is considering a ban on the sale of straws, stirrers, and cotton swabs made of plastic.

3 Progress in Japan

The recycling rate of plastics in Japan, when thermal recycling (use of waste as fuel stock) is included, is higher than that of other countries. However, the volume of single-use packaging waste per capita of Japan is the second largest[6] in the developing nations, following the United States.

[6] Jena R Jambeck, et al : Plastic waste inputs from land into the ocean, Science (2015)

Furthermore, Japan used to export large volumes of plastic waste as "resources." The destinations of export, China and Southeast Asia, are the utmost contributors of marine debris due to the insufficiency of trash collection infrastructure and waste management facilities.

In December 2017, the Chinese government banned imports of plastic waste and other Asian countries, including Thailand, followed their lead. Japan is losing the export market for its plastic waste. It has become necessary to make a commitment to domestic resource recycling without relying on exports, which in part contributed to the major advancement of initiatives regarding plastic waste seen in Japan in 2018.

(1) Initiative of the Ministry of the Environment

In June 2018, the 4th Fundamental Plan for Establishing a Sound Material-Cycle Society was approved by the Cabinet. The Ministry of the Environment held four meetings of experts, drafted a "Plastic Resource Recycling Strategy," and requested public comments from November to December.

It included measures such as "making it mandatory to charge fees for plastic grocery bags (prohibition of giveaways)," and set quantitative tar-

gets such as to “reduce the waste of single-use plastics (containers and packaging) by 25% by 2030.” The Japanese government did not sign the aforementioned the G7 Ocean Plastics Charter and was met with criticism from home and abroad. Following the new strategy outlined by the then Minister of the Environment Masaharu Nakagawa at the G7 Environment, Energy and Ocean Ministers Meeting held in September, it is imperative for Japan to set goals exceeding those of the Charter.

In the same month, the Ministry of the Environment initiated a campaign, “Plastics Smart — for sustainable oceans” to disseminate ways to “use plastics in a wise manner” and to support cooperation and collaboration among a broad range of entities including individuals, local governments, NGOs, companies, and research institutions. A logo mark for the campaign is provided free of charge for supporters to use on materials for publicity. Cases of 3R initiatives are collected and will be posted on the newly created program site[7] in Japanese and English to provide information both domestically and internationally.

[7] http : //plastics-smart.env.go.jp/

(2) Local Government Initiatives

Forward-thinking local governments such as Sayama City in Saitama Prefecture initiated a move to reduce plastic grocery bags early on. Following the revision of the Containers and Packaging Recycling Law in June 2006, Suginami ward in Tokyo, Okinawa prefecture and Toyama prefecture started to address the issue as well. In fiscal year 2008, Toyama prefecture started charging ¥5 per plastic grocery bag at the major supermarkets in the prefecture all at once. In the first fiscal year, about 200 stores participated and the average percentage of customers bringing their own bags surpassed 90%. Then the number of participating stores increased to more than 400[8]. An effort initiated mainly to reduce CO_2 emis-

[8] http : //www.pref.toyama.jp/cms_sec/1705/kj00010807-004-01.html

Figure 4 Plastic Litter Free Kanagawa Declaration logo mark

(Source : Kanagawa Prefecture “Ken no Tayori” (News of the Prefecture). November issue)

sion resulted in contributing to the reduction of marine debris.

In June 2018 Kanagawa prefecture was designated an "SDG Future City" by the Cabinet Office and in September it announced the "Plastic Litter Free Kanagawa Declaration" as a resident-led initiative following the SDG concept[9]. It calls for the banning and/or collection of single use plastic products at retail stores and environmental events in the prefecture, and asks beachgoers to "take your plastic garbage home." It provides an action plan that consists of 16 targets from which the residents could choose 10 targets to create a voluntary "My Eco 10 Declaration." In August 2018, plastics were found in the stomach of a blue whale cub beached on Yuigahama, Kamakura City. Since the incident prompted the movement, the logo mark for the initiative shows a whale shedding tears. Also, in October 2018, Kamakura City announced its "Plastic Litter Free Kamakura Declaration," in coordination with the prefecture, asking tourists and visitors to bring their own bags.

This movement has spread to Kitakyushu City in Fukuoka prefecture and Kameoka City in Kyoto prefecture. In December 2018, Kameoka City announced the "Plastic Litter Free Kameoka Declaration" and expressed its policy plan to enact an ordinance to ban plastic grocery bags in fiscal year 2020. In Tokyo, Governor Yuriko Koike stated that she would consider measures to address plastic waste with a view to enacting an ordinance. As a first step, a pilot program to provide paper straws in the stores in government buildings was introduced[10].

⑶ Industry Initiatives

As an initiative by consumers, bans on plastic straws took center stage in 2018.

As for global corporations, in May, Hilton Hotels announced it would remove plastic straws from its managed properties by the end of 2018. Then in July, Marriott Hotels and, in September, Hyatt Hotels followed suit[11]. In July, Starbucks, a food and beverage retailer, announced it would eliminate plastic straws by 2020. In the same month, Disney announced its plan to eliminate single-use plastic straws and drink stirrers by 2019 and its intent to transition to refillable in-room amenities in their hotels and other establishments[12]. McDonald's announced that it would replace plastic straws with paper ones in its UK and Ireland restaurants beginning from September.

Packaging accounts for 36% of global plastic production (See Figure 3). Reducing production of single-use plastic packaging holds the key to addressing marine debris. In October 2018, the New Plastics Economy

[9] http : //www.pref.kanagawa.jp/docs/r5k/prs/r2305548.html

[10] http : //www.metro.tokyo.jp/tosei/governor/governor/kishakaiken/2018/09/21.html

[11] http://newsroom.hilton.com/corporate/news/hilton-commits-to-cutting-environmental-footprint-in-half-and-doubling-social-impact-investment

[12] http://disneylandparis-news.com/en/disney-expands-environmental-commitment-by-reducing-plastic-waste/

Figure 5 Straws made of wood from trees fallen during the torrential rainstorm of 2018 in western Japan and timbers from forest thinning
(Photo courtesy of The Capitol Hotel Tokyu)

Global Commitment[13] led by the Ellen MacArthur Foundation in collaboration with UNEP was officially unveiled in advance of the Our Ocean Conference. More than 250 companies and organizations including the Coca-Cola Company, Danone, Nestlé, and Unilever signed the commitment to ensure 100% of plastic packaging could be easily and safely reused, recycled, or composted by 2025.

Even while no Japanese companies are among the signatories, Skylark Holdings Co., Ltd., a major Japanese restaurant chain, decided to eliminate plastic straws in August and went ahead to remove straws from its self-service drink stations in all the Gusto restaurants it manages in December. Seven & i Food Systems Co. Ltd., another major restaurant chain, implemented a pilot program to remove plastic straws from its self-service drink stations in some restaurants in November.

While recycling efforts are taking a backseat to reducing, many companies actively collect plastic containers to produce recycled products. Products made of single material such as PET (polyethylene terephthalate) bottles are suitable for material recycling. In November 2018, the Japan Soft Drink Association announced the Plastic Resource Recycling Declaration with a goal of recycling 100% of PET bottles by fiscal year 2030. Seven & i Holdings Co., Ltd. has placed “automated recycling boxes” in front of the convenience stores (7-Eleven) and general merchandise stores (Ito-Yokado) it operates, in the effort to recycle domestically. The number of the boxes reached about 700 as of February 2018 and they serve as bottle-collection stations for their communities.

Manufacturers of plastics are making efforts as well. The Japan Plastic Industry Federation (JPiF), which represents the Japanese plastics produc-

[13] https : //newplasticseconomy.org/news/globalcommitment

ers, announced a Declaration to Address Marine Plastic Debris in April 2018 and has been asking its member companies and organizations to sign the declaration and to make voluntary efforts. In September, five industry groups including JPiF established the Japan Initiative for Marine Environment (JaIME). Its action plan sets goals to "accumulate scientific knowledge," to "support improvement of plastic waste management in newly developing countries in Asia," etc[14].

In addition, many companies are taking steps to address the issue by changing the coating agent for waterproof paper to biodegradable polymer, developing a material with biodegradability not only in soil but also in sea water, and re-examining plastic additive agents, etc. Kaneka Corporation, which developed PHBH, biomass-derived biodegradable polymer, announced its plan to invest about 2.5 billion yen to expand its manufacturing facility. It is expected to be operational in December 2019[15].

[14] http : //www.env.go.jp/council/03recycle/y0312-01/y031201-3.pdf

[15] http://www.kaneka.co.jp/service/news/nr20181808071/

⑷ New Initiative of The Nippon Foundation

The Nippon Foundation started the Change for the Blue project, a new initiative to address the problem of marine debris involving the private sector, the public sector, and academia in November 2018, leveraging the framework of The Ocean and Japan Project launched in 2016.

At the press conference, findings of a survey of 1,400 people conducted in preparation for the project launch were announced. They cast light on the current situation and existing challenges. Most of the respondents (80.9 %) were aware of marine debris while unfamiliar with detailed information on its various components. While they were willing to make an effort to reduce marine debris, they feel there are not enough easy activities to participate in. The mechanism of marine debris generation was also illustrated : plastics escape at every stage along the cycle, from production, distribution and use to disposal, and once breaking loose in the natural environment, plastics eventually find their way into the oceans by way of rivers and other means, unless picked up by someone. The importance given to cleaning up litter from streets and rivers, the places closest to us and easy to access, was thus warranted.

Moreover, The Nippon Foundation announced a plan to pursue projects in collaboration with stakeholders in twelve categories for developing various "models" to address marine debris. The Foundation is deploying a wide-range of efforts, such as a joint endeavor with a major company to install PET bottle recycling stations, promotion of material recycling, development of the "Whole Town Effort Model" package in collaboration with local governments, and promotion of research and study in coopera-

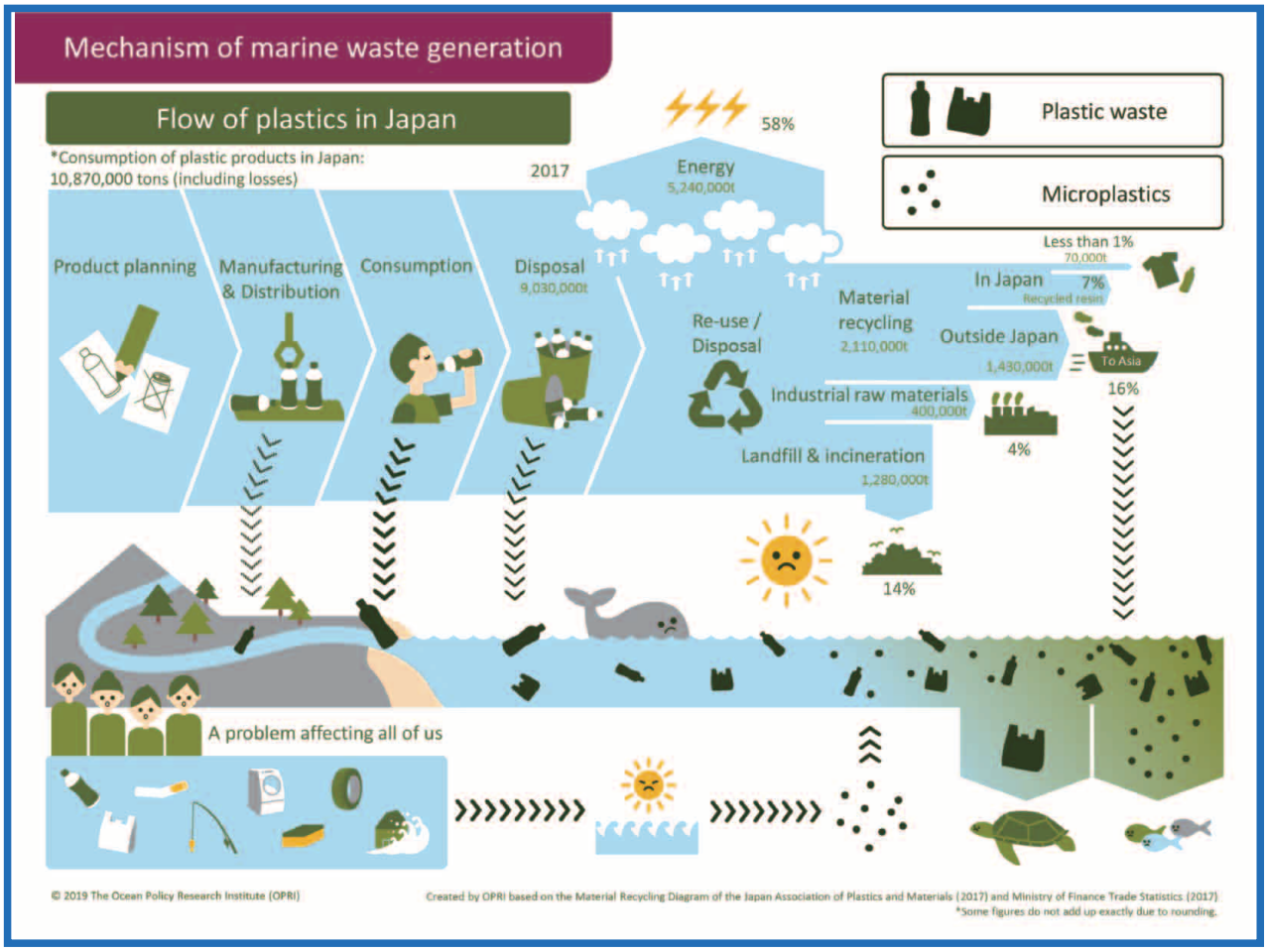


Figure 6 Illustration of the mechanism of marine debris generation in Japan (figures are as of 2016). For example, during the manufacturing process plastic pellets and grinding sludge are discharged with wastewater stream into rivers. Plastics find their way into the natural environment in every aspect of the product cycle.
(Source : Ocean Policy Research Institute, The Sasakawa Peace Foundation)

日本財団 海と日本 PROJECT
CHANGE FOR THE BLUE
海の未来を変える挑戦

Figure 7 Logo Mark for Change for the Blue project, symbolizing changes toward clean oceans.

tion with academics in Japan and overseas. It also invites the public to participate in nationwide simultaneous cleanup activities in cooperation with the Ministry of Environment, and is organizing an international symposium in preparation for the G20. It is also considering expanding its efforts overseas, including Southeast Asia and island nations.

⑸ Preparing for the G20 Osaka Summit

Plastics have only some 100 years of history. Yet plastics are making their presence felt everywhere in the deep vast oceans. Japan, comprised of many islands, has a long coastline and so isn't immune to the marine plastic debris problem.

Japan hosts its first ever G20 Summit in June 2019, where the issue of marine plastic debris will be addressed. At the 20th Tripartite Environment Ministers Meeting (TEMM20) among Japan, China and the Republic of Korea held in June 2018, the three countries expressed their willing-

The coast of Hateruma Island in Okinawa

ness to cooperate and coordinate toward the success of the G20 Summit in Japan, and to increase efforts to reduce marine debris. The Ministry of Environment plans to take advantage of G20 Ministerial Meetings to strengthen the partnership with G20 Countries, including developing nations, and to implement effective measures to control marine plastic debris through exporting Japan's advanced soft and hard infrastructure.

It is Japan's responsibility as a major producer of plastics[16] to actively participate in international discussions and contribute to reducing marine debris across the globe.

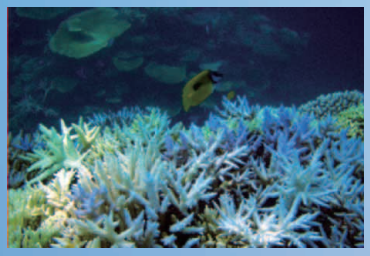
(Tomo Shioiri and Mai Fujii)

[16] Single-use Plastics : A roadmap for Sustainability, UNEP (2018)

2019 CONTENTS

FOREWORD

Why is plastic an ocean issue ?



Japan and the World's Ocean Initiative

1 Science Unlocks the Future of the Oceans

Preparing for the UN Decade of Ocean Science for Sustainable Development

1 Human Activities beyond Planetary Boundaries

In December 2017, the United Nations proclaimed the Decade of Ocean Science for Sustainable Development (2021–2030). The oceans cover more than 70% of the earth's surface. Scientific knowledge about the oceans plays a major role in developing sustainable civilization on our planet.

Since the Industrial Revolution, the atmospheric concentration of greenhouse gases, such as carbon dioxide (CO_2), has shown accelerated growth in a hockey stick pattern[1]. Despite some fluctuation, average surface temperatures have been increasing steadily as well. The northern hemisphere, in particular, has experienced noticeable effects of global warming. Not only has sea ice in the Arctic region retreated, but also the global oceans have absorbed more than 90% of the earth's additional heat, warming the oceans even within its deep layers. Increasing ocean heat content coupled with natural climate patterns like El Niño contribute to unusual and extreme weather events including droughts, floods, and violent typhoons. Financial damages are escalating dramatically.

1 Hockey stick graphs are used to describe the accelerated growth pattern of climate, envisaging a graph that is relatively flat followed by sharp increase as forming a horizontally laid ice hockey stick.

A paper published in the Philosophical Transactions of the Royal Society by American climatologist Dr. Will Steffen and collaborators in 2011, showed a striking similarity between the change in indicators of human activity and global environmental indicators for the past 250 years (1750–2000)[2]. Time series of indicators of human activity such as population, GDP, and water use and global environmental indicators such as atmosphere CO_2 concentration, average surface temperature, and biodiversity, rapidly increased in a parallel manner (See Figure 1–1). While correlation alone does not necessarily imply causation, it is obvious that, based on knowledge accumulated in the academic fields of meteorology, oceanography, climatology, biogeochemistry, etc., human activities are seriously affecting our global environment including the biosphere.

2 Steffen, W., et al., 2011: Phil. Trans. R. Soc. A, 842–867.

The Earth is no more than a planet in the solar system. However, it is uniquely situated so that water freely transitions between liquid, solid and vapor phases. Since Dr. Michel Mayor at the University of Geneva announced the discovery of an exoplanet orbiting 51 Pegasi -- a Sun-like star located about 50 light-years from Earth in the constellation of Pegasus -- in 1995, more than 3,000 exoplanets have been discovered. While it appears that we are in a planet discovery boom, it is expected that planets like Earth are quite rare throughout the whole universe.

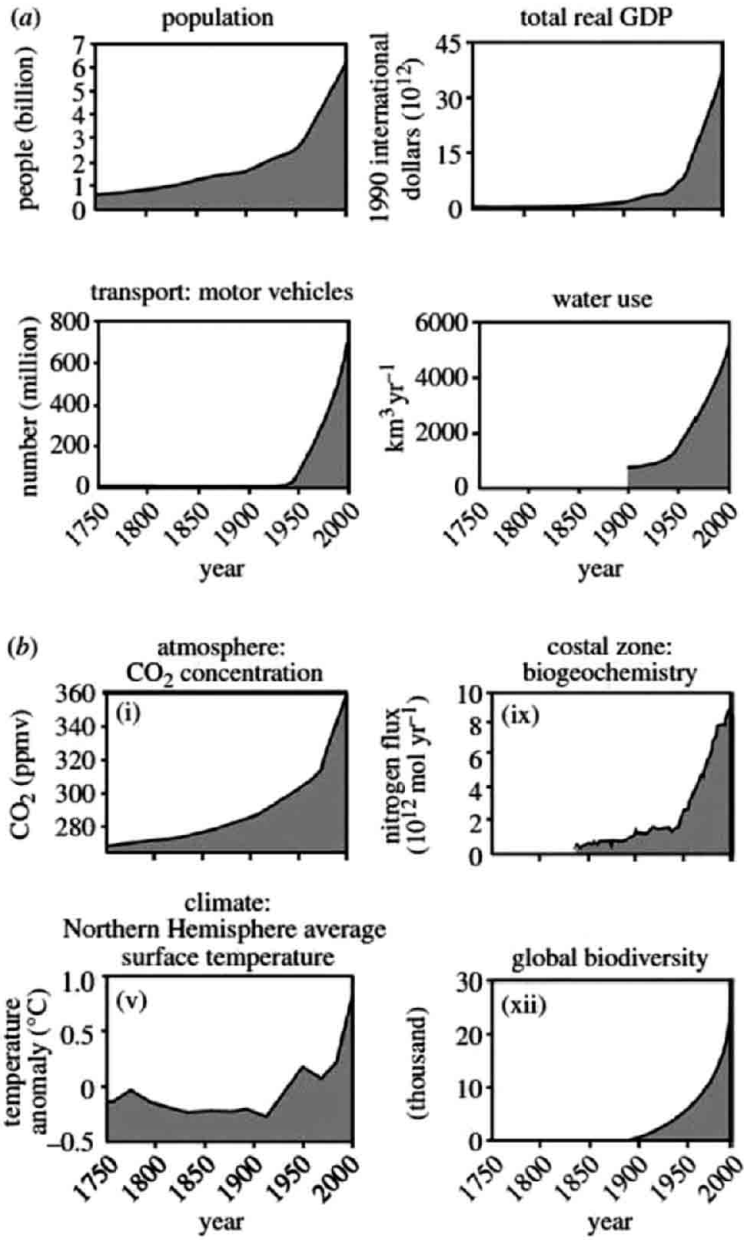


Figure 1–1 Change in indicators of human activity (a) and Change in global environmental indicators (b) for the past 250 years (1750–2000)

(Source : Steffen, W., et al. 2011)

Phase transition of water, unique to the earth, accompanied by release of latent heat contributes to dynamic climactic and hydrographic phenomena, such as the accelerated weathering of rocks. Water is so versatile in nature that it can dissolve diverse elements, enable circulation of substances, and facilitate chemical reactions between them.

Earth, our inhabitable watery planet, has promoted the coevolution of life and the environment. The irony is that human activities now transgress planetary boundaries and affect the entire planetary system of the Earth, threatening the sustainability of human activity.

The Earth is supposed to be in the *Holocene*, a geological era of stable climate after the ice age. However, human activity has caused drastic changes such as

the aforementioned global warming. Some scientists consider that the Earth is moving into a new *Anthropocene* era. It is high time to reassess human activity from the standpoint of a planet in the universe, and to rethink individually our own way of living.

2 Future Earth Initiative

In the 1950s, academic efforts to understand the Earth's entire physical system through international cooperation picked up momentum. An international scientific project, International Geophysical Year, lasted from July 1957 to December 1958 under the initiative of geophysicists. The Soviet Union launched the first successful artificial satellite, Sputnik 1, and then the U.S. artificial satellite Explorer 1 discovered the Van Allen radiation belt captured and held by the magnetic field of the Earth. As for the oceans, it happened to be an El Niño year and oceanographic and climatological observation data were obtained through cooperation of participating nations. This formed the basis for the study of ocean-atmosphere climate interaction.

Ocean science is the study of the physical, chemical, biological and geological aspects of the oceans and is a highly international and interdisciplinary academic field. It is no coincidence that the Scientific Committee on Oceanic Research (SCOR) was established by the International Council of Scientific Unions (ICSU; now the International Science Council) to promote the interdisciplinary approach in 1957. In Japan, the Committee for Oceanic Science was established by the Science Council of Japan in response to these developments around the world. Thanks to the efforts by Professor Koji Hidaka of the University of Tokyo and its President Dr. Seiji Kaya, the nation's first Ocean Research Institute was established in 1962 at the University of Tokyo as a joint research center, whose facilities were also used by other Japanese universities and institutions.

In 1960, the Intergovernmental Oceanographic Commission (IOC) was established within UNESCO for the purpose of oceanographic observation, data exchange, and capacity building. Japan played a pivotal role in establishing the Commission, acting in accordance with its national policy to regain the trust of the international community by being a science-oriented nation. The IOC has become a leading body to promote operational aspects of ocean science in cooperation with SCOR, which promotes academic research.

More than half a century has passed since these early developments. Now that Earth is moving into the Anthropocene epoch, it is not sufficient just to strengthen our knowledge through interdisciplinary cooperation within the field of natural science. Natural sciences alone will not be enough to respond effectively to the risks and opportunities associated with our rapidly changing earth system, including the oceans. Interdisciplinary cooperation with the humanities and social sciences is also needed. We also need to go beyond interdisciplinary cooperation to work together with various stakeholders in society to design the future Earth

and create a sustainable humanity.

In 2015, ICSU and the International Social Science Council (ISSC) initiated Future Earth, a 10-year international research program. The program lays out three themes: 1. Dynamic Planet, 2. Global Sustainable Development, and 3. Transformations towards Sustainability. In July 2018, the two organizations merged to become the International Science Council (ISC) which has taken on a new dimension. This development underlines the ever-increasing importance of cooperation and collaboration between academics and society.

3 Sustainable Development Goals (SDGs)

The 1987 Report, "Our Common Future," prepared by the World Commission on Environment and Development (the Brundtland Commission) led to the first concrete step toward sustainable development: the United Nations Conference on Environment and Development (the Rio Earth Summit) held in 1992.

At the Summit, an action plan, Agenda 21, was adopted and the United Nations Framework Convention on Climate Change and Convention on Biological Diversity were signed. In chapter 17 of Agenda 21, the importance of the oceans was recognized for the first time. Protection of the oceans and coastal areas, along with rational use and development of their living resources was advocated. In response to Agenda 21, the Global Ocean Observing System (GOOS) program was initiated by the IOC.

As a body with functional autonomy within UNESCO, the IOC has worked to establish an observation framework and network with respect to its three major focus areas: climate change and the ocean, operational services (coordination of programs that provide technical assistance regarding ocean and coastal manage-

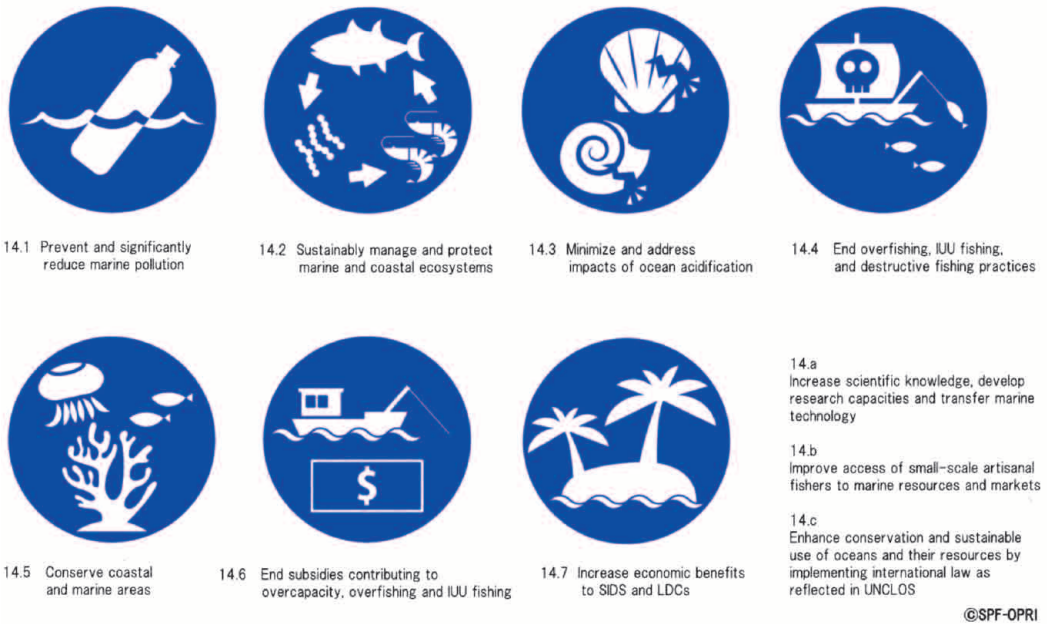
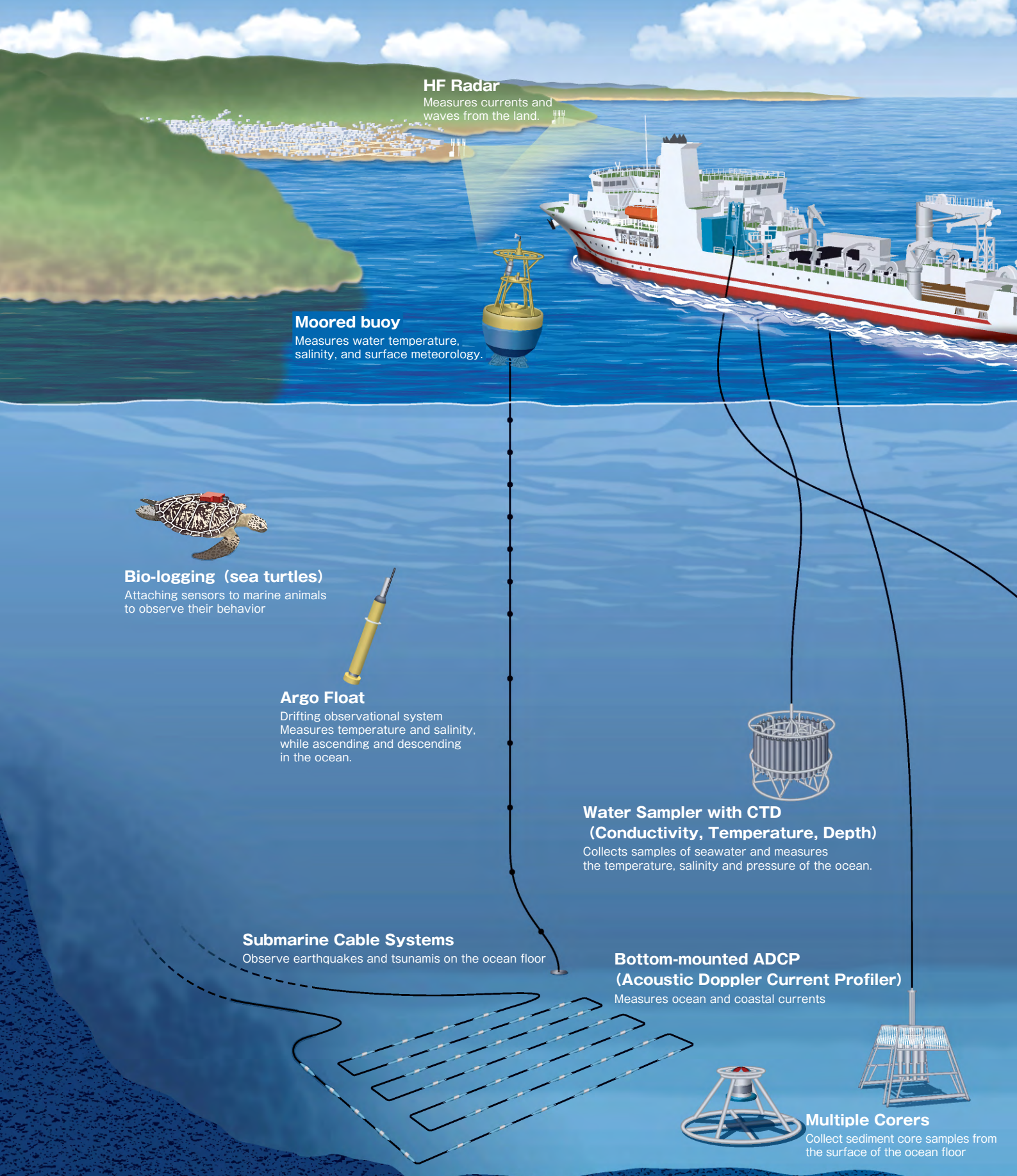


Figure 1–2 SDG Goal 14. "Conserve and sustainably use the oceans, seas and marine resources for sustainable development."

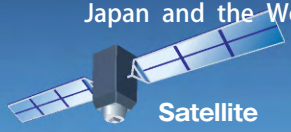
Illustration: Ocean Monitoring

"Ocean Monitoring" means the collecting and providing of observation data in order to understand the current state of the ocean environment and what kind of changes the oceans have undergone in the past.
Various instruments and measuring techniques are used for ocean monitoring.



For more information on marine observation equipment (access to website of Japan Agency for Marine-Earth Science and Technology) https://www.jamstec.go.jp/e/about/equipment/observe/

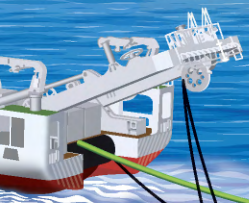
Airborne Lidar
Measures atmosphere over the oceans and oceanic aerosol



Satellite
Measures sea surface temperature, sea level, and sea ice. Used for vessel monitoring.

VOS
(Volunteer Observing Ship)
Observations by commercial vessels and fishing vessels

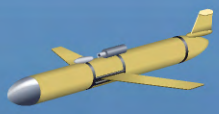
Drifting Ocean Buoy
Measures water temperature, wave height and wave period.



Streamer Cable
Used with air gun for seismic surveys to investigate geologic features beneath the ocean floor

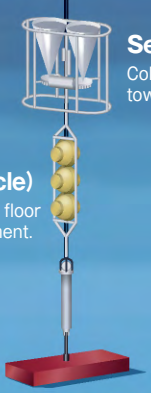
Air Gun
Used with streamer cables for seismic surveys to investigate geologic features beneath the ocean floor

XBT
(Expendable Bathythermograph)
Measures vertical profile of ocean temperature (XCTD measures salinity as well)



Underwater Glider
Autonomous underwater observation system

AUV
(autonomous underwater vehicle)
Acquires ocean floor topography data and sub-bottom profiler data.



Sediment Trap
Collects particles falling toward the ocean floor.

ROV
(Remotely Operated Vehicle)
Used for deep sea surveys, ocean floor sampling and installation of equipment.

Finder-Mounted Power Grab
Collects samples such as seabed minerals

Dredge Bucket
Collects sediment and rocks on the ocean floor

Note: Adapted from homepages and publication of Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and Japan Oil, Gas and Metals National Corporation (JOGMEC) , etc.

ment to member nations), and a healthy ocean ecosystem.

As for international efforts toward sustainable development, after the Johannesburg Summit in 2002 and then Rio+20 in 2012, the 2030 Agenda for Sustainable Development was adopted at the United Nations Sustainable Development Summit in 2015. Seventeen Sustainable Development Goals (SDGs) to be achieved by 2030 were specified.

Included are the goals intended to eradicate extreme poverty mainly in developing countries as specified in the Millennium Development Goals (MDGs), established in 2000 for the year 2015. Goals to conserve the global environment involving developed nations are emphasized in the SDGs as well.

As for the oceans, Goal 14 was put forth to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development." While there are some problems such as imbalance among and insufficient integration of the goals, the SDGs, which aim at social, economic and environmental sustainability, take the same path as the Future Earth Initiative as proposed by academia.

4 Preparing for UN Decade of Ocean Science for Sustainable Development

Based on the Paris Agreement adopted at the 21st Conference of the Parties of United Nations Framework Convention on Climate Change (COP21), a special report, *Global Warming of 1.5℃*, was presented at the 48th session of the Intergovernmental Panel on Climate Change (IPCC) held in Incheon, Republic of Korea. The report suggests that reaching and sustaining net zero global anthropogenic CO_2 emissions by 2050 and limiting global warming to 1.5℃ compared to 2℃ specified in the Paris Agreement would substantially reduce the threat of climate change. Given the current global situation, the outlook is hopeless to meet the target of 1.5℃., but recently a sensational paper was published on the matter in the Proceedings of the National Academy of Science of the United States of America (PNAS)[3]. Its authors argue that even if the target of the Paris Agreement is met, global warming and permafrost thawing, weakening carbon uptake by land and ocean systems, CO_2 emission from increased marine bacterial respiration, diminishing tropical rainforests and woodlands could cause a cascade of feedbacks. Once the threshold is crossed, the Earth System could take a rapid trajectory toward a "Hothouse Earth" (Figure 1-3). Not only should we meet the global temperature target, they say, but also take biogeochemical feedbacks into consideration. A social transformation that involves changing our values can no longer be delayed.

In order to form a sustainable society, we must first recognize the current state of the Earth system. Without accurate understanding of present threats beyond global warming to the environment of our watery planet Earth, we can't proceed. An organizational framework should be built for data acquisition, technical assistance services, and mechanisms that facilitate active communication with policymakers.

3 Steffen. W., et al., 2018: Proc. Natl. Acad. Sci. USA 115 (33), 8252-8259

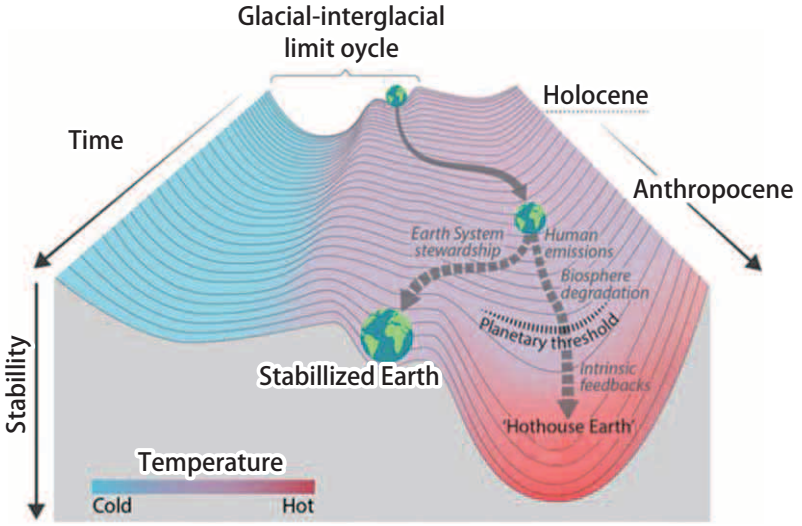


Figure 1-3 Overview of the Earth System in the Future.

The present Earth system is just out of the glacial-interglacial limit cycle. We are facing a fork in the road of the Anthropocene. Driven by a cascade of biogeophysical feedbacks, the Earth could cross the planetary limit and lead to Hothouse Earth, or by proper management of carbon cycle-climate feedback, it could lead to Stabilized Earth.
(Source : Steffen et al., 2018)

2021 2030 United Nations Decade of Ocean Science for Sustainable Development

Figure 1-4 The logo for the United Nations Decade of Ocean Science for Sustainable Development

As mentioned above, the United Nations proclaimed the Decade of Ocean Science for Sustainable Development (2021-2030) in December 2017. This provides a common framework that will ensure ocean science can support countries in achieving the 2030 Agenda for Sustainable Development.

Prior to the proclamation, UNESCO-IOC published the *Global Ocean Science Report*. It divides marine science into eight categories: Marine Ecosystem functions and processes, Ocean and Climate, Ocean Health, Human Health and Wellbeing, Blue Growth (Systematic growth of the economy through sustainable use of marine resources), Ocean Crust and Marine Geohazards, Ocean Technology and Engineering, and Ocean Observation and Marine Data. The report provides a quantitative assessment of the current state of ocean science in the world. For example, analysis of a number of scientific publications highlights the gap between the capacities of developed nations and developing nations. Based on these evaluations, the IOC is preparing an implementation plan for the start of the Decade in 2021.

Figure 1-5 Publication map of the world where the area of each country is scaled and resized according to the number of ocean science publications received.
(Source : Global Ocean Science Peport)

The UN Decade for Ocean Science is a once in a lifetime opportunity to build a new framework that transcends the border of science and policy. It is a groundbreaking call to bring the scientific community, policymakers, business, and civil society together. Expectations for active contributions by Japan, as an advanced ocean science nation, will continue to increase.

(Toshio Yamagata)

Pioneer the frontier

1 Science of Polar Regions

1 Environmental Changes in the Arctic and Arctic Ocean Observation and Research

According to the Arctic Report Card[4] that the US National Oceanic and Atmospheric Administration (NOAA) publishes annually in December, 2018 was the second warmest year on record in the Arctic since 1900 (+1.7℃ relative to the average of 1981–2010; the highest recorded was 2017) and the average temperature for the past five years from 2014 to 2018 also surpassed all previous records. The atmospheric warming in the Arctic region is twice as large in comparison to the global mean temperature, which is known as Arctic Amplification. Accompanied by this phenomenon, the Arctic sea ice cover has been rapidly decreasing since the 1990s, suggesting that the Arctic Ocean might be ice free in summer by the middle of this century. As sea ice retreats, the sea surface temperature rise in the Arctic Ocean is causing chemical and physical changes in the ocean, such as freshening and acidification of seawater, and is activating oceanic current and sea ice movement. These changes in the environment are impacting the Arctic ecosystem. Ocean acidification is progressing faster in the Arctic than any other region, the disappearing sea ice is threatening species living on the ice, and species native to the Pacific and Atlantic Oceans are starting to find their way into the Arctic Ocean.

Warming of the Arctic has significant impact on the ice sheet in Greenland, glaciers in high-latitude land regions, and permafrost and land ecosystems as well. In particular, the melting ice sheet in Greenland contributes greatly to sea level rise. It is suggested that one third of global sea level rise is attributable to the melting Arctic ice, half of which is caused by the melting ice sheet in Greenland. However, many things regarding the melting ice sheet are still unknown and their effects might be underestimated.

Change in the Arctic region greatly affects weather and climate. The causal association of sea ice retreat in the Arctic Ocean and the advance of cold waves (and/or heavy snowfall) to the mid-latitude regions, including Japan, with accompa-

4 Osborne, E., J. Richter-Menge, and M. Jeffries, Eds., 2018: Arctic Report Card 2018, http://www.arctic.noaa.gov/Report-Card.

nying torrential snow is widely recognized. We should be aware that the impact of environmental changes in the Arctic is a global concern.

Melting ice has made Arctic shipping routes possible and it has been used for commercial transit since around 2010. While sensitive to geopolitics, the Arctic shipping routes not only could have economic benefits but also could contribute to mitigation of global warming[5], and their use is expected to increase. The Arctic coastal countries as well as other countries have interests in exploitation of Arctic natural resources. Russia has already started commercial operation of the Yamal LNG plant. As for tourism, cruises along the Arctic shipping routes are attracting attention. Meanwhile, melting sea ice and thawing permafrost are having serious consequences for the life of indigenous inhabitants. Ground erosion, storm surge and waves, and coastal erosion have forced residents of some coastal cities to relocate. Also of concern is the impact of increased marine traffic from the use of Arctic shipping routes on marine ecosystems and indigenous communities. Clearly, environmental changes in the Arctic Ocean region warrant serious consideration for their effects on society.

5 Shorter travel distance and transit time save fuels, which in turn contributes to mitigation of global warming.

The Arctic Monitoring and Assessment Programme (AMAP), one of six Working Groups of the Arctic Council, released the environmental assessment report, Snow, Water, Ice and Permafrost in the Arctic (SWIPA 2017), in April 2017[6]. Six key findings about ongoing Arctic change were identified in the report:

① The Arctic's climate is shifting to a new state
② Climate change in the Arctic has continued at a rapid pace
③ Changes will continue through at least mid-century
④ Substantial cuts in global greenhouse gas emissions now can stabilize impacts after mid-century
⑤ Adaptation policies can reduce vulnerabilities
⑥ Effective mitigation and adaptation policies require a solid understanding of Arctic climate change

6 AMAP, 2017. Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017. Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv + 269 pp and AMAP, 2017. Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017. Summary for Policy Maker (SPM). Arctic Monitoring and Assessment Programme (AMAP), Oslo, Norway. xiv +20pp

Based on the findings, the following "Recommended Action Steps" were presented to the Arctic states, permanent participants, and observers to the Arctic Council: 1) implement policy measures to limit future change; 2) prioritize research and knowledge-building efforts leading to enhanced certainty in predictions of changes; 3) continue its efforts to monitor, assess, and understand Arctic climate change and its implications; and 4) prioritize informing and educating the public about observations and projections of Arctic climate change.

As SWIPA 2017 recommended, we should understand the current state of the rapidly changing Arctic environment and its implications, undertake research activities to enhance certainty in predictions of changes, and inform the public about the outcome. In Japan, the research project, "the Arctic Challenge for Sustainability (ArCS)", has been in progress since fiscal year 2015. The project was funded by the Ministry of Education, Culture, Sports, Science and Technology, with the National Institute of Polar Research (NIPR) as the project leader and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) and Hokkaido University as sub-leaders.

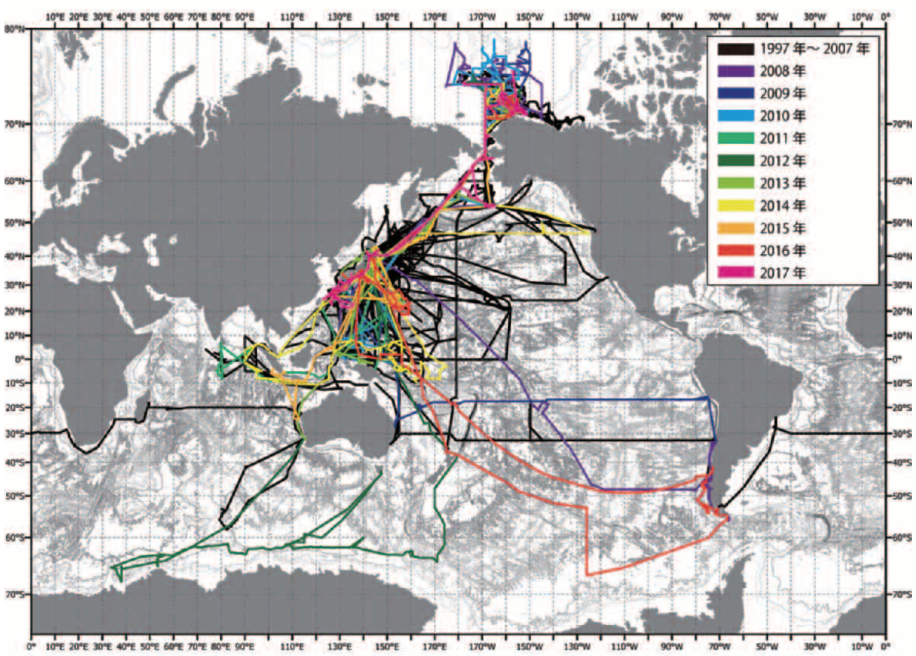


Figure 1–6 A track chart of the Arctic observation cruises the *Mirai* conducted between 1997 and 2017. The *Mirai* made 16 cruises by 2018, acquiring valuable observation data and the findings were released to the public.

Figure 1–7 The *Mirai* on an Arctic cruise.

This project aims to understand changes in the Arctic climate and environment and the implications for societies, as well as provide accurate projections and environmental assessments. It also aims to provide relevant and important information to stakeholders, both domestic and international, by integrating scientific knowledge obtained through comprehensive study on the Arctic region. In addition to scientific research, the ArCS has made an effort to disseminate information by sending out researchers to the working groups of the Arctic Council and other relevant international meetings to participate in drafting reports. It also actively holds public lectures to enhance citizens' understanding of Arctic issues.

One of the ArCS's research projects, involving JAMSTEC's oceanographic research vessel *Mirai* and Hokkaido University's training ship *Oshoro-Maru*, is conducting field observations to understand Arctic Ocean environmental changes and

assess their impact.

The *Mirai* was previously the nuclear-powered vessel *Mutsu*. After decommissioning, it was reconfigured as a conventional diesel-powered vessel and enhanced with sophisticated equipment for oceanographic, meteorological, and geophysical observation. Its excellent navigational performance, high endurance, and superior resistance in icy conditions, have enabled it to conduct long-term observation voyages across wide areas since 1997. It is used for oceanographic surveys in the Antarctic, Indian, Arctic and Pacific Oceans. From August 2003 to February 2004, the *Mirai* undertook an oceanographic observation cruise around the Southern Hemisphere and obtained valuable data and knowledge on seawater, heat and mass transport between the Antarctic Ocean and the Pacific, Indian, and Atlantic Oceans[7].

In the Arctic Ocean, the *Mirai* undertook 16 cruises in the 21 years between 1998 and 2018. While not being an icebreaker, it has conducted research and study on the effect of melting sea ice in the Pacific Arctic region where the sea ice retreat has been prominent. It also deployed and recovered subsurface mooring systems to acquire data in sea ice areas during periods when they are inaccessible to vessels, so that it could record changes associated with the increase and decrease of sea ice throughout a whole year. The valuable data obtained was released to the public, and its analysis results produced many findings. For example, as sea ice retreats, warming and freshening of the surface water are accelerated, intensifying ocean flow and eddy mixing. Changes in ocean circulation have impacted the transport of heat, freshwater, and nutrient sources for living organisms. Ocean waves and storm surges, which were nonexistent when the ocean was covered with sea ice, have become problematic in the coastal regions of the Arctic.

Ocean acidification is the one of the most significant issues among ongoing environmental changes in the Arctic. Through international cooperation, the observations of the Arctic Ocean, including that of *Mirai*, have revealed that the Canada Basin[8] in the Pacific Arctic region has experienced the most rapid acidification. As atmospheric carbon dioxide (CO_2) levels increase, the CO_2 that is absorbed by the ocean also increases because of sea ice melt[9]. In addition to this usual ocean acidification process, increasing inflow of fresh water originating from sea ice melt and river runoff lowers calcium carbonate concentration in the Canada Basin, which also contributes to acceleration of ocean acidification. It is already affecting the marine ecosystem. For example, laboratory experiments demonstrate that ocean acidification weakens the skeletons of organisms. Many countries have been conducting research on the impact on organisms *in situ*.

Japan has been conducting advanced monitoring of sediments including plankton since 2010 (Figure 1-8), particularly in the Pacific Arctic region (the western Canada Basin) where sea ice melt has a significant impact on ocean acidification. It is expected that the impact of ocean acidification will be made clearer by analyzing the data along with that of sea ice and the ocean environment obtained concurrently. In October 2018, AMAP published Assessment 2018: Arctic Ocean Acidifi-

7 e.g. Katsumata and Fukasawa, Prog. Oceanogr., 2011

8 The Canada Basin is a deep oceanic basin in the Arctic Ocean, extending from 70 to 85 degree north latitude and from 120 to 180 degree west longitude off the coast of Alaska and Canada. Its depth is 3,000 to 4,000 m.

9 Yamamoto-Kawai et al., Science, 2009.

Figure 1–8 Sediment Trap Mooring System to sample falling solid particles in the ocean.

cation, which summarized up-to-date information on ocean acidification in the Arctic[10]. The report states that in light of accelerating ocean acidification and its consequences, mitigation actions for ocean acidification should include reduction of anthropogenic CO_2, just as with global warming mitigation measures.

Japan has been conducting observation and research in the Arctic using oceanographic research vessels including the *Mirai*, focusing on the phenomena caused by the loss of sea ice and its effects, contributing to various scientific findings. At the same time, Japan has obtained data of the ice-covered area, participating in research cruises on icebreakers with international cooperation, installing drifting buoys on sea ice for automatic observations, etc., and published its findings. For example, JAMSTEC has been conducting observation using drifting buoys since the 1990s in the ice-covered area. The findings on the correlation between sea ice melt and heat transport between the ice-covered area and the oceans has been published[11].

The pace of sea ice retreat in the Arctic Ocean and consequent environmental changes are exceeding past projections. It is now expected that by mid-century the Arctic Ocean will be ice-free in summer. It will be in an undeniably different state from current conditions. We do not have enough data and knowledge to predict when, to what extent, and how the ice will retreat. To make an accurate prediction, several important processes should be understood to fill in pertinent scientific knowledge gaps. For example, there are not enough data and knowledge on distribution of the thickness of sea ice and correlation between sea ice and the ocean. Such a lack of knowledge impedes development of further sophisticated and more accurate sea ice and climate models. It is imperative to develop observation systems to understand those processes.

Autonomous underwater vehicles (AUVs) are used for observation of the ocean under sea ice. JAMSTEC is carrying out the development of small and lightweight "underwater observation drones" for ocean observation beneath sea ice and conducting necessary preliminary studies. For example, to operate an underwater drone beneath sea ice, it is necessary to identify its precise location. A navigation

10 AMAP, 2018. AMAP Assessment 2018: Arctic Ocean Acidification. Arctic Monitoring and Assessment Programme (AMAP), Tromsø, Norway. vi+187pp

11 Kikuchi et al., Deep-Sea Res., 2007. and Kawaguchi et al., Polar Sci., 2012.

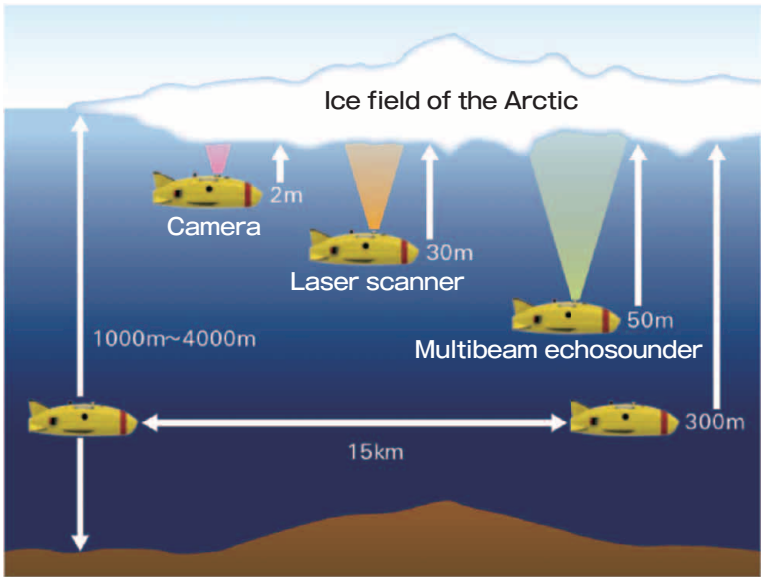


Figure 1-9 Schematic Illustration of comprehensive observation using multiple underwater observation drones.

system and an electromagnetic modem system for identification of location beneath sea ice are being developed. The near-term goal is to deploy an underwater drone to observe the ocean beneath sea ice. In the longer term, comprehensive observation by deploying multiple underwater drones from ice-edge to beneath sea ice is envisioned (Figure 1-9).

With increased world interest in the Arctic, various international conferences are being held to discuss research activity on the Arctic and its interplay with society. The annual Arctic Circle Assembly, hosted by Iceland since 2013, is an international gathering on the Arctic. Japan has participated in the Assembly since 2014 and established a high profile. Japanese Ambassadors in charge of Arctic Affairs have given speeches and the ArCS has held sessions and given presentations. At the latest Assembly held on October 19-20, 2019, Mr. Taro Kono, Minister of Foreign Affairs of Japan, gave a keynote speech for the first time on Japan's Arctic policy. At the 2nd Arctic Ministerial Meeting held in Berlin on October 25-26, 2018, Mr. Masahiko Shibayama, Minister of Education, Culture, Sports, Science and Technology of Japan, reported on Japanese Arctic research activities. He proposed that Japan would host the 3rd Ministerial Meeting with Iceland as a co-host and it was approved[12]. Japan should continue its efforts to build an international presence in Arctic science.

(Takashi Kikuchi)

12 http : //www.mext.go.jp/a_menu/kaihatu/kaiyou/houdou/1410697.htm

2 Collaboration between Space and Maritime domain

Satellites high above the Earth provide various services, such as satellite communication systems, the global positioning system (GPS), and remote sensing and observation of the vast oceans.

On December 23, 2017, *Shikisai* (GCOM-C), a global climate change observation

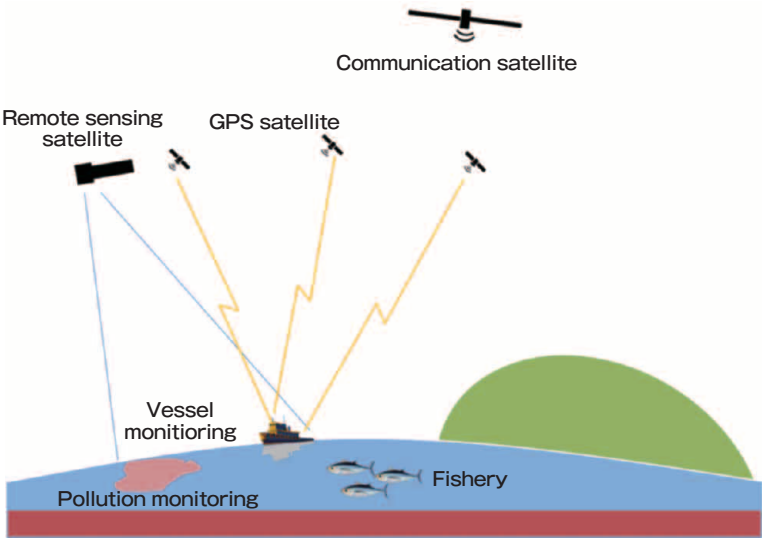


Figure 1–10 Use of Space-based Technologies for Ocean Observation

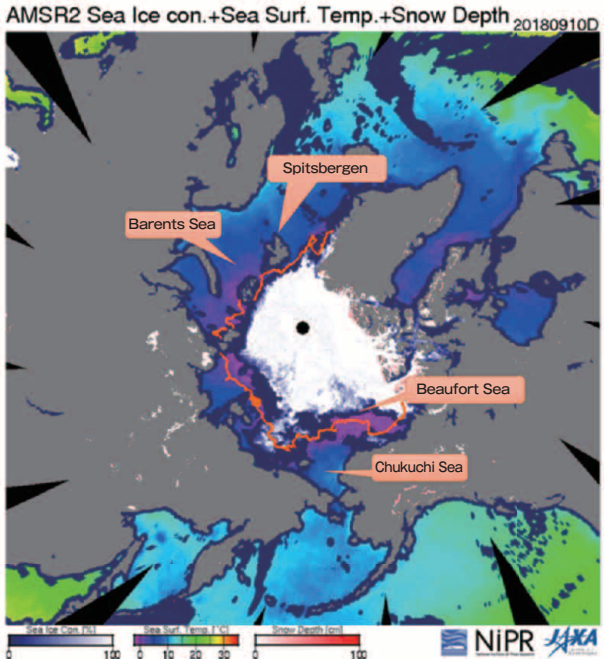


Figure 1–11 Images showing seawater temperature and sea ice in the Arctic region created using AMSR 2 (the Advanced Microwave Scanning Radiometer 2) on board *Shizuku*.
(Source: JAXA Homepage)

satellite, was launched. *Himawari*, a weather satellite with enhanced sensor capability and *Shizuku* (GCOM-W), a global change observation satellite, are already sending observation data from space. With the addition of *Shikisai*, Japan has come to own satellites with various wavelength bands and observation scopes. Japan has entered a new age of ocean data collection by its own satellites.

Moreover, satellites are used to collect vessel identification data in the vast oceans from space. This provides a comprehensive and perspective situational awareness unlike any before.

In the satellite communications arena, overseas ventures are exploring high-speed communication services using small satellites and attracting investment at an accelerating rate.

As for geo-spatial positioning services, in addition to the ubiquitous United States operated GPS satellite system, the Japanese Quasi-Zenith Satellite System (QZSS)[13], *Michibiki*, provides high precision regional positioning services and it is anticipated that such use will expand in years to come.

Against this background, the Third Basic Plan on Ocean Policy formulated in May 2018 refers to space technologies in many instances, including the collaboration between space and maritime policies, promotion of R&D aimed at realizing Society 5.0[14], enhancement of Maritime Domain Awareness (MDA)[15], and R&D of high-speed communications technologies using satellites in order to transmit large volumes of oceanographic data. Considering the above, this article provides an overview of contributions of space technologies to ocean governance, from environmental monitoring to vessel surveillance.

13 QZSS is a Japanese satellite positioning system composed mainly of satellites in quasi-zenith orbits (QZO). By flying a multiple number of satellites that take turns, one satellite is above Japan all the time. It is compatible with the GPS system and works as an augmentation system.

14 A human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space.

15 Maritime domain awareness is defined by the International Maritime Organization as the effective understanding of anything associated with the maritime domain that could impact the security, safety, economy, or environment.

1 Current Status of Collaboration between Space and Maritime domain

Satellite communications/broadcasting, providing positioning data, and observation of a broad area by satellite are among the space-based technologies most pertinent to ocean observation.

First, advancement in satellite communications has enabled remote condition monitoring of shipboard machinery (e.g. failure prediction) via the Internet of Things (IoT). It has contributed to the establishment of continuous monitoring of vessel integrity, and diversification of shore to ship communications, such as image transmission via high-speed Internet connection using broadband networks.

In addition to communications services using traditional geostationary satellites such as Inmarsat, a British satellite communications company, provision of broadband networks using small low Earth orbit satellites are currently envisaged. For example, Oneweb, a U.S. global communications company, plans to provide a communications network using a constellation of a large number of small satellites. Unlike geostationary orbiters, such networks are suited for broadband communications due to low-latency and won't have the issue of low elevation angle in high latitude regions including the Arctic.

Second, as for positioning data services, the United States pioneered establishing GPS satellites services. In addition to the U.S.'s GPS and the Russian GLONASS, the European Union, China and others have launched positioning satellites and offer services of their own. Also in and around Japan, the four-satellite QZSS *Michibiki* became operational in 2018 and has been providing positioning data with high accuracy. Moreover, constellations of satellites such as China's *Beidu*, the EU's *Gallileo*, and India's *NAVIC* have come to be operational, adding satellites one after another.

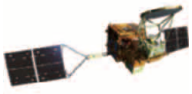
Since *Michibiki* satellites can provide positioning data with higher accuracy than the GPS satellites, the potential for application to autonomous navigation of the next generation of vessels is attracting worldwide attention.

Lastly, advancement in remote sensing technologies has brought about a diversification of targets, sensors, and methods in ocean observation. In addition to traditional observations using visible and infrared lights, global and regular observations of physical quantities of sea surface temperature, oceanic current, sea ice, ocean surface wind, sea surface salinity and others are being conducted using microwave radiometers, and global surface currents are observed using satellite radar altimeters.

The synthetic aperture radar (SAR) on board an Advanced Land Observing Satellite (ALOS), *Daichi*, is a sensor using backscattering of microwaves. Unlike optical sensors, it is independent of weather. It is used to track vessel movements in combination with other information such as Automatic Identification System (AIS) data, which will be described later. Currently, many SAR satellites are operational, including ALOS-2 of Japan, RADARSAT-2 of Canada, COSMOSKY-Med of Italy, and TERRASAR-X of Germany.

AMSR2, the Advance Microwave Scanning Radiometer (AMSR) on board the Satellite *Shizuku*, has expanded upon data collection functions of AMSR and AMSR-E

Table 1-1 Major Remote Sensing Satellite in Japan involved in Ocean Observation

Satellite	Daichi 2 (ALOS-2)  ©JAXA	Shizuku (GCOM-W)  ©JAXA	Shikisai (GCOM-C)  ©JAXA	Himawari -8/9  ©JMA
Sensor	Synthetic-aperture radar (SAR)	Advanced Microwave Scanning Radiometer 2 (AMSR2)	Second Generation Global Imager (SGLI)	Advanced Himawari Imager (AHI)
Satellite Type*	Polar orbit satellite	Polar orbit satellite	Polar orbit satellite	Geostationary satellite
Application	High resolution imaging, vessel monitoring, hydrographic observation (waves, etc.)	Sea surface temperature measurement (global and regional), sea ice observation	Sea surface temperature measurement, red tide detection, identification of fishing grounds	Sea surface temperature measurement (large area, high frequency), meteorological observation

* *While a polar orbit satellite operates at low altitude between 800-1,000km, a geostationary satellite operates at a height of 36,000 km, thus covering a larger area of the Earth.*

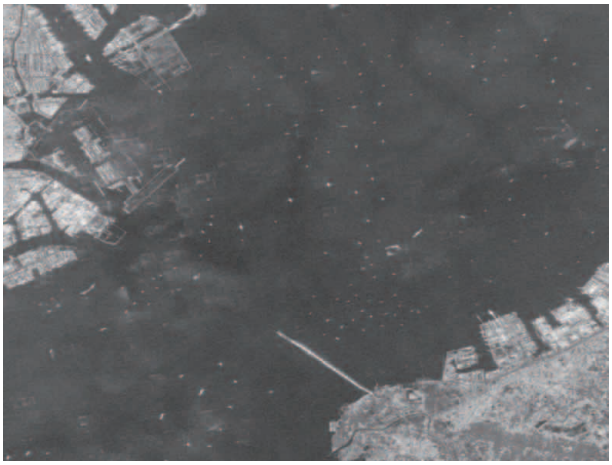


Figure 1-12 Radar image of vessels in Tokyo Bay taken from ALOS2 (*Daichi* 2)

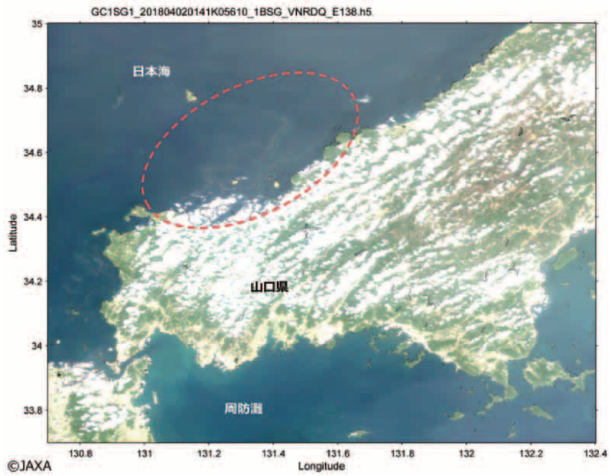


Figure 1-13 Image of red tide (encircled with red dashed line) taken with SGLI on board *Shikisai*.
(Source : JAXA Homepage)

on board the satellite *Midori 2* (ADEOS-2) and the United States' satellite *Aqua*, conducting global and continuous observation of sea surface temperature, sea ice coverage, and ocean surface wind. The U.S.'s SMOS[16] satellite also conducts observation of ocean salinity. As data from the microwave radiometer is weather -independent, while not high in resolution, it is used to understand climatic shifts such as El Nino.

The Second Generation Global Imager (SGLI) on board the Satellite *Shikisai* uses 17 wavelengths ranging from visible light to infrared light to observe and measure various physical quantities of ocean surface. It can estimate the amount of chlorophyll from ocean color and is used to estimate the growth of phytoplankton and primary productiv-

16 Soil Moisture and Ocean Salinity

ity. Those data are used to locate fishing grounds.

2 Future Outlook

As the satellite data user base broadens, it will be difficult to expect users to have detailed technical knowledge or an analysis environment for such data. Instead of providing raw data, it is likely that data will be processed into information users' needs and that a data analysis environment will be provided along with raw data so that users can easily analyze for themselves. As more small satellites are launched, the use of communications and remote sensing will expand. Combined use of small satellites and larger ones with high capability will progress. It is expected that leveraging cloud technologies, affordable platforms with high computing power will be provided and that using multiple satellite data or combinations of satellite data and other data, more information processing services will be offered.

① Bathymetry Survey

Survey of remote islands is usually conducted on site. However, it is difficult to survey frequently on remote islands in open water and foreign islands. Bathymetry data of coastal waters on difficult-to-access areas can be derived from high-resolution satellite images acquired with optical sensors. While Satellite Derived Bathymetry (SDB) is less accurate than laser or ultrasonic depth sounders, its use is expected to grow where on-site survey capacity is restricted or to improve operational efficiency.

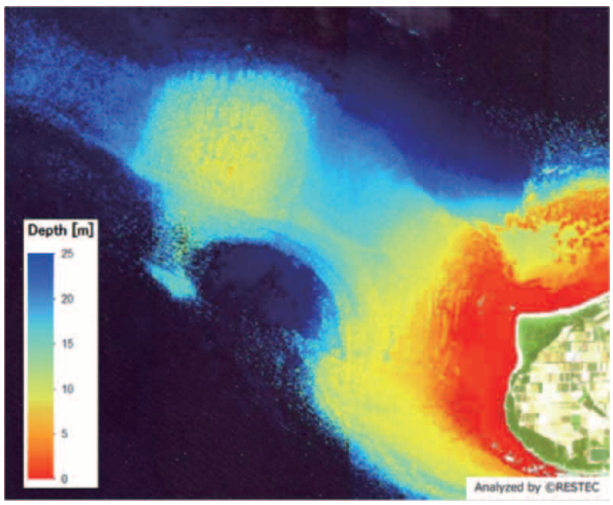


Figure 1-14 Coastal bathymetry derived from satellite Images

② Integration of Data by Data Assimilation

When we make weather maps, isobar lines are drawn connecting points of equal pressure using observed values at multiple spots. Isobars need to be drawn consistent with the observational data's dynamic rules. Output from a numerical weather forecast model is combined with observational data to produce an optimal estimate of atmospheric pressure fields. This technique is called data assimilation and it effectively produces spatially and temporally homogeneous grid data. Remote sensing data of satellites, except for geostationary satellite data, present spatially and temporally seamless data discretely distributed. Therefore, the remote sensing data are assimilated with outputs from numerical models to produce temporally and spatially contiguous physical quantities, which is processed to be a

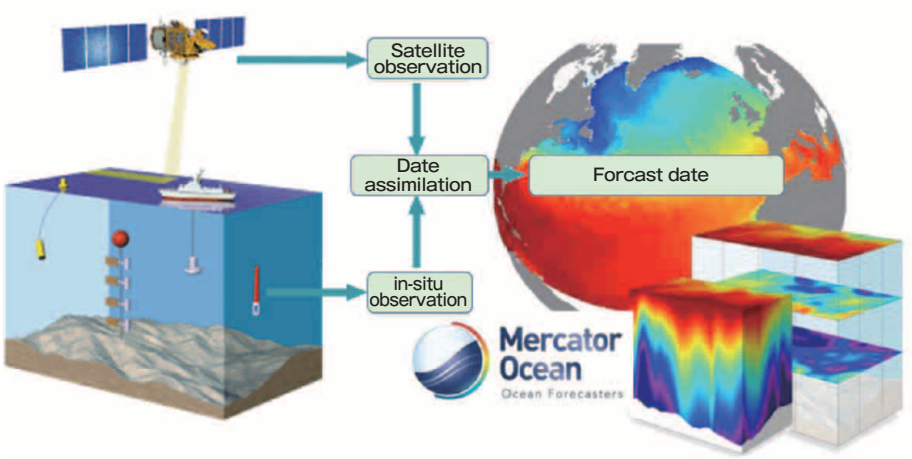


Figure 1-15 Schematic illustration of data assimilation of satellite and in-situ data through simulation modeling
(Source : Adopted from MERCATOR OCEAN literature)

grid data.

COPERNICUS, an Earth observation programme coordinated by the European Union (EU) that aims at providing comprehensive services from development to practical utilization of satellites, is providing satellite and *in-situ* data together with output of data assimilation from ocean modeling through the oceanographic information service MERCATOR OCEAN.

③ Application of small satellites

While, basically, services can be provided to any point on Earth from satellites' orbits, orbits suitable for a specific mission are limited. Geostationary satellites are capable of providing continuous observation and communications services with a broad scope from an orbit 36,000km above Earth's equator, but they also have disadvantages due to their high altitude. For example, satellite observation images have low resolution, signal delay reduces their data transmission capability, and their low elevation angle makes it difficult for ground stations in polar regions to receive signals. On the other hand, low-earth-orbit (LEO) satellites several hundred kilometers above the earth do not have those issues. However, since they are not always above the mission areas, observation time frame is severely limited.

In recent years, multiple LEO satellites (constellation) are used to provide services. Due to the higher cost of creating constellations with medium or large size satellites, in many cases small satellites are used.

LEO satellites also have disadvantages. They have less coverage than geostationary satellites and they pass above targets of observation and telecommunication within a limited timeframe. As a weather observation satellite, it could miss the target due to weather or movement.

To overcome those disadvantages, more and more service providers have come to employ satellite constellations, deploying multiple small satellites on orbits so that they pass above the target in high frequency. Mass production of smaller satellites has been contributing to cost reduction, accelerating the development by venture businesses and developing countries.

With regard to communications satellites, LEO satellites are closer to the Earth's surface and can secure high-speed services. OneWeb and others are moving forward with a concept for building an LEO satellite constellation to provide global satellite Internet broadband services.

④ Ship Tracking (Including fishing vessels)

VHF signals from an Automatic Identification System (AIS), used for collision avoidance, are also used to monitor vessel movements. The signals are received onshore and monitoring of vessels is only possible in coastal areas. Satellites receiving the AIS signals have made monitoring of the entire ocean possible. Private companies such as ExactEarth (Canada) and Orbcom (U.S.) offer vessel tracking services using satellite AIS, realizing frequent monitoring with multiple satellites.

Combining images of ships taken with the aforementioned SAR, satellite AIS information and others also contribute to maritime ship movement tracking. Many countries operate SAR satellites, including Japan's ALOS series. A U.S. satellite imagery provider, PLANET, provides daily high-resolution images using almost 200 satellites. A U.S. venture company, Spire, uses nanosatellites to receive AIS signals to reduce costs.

Global Fishing Watch (GFW), an initiative to monitor illegal, unreported and unregulated (IUU) fishing in partnership with Google (U.S.) and others, detects illegal fishing using satellite images as well as AIS and VMS.[17] It also uses nighttime lights observation findings of the NPP (National Polar-orbiting Partnership) satellite, which is capable of detecting fishing lights at night, especially fish collecting lamps, to monitor activities of fishing vessels.

In the realm of maritime security, space technology is used to enhance Maritime Domain Awareness (MDA). Under the concept of MDA, ship tracking services are provided by combining AIS data and satellite images and maritime surveillance platforms to collect and analyze comprehensive information on the oceans as well as vessels.

e-GEOS (EU) and MDA (Canada) (currently Maxar Technologies, U.S.) offer maritime domain awareness platforms for users in security fields. These maritime surveillance service platforms provide comprehensive analysis of AIS in-

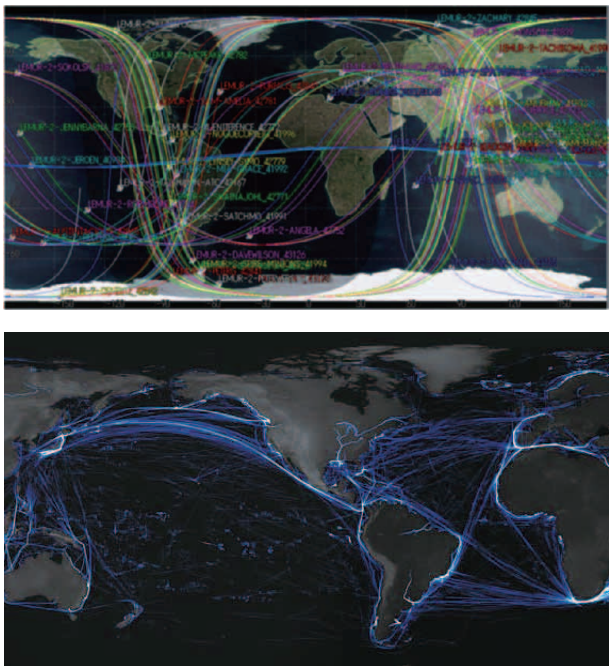


Figure 1-16 Satellite orbit of Spire Global, Inc. (top) and ship tracking information derived from the satellite (bottom).

Spire Global, Inc. collects ship positioning information all over the world by receiving AIS signals with a constellation of small satellites.

17 Vessel Monitoring System is a system to track and monitor the activities of commercial fishing vessels.

formation collected onshore and from satellite, integrated with vessel identification data, satellite images derived from SAR sensors and meteorological-oceanographic data.

As noted above, high temporal-spatial resolution surveillance systems and broadband communications with the use of small satellites, and high accuracy positioning information provided by satellites such as *Michibiki* are closing the gap between the needs of users in marine science and maritime security and the services satellites provide. As satellite technologies advance, it will become more important to create platforms, which leverage analysis of data in combination with IoT sensors, use of AI, and application of analysis techniques such as data assimilation.

(Eiichi Sakata)

COLUMN 1 International Competition for Deep-Sea Exploration with Unmanned Solutions

The deep sea is the last frontier on Earth. The Shell Ocean Discovery XPRIZE competition with the aim to advance deep sea exploration held its final round at the end of 2018. The XPRIZE Foundation, the organizer of the competition, was founded in 1995 in the U.S. and plans to have 5 competitions related to the oceans. In the past, it had organized competitions for oil spill cleanup methods (2010) and pH sensors to detect ocean acidification (2013) and has given out prizes of millions of dollars to the winning teams.

Unmanned Robots Working in an Extreme Environment

The deep sea with low temperature, immensely high pressure, pitch-black darkness, and no radio wave reception, conceals many mysteries, such as unknown living organisms, natural resources, shipwrecks, and wreckages of crashed planes. Affordable deep sea technologies for fast and accurate ocean floor exploration is needed both for the development of resources as well as for the preservation of the marine environment.

The US$7 million Shell Ocean Discovery XPRIZE competition was launched in late 2015 with the oil and gas major Royal Dutch Shell pledging $6 million and the US National Oceanic and Atmospheric Administration $1 million for the Bonus Prize. Following the application screening and Round 1 Technology Readiness Test, the 32 teams that have entered the competition were whittled down to 9 teams. Furthermore, only 5 teams out of the 9 were able to take on the challenges of Round 2, the final round.

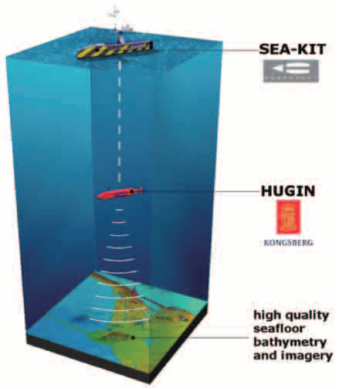
Round 2 was conducted off the coast of Kalamata, Greece from November 2018 to February 2019. At a depth of 4,000m, teams were required to map a minimum of 50% (250km^2) of the 500km^2 competition area at a resolution of 5m and collect at least 10 photos of underwater targets within 24 hours. The teams also had to create a bathymetric map from the data collected and submit it within 48 hours after the initial 24 hours was over. Stringent requirements were imposed. The equipment had to fit into a single 40 ft. container and be capable of autonomous operation. In addition, no human entry into the competition area was allowed and equipment had to be deployed from land or air.

At the award ceremony held on 31st May 2019 at the Musée Océanographique in Monaco, it was announced that the GEBCO-Nippon Foundation Alumni Team had won the competition and was awarded the top prize of $4 million. Team Kuroshio, a collaboration among industry, academia and government in Japan, came in second place to earn the $1 million prize. Their bathymetric maps will be used for collaborative research to install a next generation neutrino telescope in the Aegean Sea, KM3NeT*.

The GEBCO-Nippon Foundation Alumni Team, led by the alumni of The Nippon Foundation/GEBCO (General Bathymetric Chart of the Oceans) Ocean Bathymetry training program, saw 78 people, including industry partners, coming together from 22 countries. The team had combined existing and emerging technologies to develop an unmanned surface vessel with a capability to transport, deploy and retrieve an AUV and acted as a positioning vessel, telecommunications portal and data collection platform. By using this system, the team succeeded in mapping 278.9km^2 at the specified resolution and taking 30 photos of underwater targets. The deepest point at which the team had managed to map was at a depth of 4,134m − no other team had managed to surpass 4,000m or even come close to that depth.

GEBCO is the only organization working on providing the official bathymetric maps of the world's oceans. In partnership with the Nippon Foundation, it promotes the Nippon Foundation-GEBCO Seabed 2030 project, which aims to produce the definitive map of the world ocean floor by 2030. In less than 2 years since the project had started, it managed to gather 32,000,000km^2 of bathymetric data from companies and governments − an area larger than the entire landmass of the African continent. The area of the seafloor that has been mapped has more than doubled from 6 percent at the start of the project to 15 percent with the release of the newest version of the GEBCO grid in April 2019. It is hoped that there will be future collaborations between teams that have participated in XPRIZE to work towards the common goal of mapping the world's ocean.

*: Neutrino telescope of a cubic kilometer scale. Its infrastructure will consist of the neutrino telescope and an associated sciences infrastructure supporting one of several science nodes.



Concept of the GEBCO-NF Alumni Team
(Source : https://www.gebco-nf.com/news-and-updates)

Group Photo of the GEBCO-NF Alumni Team
(Courtesy of The Nippon Foundation)

2 Marine Environmental Conservation

Ocean Environmental Conservation Initiatives

1 Ocean Environmental Conservation Initiatives in Japan

1 The Third Basic Plan on Ocean Policy

On May 15, 2018, the Third Basic Plan on Ocean Policy was approved by the Japanese Cabinet. The revision was made in accordance with the Basic Act on Ocean Policy, which requires a review of the Basic Plan every 5 years.

The environmental conservation aspect was enhanced in the Third Basic Plan. For example, while the word "environment" was used only 135 times in the Second Basic Plan, the number has more than doubled to 285 times in the Third Basic Plan. In the Second Basic Plan, the focus was placed on balancing development and the preservation of the oceans, reflecting the line of thinking that those are conflicting values and the balance was tipped somewhat toward development. The Third Basic Plan includes a separate section for "maintenance and conservation of marine environment." In the preamble of the Third Basic Plan, the current situation warranting the revision was recognized. Ocean environment issues such as ocean acidification, loss of biodiversity, and ocean plastics pollution have been coming to the forefront and, with increased domestic and international attention, discussions are intensifying in the international arena, including the U.N.

Reflecting recognition of the current situation, the Third Basic Plan devotes 6 full pages to various policy measures on maintenance and conservation of the marine environment. It is divided into 2 sections : conservation of the marine environment and comprehensive ocean management. The Cabinet Office, the Ministry of Foreign Affairs, the Ministry of Economy, Trade and Industry, the Ministry of Land, Infrastructure, Transport and Tourism, the Ministry of Education, Culture, Sports, Science and Technology, the Ministry of Agriculture, Forestry and Fisheries, and the Ministry of the Environment each commits itself to the conservation of the ocean environment. In light of the importance of conservation of marine biological diversity in areas beyond national jurisdiction (BBNJ) and sustainable use of resources, the whole government (6 ministries, excepting the Ministry of Economy, Trade and Industry) will actively participate in discussions at the intergovernmental meetings to develop new international agreements. The Ministry of Economy, Trade and Industry is to review the whole concept of environmental impact assessment in association with the future development of deep-sea resources.

2 Head-of-State Diplomacy

As the Third Basic Plan recognizes, issues on conservation of the ocean envi-

ronment have been gathering domestic and international attention, and discussions at international forums, including the U.N., are intensifying. What prompted such momentum was Future of the Ocean : Impact of Human Activities on Marine Systems, the G7 Science Academies' statement issued in advance of the G7 meeting held in Germany in 2015. Recognizing that the rising atmospheric CO_2 level is causing environmental degradation of the oceans, including ocean warming, acidification, deoxygenation and nutrient enrichment, it recommended accelerating implementation of necessary mitigating measures. It also recognized the problem of coastal pollution, including plastic debris, and the problem of illegal, unregulated and unreported (IUU) fishing. The necessity of advancing marine science was pointed out as well.

As a result, the G7 Leaders' Declaration adopted an action plan to combat marine litter. In response to that, at the meeting of the G7 Ministers of Science, advancing scientific observation and research about the future of the oceans, including marine debris, was recognized as essential. The G7 expert working group on ocean science was established at the G7 in Germany in 2015 and it has reported its findings and recommendations at subsequent G7 meetings.

The momentum continued on to the G7 Japan in 2016. Marine litter was one of the main themes discussed at the G7 Environment Ministers' Meeting in Toyama. At the G7 Science and Technology Ministers' meeting in Tsukuba, vigorous discussions were held concerning advancement of ocean science, and the G7 Ise-Shima Leaders' Declaration expressed their support of scientific work to enhance global ocean observation and assessment.

The G7 Canada meeting in 2018 took up the issues of climate change, oceans, and clean energy under a single theme. At the G7 Environment, Energy and Ocean Ministers meeting held in Halifax in September, proactive policy measures to address the ocean environment issue were presented. Mr. Masaharu Nakagawa, the Minister of the Environment of Japan, attended the meeting and emphasized Japan's efforts to conserve the ocean environment to countervail Japan's not endorsing the Ocean Plastics Charter[18] drawn up at the G7 Charlevoix summit held in June 2018.

Japan's international performance in ocean conservation efforts can be seen not only at the G7 but also at the G20. In preparation for the G20 to be held in Japan in 2019, the Science Council of Japan, Japan's science academy, is drafting recommendations, just as the G7 Science Academies' Statement was prepared before the G7 in Germany. Focusing on remedies for coastal and marine ecosystems, and conservation of the ocean environment, the recommendations will be finalized in March. It is expected that the ocean environment issues will be taken up extensively at the G20 Environment Ministers' Meeting to be held in Nagano on June 15–16 and the G20 Leaders Meeting held on June 28–29. An international consensus on ocean environment conservation at the G20 will be a great step toward future sustainable use and conservation of the oceans.

18 The G7 countries except Japan and the U.S. signed the Charter. For details, see the featured article.

3 U.N. Initiatives

The Sustainable Development Goals (SDGs) are now the guiding principles for

all sectors around the world. While the preceding Millennium Development Goals (MDGs) focused on the developing nations, SDGs target conservation of the environment and development of sustainable society with the involvement of the developed countries. Thanks to this expansion of the scope, every person in the world now can participate in the effort. Moreover, substantially more subjects are covered and the issues on the oceans are explicitly addressed.

The SDG14 mainly addresses ocean ecosystems and includes 7 specific and 3 overarching targets. The SDG14 is so ambitious that while, in principle, the goals are to be achieved by the end of 2030, some goals are set to be achieved by the end of 2020. For example, SGD14.5 sets a goal to conserve at least 10 per cent of coastal and marine areas by 2020, which can be considered in line with the 2020 Aichi Biodiversity Targets of the Convention on Biological Diversity (CBD). However, the CBD targets 10 per cent of the waters of each country, while the approximately commensurate high seas area is not included. It is hard to achieve SDG14.5 without accelerating discussion on biodiversity in the high seas (BBNJ).

Small Island Developing States (SIDS) have made their presence felt in the SDG 14 discussion as well as the BBNJ negotiations and the discussion on the U.N. Framework Convention on Climate, in particular at the Ocean Conference held at U.N. Headquarters in New York in 2017 to support implementation of SDG14. A major outcome of the Ocean Conference is a registry system of voluntary commitments to achieve SDG14. As of January 15, 2019, 1,506 commitments are registered, of which only 11 were registered by the Japanese government. As a country with the world's 6th largest Exclusive Economic Zone (EEZ), this level of commitment is not sufficient. When the registry is searched with the key word "Japan," 34 commitments are identified. This indicates the private sector is much more committed to the commitments. The next Ocean Conference is to be held in Lisbon, Portugal in 2020. Industry, government, and civil society of Japan are expected to be more actively involved.

There is a broad range of activities with regard to the oceans in the U.N. A noteworthy development in 2018 was designating the 10-year period starting in 2021 as the U.N. Decade of Ocean Science for Sustainable Development, which succeeds the U.N. Decade on Biodiversity. It is notable that the actions of the decade are dedicated to ocean science. The Intergovernmental Oceanographic Commission (IOC) of UNESCO will lead the initiative. Japan, as one of the founding members of the IOC, has been an active contributor. It is expected that academia in Japan will lead the initiative by establishing a domestic framework for implementation in preparation for the start in 2021.

4 Private Sector Initiatives

The private sector is also very active in the effort to conserve the ocean environment. The World Economic Forum, also known as the Davos Forum, generated the momentum. In 2016, the forum issued a warning that by 2050 the oceans were expected to contain more plastics than fish by weight and advocated the importance of the circular economy. Since then it presented various recom-

mendations concerning the oceans and has been leading global discussion.

Meanwhile, the Our Ocean Conference (OOC) is also facilitating active discussion focusing on the oceans. The conference was started in 2014 under the initiative of Mr. John Kerry, the Secretary of State in the Obama Administration. The OOC strives to inspire stakeholders in all the sectors including government, industry, and academia to discuss voluntary efforts to conserve the ocean environment, and prompt the world to jointly commit to actions to conserve the oceans.

The 5th OOC was held in Bali, Indonesia in October 2018. From Indonesia, the host country, President Mr. Widodo, Minister of Foreign Affairs Ms. Retno Marsudi, and Minister of Maritime Affairs and Fisheries Ms. Susi Pudjiastuti attended. Mr. Waga, President of Nauru, Environment, Maritime Affairs and Fisheries Commissioner Mr. Karmenu Vella of European Commission, Minister of Foreign Affairs Ms. Ine Eriksen Søreide of Norway, the aforementioned Mr. John Kerry (currently a visiting distinguished statesman at the Carnegie Endowment for International Peace), and Prince Charles of the United Kingdom (via video message) gave keynote speeches. In addition, heads of states from 5 countries including Palau and Micronesia, cabinet members from past and future OOC host countries, such as Norway and Chile, Prince Albert II of Monaco, and many other dignitaries attended the conference.

According to the OOC website, 305 concrete initiatives were listed overall and the monetary contributions amounted to US 10.7 billion dollars. Moreover, the registered initiatives will create 14 million square kilometers of marine protected area in total. As total ocean area is about 3,600 million square kilometers, if all the initiatives succeed, it will add 5% of the total ocean to marine protected areas.

Mr. Yoichi Satake, Deputy Director-General, National Ocean Policy Secretariat, Cabinet Office, and Mr. Yasuo Takahashi, Vice-Minister for Global Environmental Affairs, Ministry of the Environment attended the conference from Japan. Atushi Sunami, President of the Ocean Policy Research Institute of the Sasakawa Peace Foundation, and 2 representatives of the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) also attended the conference.

While only a few statements were offered from Japanese attendees at the previous conference, Japan this time demonstrated a significant presence with more speeches and also reported 31 initiatives, more than 10% of the total (Table2-1). For example, JAMSTEC reported 8 initiatives, including development of methods to automatically analyze microplastics using hyperspectral cameras. It is expected for Japan to continue to showcase its initiatives actively at future conferences.

Table 2-1 Number of initiatives Japan presented and reported at the 5th OOC (according to the OOC website).

Fields of Initiatives	Maritime Safety	Marine Protected Area	Sustainable Fisheries	Ocean Pollution	Sustainable Ocean Economy	Climate Change
Japanese Government	5	1	4	2	1	0
JAMSTEC	3	0	0	2	0	3
Others	7	0	0	0	2	1

2 Climate Change and the Oceans

1 Outcome of COP24

Seawater absorbs far more heat than the atmosphere. Therefore, the oceans bear the greatest brunt of climate change. It would not be an overstatement to say that understanding the oceans leads to the understanding of climate change. However, the role of the oceans in the U.N. Framework Convention on Climate Change does not reflect their significance. For example, in the report on COP24 held in Poland at the end of 2018 prepared by Japanese government, very few mentions were found about oceans, e.g. the display regarding commercialization of offshore wind power in the Japanese Pavilion. The Japanese government's report on COP24 held in Poland at the end of 2018 made very few mentions of the oceans, touching on the commercialization of offshore wind power display in the Japan Pavilion.

On the other hand, the side events were well received, especially those associated with "Oceans Action Day," which had approximately 300 attendees. In detail, the Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF), in coordination with the Global Ocean Forum (GOF), the Oceano Azul Foundation, and IOC-UNESCO, and others, hosted this ocean and climate policy event on December 8, 2018. It has convened every year since 2015. "Interlinkages between Oceans and Climate Change" was the main theme of this year's event. Participants heard presentations from about 60 speakers, including representatives of international organizations, governments, academia, and NGOs involved with the issue of climate change and oceans. Topics discussed from the perspective of the oceans included mitigation and adaptation measures of climate change, scientific knowledge, financing, and the issue of population displacement.

In the High Level Opening Session held in the morning, Mr. Tomasz Chruszczow, COP 24 Special Envoy for Climate Change and High-level Climate Champion from Poland, the host country, and Mr. Peter Thomson, the UN Secretary General's Special Envoy for the Ocean, made speeches. From Japan, Yoshihisa Shirayama of the Japan Agency for Marine-Earth Science Technology (JAMSTEC) took the podium and emphasized the importance of collaboration among various stakeholders. Atsushi Sunami, President of OPRI-SPF, summarized the discussion.

In the afternoon, three sessions on the major themes of the Roadmap to Oceans and Climate Action (ROCA) : "Scientific Knowledge," "Adaptation and Population Displacement," and "Nationally Determined Contributions (NDCs) and Financing" were held in the Japan Pavilion. Miko Maekawa, Senior Fellow of OPRI-SPF, chaired the "Adaptation and Population Displacement" session. Mr. Hans-Otto Pörtner, Co-Chair of the IPCC's Working Group II, made a presentation outlining the *Intergovernmental Panel for Climate Change (IPCC) Special Report on Global Warming of 1.5°C* in the "Scientific Knowledge" session. In the "NDGs and Financing" session, it was discussed how to incorporate the target for the ocean contents into NDCs.

Atsushi Sunami, President of OPRI-SPF, chaired the High Level Closing Session. Ms. Susi Pudjiastuti, Minister of Maritime Affairs and Fisheries of Indonesia, Mr. Luis Alfonso de Alba, U.N. Special Envoy for the Climate Change Summit, and others made statements emphasizing the importance of the oceans.

Figure 2–1 Speakers at the High Level Opening Sessions

Photo : (From left) Mr. Tomasz Chruszczow, COP 24 Special Envoy for Climate Change and High-level Climate Champion, Mr. Peter Thomson, the UN Secretary General's Special Envoy for the Ocean, and Dr. Atsushi Sunami, President of OPRI-SPF

In addition, the side event "Blue Carbon - linking the latest science and policies," organized by OPRI-SPF, IOC-UNESCO, and others, took place as part of the Networked Oceans Action Day in the Japanese Pavilion on December 7th. Blue Carbon, which is the carbon captured by the world's oceans and coastal ecosystems, has been attracting attention as an effective global warming mitigation measure.

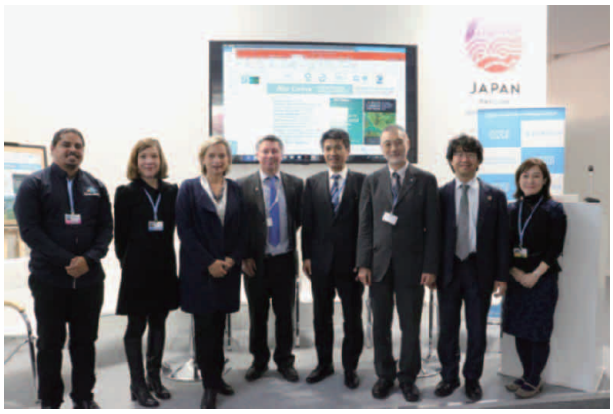


Figure 2–2 Speakers at the side event "Blue Carbon - linking the latest science and policies," held as part of the Networked Oceans Action Day.

The *IPCC Special Report on Global Warming of 1.5°C* highlighted that climate change of +1.5°C has significantly less impact than of +2.0°C on both Earth's ecosystems and human society. The participants, especially representatives of island nations, were alarmed by the prognosis that even 1.5°C of global warming would have significant adverse effects on coral reefs (Figure 2–3).

At COP24, discussion was focused on the drafting of detailed rules to implement the Paris Agreement, the summary of the *Talanoa Dialogue* initiated at COP 23, and financial support for developing nations. Agreement on detailed rules was

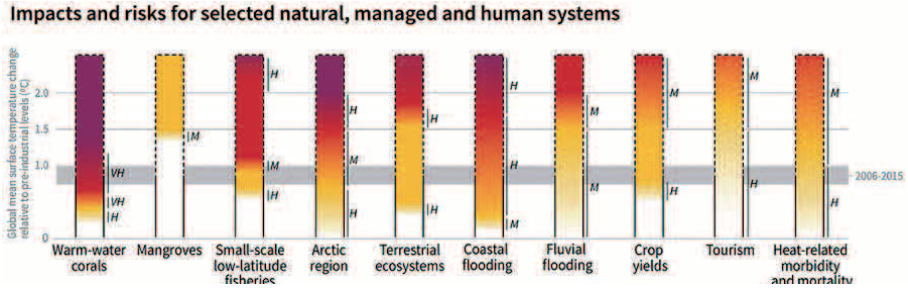


Figure 2–3 Assessment of the Difference between the Effects of 1.5°C and 2.0°C Global Warming. Source : IPCC1.5°C Special Report

The horizontal lines represent 2.0°C, 1.5°C, and 1.0°C temperature rise respectively from the top. Darker color of the bars indicates higher risk. Corals (far left) is at high risk even at the current 1.0°C temperature rise and expected to suffer significant impact at 1.5°C temperature rise.

reached in principle and all the signatories will advance climate change mitigation measures under the framework of the Paris Agreement after 2020. On the other hand, the *Talanoa Dialogue* didn't yield the desired outcome. The current CO_2 reduction plans proposed by the signatories are not sufficient to achieve the 2°C target and more aggressive reduction plans should be implemented. However, no agreement was reached on this matter. Moreover, the IPCC1.5°C Special Report, released immediately before COP24, didn't get much publicity at the conference. It is regrettable that the message from the scientists didn't penetrate the political arena. As for financing, it is agreed that negotiations will start in 2020.

2 Climate Summit

The year 2019 presents a potential tipping point for issues related to climate and oceans. The United Nations Climate Summit will be held on September 23rd at U.N. Headquarters. The U.N. is showing steady progress in preparation for this day, involving various discussion groups. It is expected that more representatives at the level of heads of states will participate than at the previous Summit and it would not be an overstatement to say that the future of the Earth's environment depends on the outcome.

The week of September 23rd coincides with the week when the IPCC discusses the Summary for Policy Makers of the Special Report on the Ocean and Cryosphere in a Changing Climate. For climatologists and oceanographers, this will surely be a milestone week. In addition, Ocean Obs'19 will be held in Hawaii in the week before. This conference is convened once a decade and plays an important role in navigating the future of marine science. In October, the 6th OOC will be held in Norway. EU has been proactive in addressing ocean environment issues. Attention will be focused on what kind of new initiatives are registered and announced as well as on the actions of the UK, which is to leave the EU. Furthermore, the second U.N. Ocean Conference will be held in 2020. Then, the Decade of Ocean Science for Sustainable Development will start in 2021.

Figure 2-4 Progress of Preparation for Climate Summit 2019 (the Climate Summit is in the second column from the right)

Many relevant conferences are planned from one year before the Summit.
(Source : https://www.un.org/en/climatechange/un-climate-summit-2019.shtml)

As outlined above, the world's activity related to the ocean environment and climate change is fast-moving. It is expected that Japan will act with a greater presence and play an important role in the safety and security of the world.

(Yoshihisa Shirayama)

Development and Outlook of the Blue Economy

The blue economy is defined as the "sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health.[19]" It has been attracting attention as a policy to revitalize the economy and promote growth of local communities hand-in-hand with protection of the oceanic environment and resources. The blue economy has been widely recognized by the international community since "Ocean-based economies" was prioritized in the action plan adopted at the United Nations Ocean Conference held in June 2017. In Article 3 of *Our Ocean, Our Future : Call for Action*[20] it was recognized that our ocean contributes to sustainable development and sustainable ocean-based economies, as well as to poverty eradication, food security and nutrition, maritime trade and transportation, decent work and livelihoods. Article 13 states that ocean-based economies are built upon activities such as fisheries, tourism, aquaculture, maritime transportation, renewable energies, marine biotechnology, and seawater desalination.

Since the blue economy comprises a broad range of activities, it is necessary to employ a cross-sectorial approach, inter-organizational cooperation, and/or interdisciplinary collaboration. A revamp of policies and systems is needed as well. Ocean and coastal resources, geographical and socio-economic characteristics and conditions should be fully taken into consideration, depending on these specific regional factors. It is not a novel concept. It also incorporates existing policies and efforts. What follows is a summary of recent progress of the blue economy around the world, challenges for its effective implementation in Japan and overseas, and the outlook for its future.

1 Development of the blue economy in the World

1 History of the blue economy in the International Community

The basic concept of a blue economy was already introduced in Agenda 21, adopted at the Rio Earth Summit (the United Nations Conference on Environment and Development) in 1992[21]. The Plan of Implementation of the World Summit on Sustainable Development adopted at the Johannesburg Summit in 2002 also regards oceans as an integrated component of the Earth's ecosystem critical for human well-being.[22] At the 2012 United Nations Conference on Sustainable Develop-

19 http://www.worldbank.org/en/news/infographic/2017/06/06/blue-economy

20 United Nations. 2017. Our ocean, our future : call for action. A/RES/71/312.

21 Paragraph 1 of Chapter 1 on Protection of the Oceans, it declares that "the marine environment - including the oceans and all seas and adjacent coastal areas - forms an integrated whole that is an essential component of the global life-support system and a positive asset that presents opportunities for sustainable development," underlining the importance of the oceans and coastal resources for achieving sustainable development.

22 Paragraph 30 states "Oceans, seas, islands and coastal areas form an integrated and essential component of the Earth's ecosystem and are critical for global food security and for sustaining economic prosperity and the well-being of many national economies."

ment (Rio + 20), environmentally responsible economic development, or the green economy, drew attention when a separate section was created for it in the outcome document, *The Future We Want*[23], as a measure for sustainable development and poverty eradication. During the preparation for Rio + 20, Small Island Developing Nations (SIDS) and New Zealand argued that the blue economy should be clearly specified as a part of the green economy. SIDS had been developing an argument for making economic development through sustainable use of the oceans and coastal resources a pillar of regional and international cooperation at the SIDS Conferences sponsored by the United Nations. While the Action Plan of the 2012 Summit did not include the term "blue economy," the perspective, which would evolve into the concept of the blue economy, began to spread throughout the international community[24].

At the same time, the outcome document adopted at the SIDS International Conference and reports on the blue economy published by international organizations such as the World Bank and OECD, provided material for policy discussion. Those documents and reports share the common ground of positioning the blue economy as an important policy measure.

In 2014, the Third SIDS International Conference held in Samoa resulted in the outcome document, "S.A.M.O.A. Pathways," in which the Green Economy was recognized as a valuable tool for achieving sustainable development, and it referred to "a sustainable ocean-based economy" in lieu of a "blue economy.[25]" Sustainable Development Goals (SDGs), adopted at the 2015 Sustainable Development Summit, set a goal to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" as Goal 14 (SDG14). Target 14.7 of SDG14 was set to increase the economic benefits to small island developing states (SIDS) and least developed countries (LDCs) from the sustainable use of marine resources through sustainable management of fisheries, aquaculture and tourism by 2030. After having those policy discussions, advancement of "sustainable ocean-based economies" was explicitly included in the Action Plan adopted at the 2017 United Nations Ocean Conference. Ever since, the international community has broadened support and increased momentum to accelerate the blue economy through the deployment of policy measures and enhanced international cooperation.

2 International Community's Efforts Aimed at Achieving the Blue Economy

Political discussion facilitated by the United Nations has resulted in several endeavors to help implement the blue economy internationally. The Seychelles[26] has accumulated large debts since the 2008 financial crisis. Some nations have offered the Seychelles debt relief and/or bond swapping on the condition of conservation of its ocean and coastal environment. In January 2018, the government of Seychelles set up a Ministry of Blue economy and introduced a policy plan, the "Seychelles Blue Economy Strategic Roadmap and Implementation," which made renewing the existing framework for ocean and coastal resources utilization a priority issue[27].

23 United Nations. 2012. The future we want. A/RES/66/288.

24 World Bank and United Nations Department of Economic and Social Affairs. 2017. The Potential of the Blue Economy : Increasing Long-term Benefits of the Sustainable Use of Marine Resources for Small Island Developing States and Coastal Least Developed Countries. World Bank, Washington DC.

25 United Nations. 2014. SIDS Accelarated Modalities of Action (SAMOA) Pathway. A/RES/69/15.

26 An archipelago country of 115 islands in the Indian ocean off the coast of eastern Africa

27 The Commonwealth. n.d.Seychelles Blue Economy Strategic Roadmap and Implementation. http : //thecommonwealth. org / project / seychelles-blue-economy-strategic-roadmap-and-implementation.

In March 2018, the European Commission, along with the European Investment Bank (EIB) and others, launched Blue Finance principles to promote investments that support cooperation and dialogue in the field of environmental protection and conservation[28].

In September 2018, the World Bank created PROBLUE, a trust fund, to support the management of fisheries and aquaculture, marine pollution control, sustainable development of tourism, maritime transport and off-shore renewable energy sectors, as well as management of marine and coastal resources[29]. In addition to the World Bank, Norway and Canada contributed to PROBLUE. Other European countries also expressed their intention to contribute. Currently the World Bank's blue economy related portfolio is around USD 4.1 billion, with an additional USD 1.5 billion in the pipeline to support projects to advance the sustainable use of marine and coastal resources[30].

3 The High Level Panel for a Sustainable Ocean Economy and the Sustainable Blue Economy Conference

Two notable gatherings in 2018 illustrate the evolution of the framework for developing countries to take the initiative, seeking cooperation with developed countries and international organizations.

① The High Level Panel on Building a Sustainable Ocean Economy

Norwegian Prime Minister Erna Solberg held a press conference in January 2018 to announce the plan to launch the High Level Panel on Building a Sustainable Ocean Economy to advance international efforts to address ocean crisis issues[31]. She expressed the intent to share Norway's experience of combining conservation and use of marine resources with the international community while combatting marine litter and microplastics. The High Level Panel consists of 12 heads of government, co-chaired by Prime Minister Solberg and President of the Republic of Palau Tommy Esang Remengesau, Jr. The Panel is made up of leaders from Australia, Chile, Fiji, Ghana, Indonesia, Jamaica, Japan, Mexico, Namibia, Norway, Palau and Portugal. The inaugural meeting was held in New York in September. The panel set up three goals : a shared understanding of the relationship between the ocean and the economy ; a recognition that economic production and ocean protection must be mutually supporting ; and a suite of innovations in policy, governance, markets and incentives. It was decided that the final report would be completed in 2020 and that the World Resource Institute in Washington, D.C. would act as Secretariat[32]. In November, the Institute of Marine Research in Norway held the "Science for Ocean Actions" Conference, a gathering of international scientists, to showcase and share knowledge from ocean-related fields in order to advance the blue economy[33].

② The Sustainable Blue Economy Conference

Kenya, with its co-hosts Canada and Japan, held the Conference on the Sustainable Blue Economy in Nairobi from November 26 to 28, 2018. The conference

28 http : //www.eib.org/en/infocentre/press/releases/all/2018/2018-060-blue-finance-principles-unveiled-to-support-ocean-health-and-investment.htm

29 http : //www.worldbank.org/en/topic/environment/brief/the-world-banks-blue-economy-program-and-problue-frequently-asked-questions

30 World Bank. 2018. The World Bank's Blue Economy Program and PROBLUE : Frequently Asked Questions. https : //www.worldbank.org/en/topic/environment/brief/the-world-banks-blue-economy-program-and-problue-frequently-asked-questions.

31 Government of Norway. Norway establishes international high-level panel on sustainable ocean economy. 25 January 2018. https : //www.regjeringen.no/en/aktuelt/norway-establishes-international-high-level-panel-on-sustainable-ocean-economy/id2587691/.

32 World Resource Institute. Heads of Government Unite for the Ocan and People Who Depend on It. 24 September 2018. https : //www.wri.org/news/2018/09/release-heads-government-unite-ocean-and-people-who-depend-it.

33 Norway Today. Prime Minister Solberg spoke to the marine experts. 1 December 2018. http://norwaytoday.info/news/prime-minister-solberg-spoke-to-the-marine-experts/.

brought together more than 16,000 participants from 184 countries, including heads of state and dignitaries. The theme of the conference, "the Blue Economy and the 2030 Agenda for Sustainable Development," was divided into nine sub-themes : 1) shipping, 2) employment, 3) cities, 4) energy, 5) marine life, 6) food security, 7) climate change, 8) maritime security, and 9) culture. The conference was held at the Kenyatta International Convention Centre. President Uhuru Kenyatta took the initiative to assure the success of the conference, passionately speaking at the opening and closing sessions and actively pursuing bilateral talks. Participants included seven heads of state and government from Kenya, Mozambique, the Seychelles, Somalia, Uganda, Tanzania, and Namibia and 84 Ministers. In addition, sessions were held by mayors and governors, businesses and the private sector, academics, NGOs, youth organizations and others. 64 side events were also held. It is noteworthy that the conference adopted a participatory approach in its operation. Masahisa Sato, State Minister for Foreign Affairs, participated as representative of the government of Japan.

The Nairobi conference resulted in the "Nairobi Statement of Intent on Advancing a Sustainable Blue Economy," which contained key policy measures to promote the Blue Economy. The Government of Kenya estimates that non-monetary and monetary commitments made by participants included in the Statement amount to approximately USD172.2 billion[34].

Reflecting the significant participation of African nations, not only coastal resources but also freshwater resources, such as freshwater aquaculture in inland lakes and rivers were addressed in the context of sustainable use and conservation of water and living resources. Discussion of sustainable fisheries and the crackdown on IUU (Illegal, Unreported and Unregulated) fishing in coastal and offshore Africa built momentum for African nations to strengthen measures to address overfishing and IUU fishing with international cooperation. In addition, the Japan International Cooperation Agency (JICA) showcased projects in the fishery sector, such as aquaculture - a major driver of the blue economy - at a side event and plenary session. JICA's technical cooperation projects, which provide practical assistance to developing countries in creating mechanisms to promote collaboration among local communities and capacity building, attracted a high level of interest from the participants.

34 Government of Kenya. 2018. Report of the Global Sustainable Blue Economy Conference 26－28 November 2018. http : //www.blueeconomyconference. go. ke / wp-content/uploads/2018/12 /SBEC-FINAL-REPORT-8-DECEMBER-2018-rev-2-1-2-PDF2-3-compressed.pdf.

4 Japan's Efforts to Contribute to the Advancement of the Blue Economy and Possibility of Application

In Japan, traditional practices such as *Satoumi*, a management concept for balancing use and conservation to maximize productivity and biodiversity in coastal areas, and policy measures such as integrated coastal zone management, have been followed to promote revitalization of local economies through conservation of the ocean and coastal environment and sustainable use of their resources. From a Japanese industry perspective, the blue economy in Japan could be illustrated as follows : There are activities and industries that affect the natural and social "foundations," which provide material to and infrastructure for "target industries." The

"target industries" in turn generate services, which lead to the creation of "social systems" (Figure 2–6).

Figure 2–5 President Uhuru Kenyatta speaking at the Sustainable Blue Economy Conference.

Examples of blue economy best practices being carried out in Japan's coastal zones should be mentioned. In the Hinase district of Bizen City, Okayama for example, the local fishing community's years of efforts to restore eelgrass beds have resulted in expanding eelgrass bed areas, a natural foundation. In recent years, catches of fish that make eelgrass beds their habitat has also increased[35]. Cultured oyster harvests have stabilized, presumably benefitting from water quality improvement and decrease of water temperatures due to the curtain effect on the sea surface caused by the expansion of the eelgrass beds. Every year local fishermen and middle school students conducted hands-on activities such as seeding and thinning to facilitate eelgrass bed growth. Restoring and preserving eelgrass beds through cooperation among stakeholders in the fields of fisheries, education, and research has had a synergic effect on the promotion of fishery, aquaculture and tourism.

In Onna Village, Okinawa, a coral reef restoration project is underway, capitalizing on local fishermen's empirical knowledge of the benefit of preserving healthy coral reefs by aquaculture of mozuku seaweed. In partnership with the fishing community, Co-op stores donate part of the profit from sales of mozuku farmed in Onna Village to the Mozuku Fund, which supports coral reef restoration activities such as farming of coral, eradication of the coral-eating crown-of-thorns starfish,

35 https://www.emecs.or.jp/s-13/wp-content/uploads/2018/04/Restoration_of_Eelgrass_Beds_2018.pdf

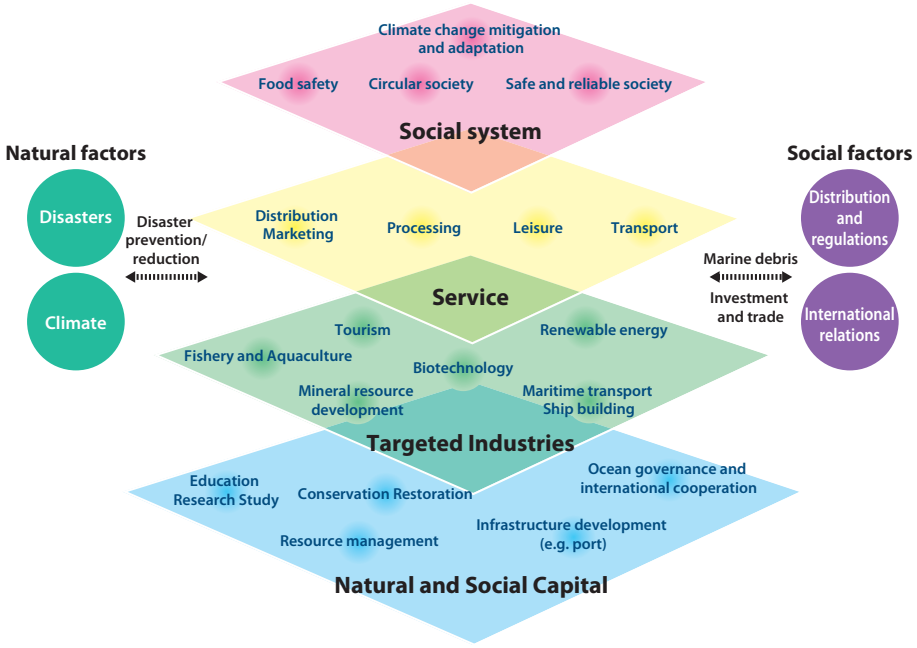


Figure 2–6 Conceptual framework for blue economy developed by OPRI-SPF

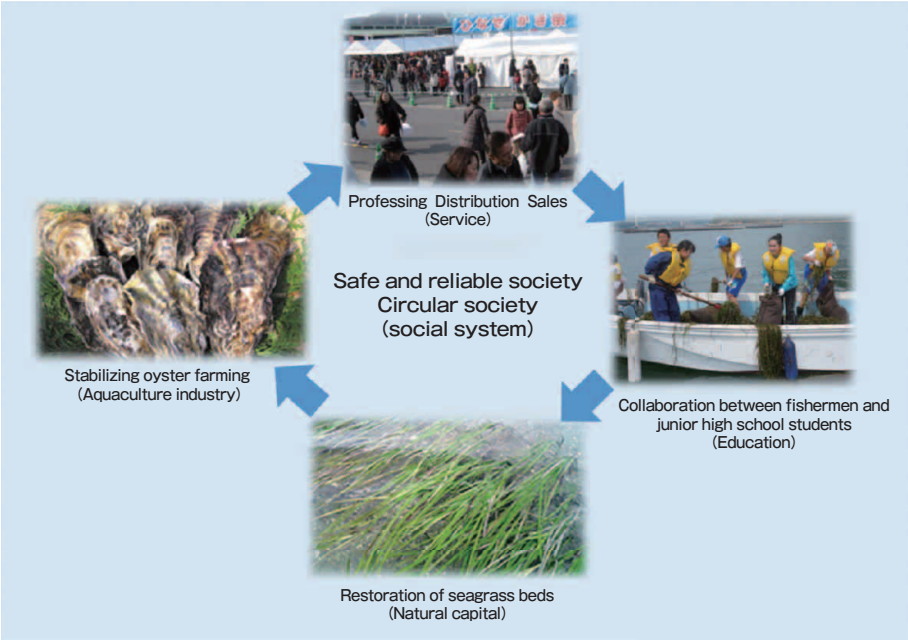


Figure 2-7 Blue economy of the Hinase town of Bizen City, Okayama Prefecture
(Photos courtesy of Hinase Fishermen's Cooperative)

and prevention of red soil runoff, which is harmful to coral reefs. To boost these regional efforts, Onna Village announced its "Coral Village Declaration" in July 2018 and launched an awareness raising campaign to encourage collaboration and cooperation among stakeholders in order to preserve coral reefs[36].

36 http://www.csnet.coop/mozuku/

On Kumejima (Kume Island), Okinawa, the Ocean Thermal Energy Conversion (OTEC) demonstration project, a renewable energy project, is underway. A multi-phase use concept, post-OTEC deep seawater is used for aquafarming of sea-grapes (seaweed) and tiger prawn and cosmetics product development, generating employment and having a positive economic effect. The "Kumejima Model," a measure for sustainable development of the regional economy using deep seawater, has drawn attention especially from Pacific islands and coastal regions in tropical and subtropical zones, and has attracted many interested visitors from abroad.

These Japanese examples of blue economy best practices promote development of the regional economy and a sustainable society by creating service industries of branding, processing, distribution, and selling of aquatic resources through industry-government-academia and cross-industry cooperation, based on scientific knowledge and new technologies. These examples of leveraging marine ecosystems and resources for promotion of the regional economy can be transferred to the Southeast Asia and Pacific Island nations, where the climate and environments are similar to Japan.

5 Pacific Island Nations and the Blue Economy

The blue economy can be an important policy initiative for Small Island Developing States (SIDS) highly dependent on ocean resources. At the Pacific Islands Forum held in Samoa in 2017, participating leaders recognized the Blue Pacific as

a new narrative and called for leadership and a long-term foreign policy that allow the Pacific Island Nations to act as one "Blue Continent." At the Nauru meeting in 2018, again the leaders confirmed the Blue Pacific narrative, to value the strategic potential of the region and to act together from a position of strength[37].

At the Micronesian Islands Forum held in Saipan in April 2018, the forum expressed concern that the distribution of tuna stocks was shifting towards the central and eastern Pacific due to rising sea temperatures and called for full implementation of the Paris Agreement to control the effect of climate change. The forum noted that the amount of IUU tuna fishing in the Western and Central Pacific Ocean was estimated to be about 300,000 metric tons with a value of USD 600 million, and resolved to combat IUU fishing collectively[38].

The Leaders' Declaration, adopted at the Eighth Pacific Islands Meeting (PALM 8), held in Iwaki city, Fukushima Prefecture, Japan in May 2018, recognized the commitment of leaders of Pacific Island States to the Blue Pacific narrative, and expressed the intention to implement capacity building measures for ensuring sustainable use of fishery resources, such as cooperation to eradicate illegal, unreported and unregulated (IUU) fishing. The Declaration also reiterated the importance of addressing climate change, disaster risk reduction, and environmental conservation. It is expected that Japan will expand its support for Pacific Island States, especially in the areas where SIDS do not have sufficient capacity and frameworks for implementing countervailing measures, such as for climate change and IUU fishing.

It is expected that policy measures such as promotion of sustainable fisheries and tourism will contribute to improvement of national well-being in Pacific SIDS. The following cases illustrate the possibilities and challenges of such policy measures in Pacific island nations.

① Cultivation of Black Pearls in Namdrik Atoll

On Namdrik Atoll, a remote atoll with 600 residents located about 400km southeast of Majuro Atoll in the Marshall Islands, an endeavor to cultivate native black pearls started in the 1990s, and in 2010, for the first time, cultured black pearls were harvested. While fishery resources are decreasing, and agricultural productivity growth is stalled due to seawater entering farmland, cultured black pearls are expected to be an alternative income source for its residents. The Namdrik Atoll Local Resources Committee was established to promote collective management of local resources. In June 2015, the United States Agency for International Development (USAID) collaborated with the Namdrik Atoll Development Association (NADA) to improve black pearl farming technology. NADA is also reinvesting part of its earnings into communities to improve their resilience to natural disasters by fortifying houses against extreme weather and procuring water tanks and pumps to cope with droughts. In June 2018, USAID announced completion of the project.

② Maruha Nichiro Katsuobushi Processing Plant in FSM

In February 2018, in Pohnpei, the capital of the Federated States of Micronesia

37 Pacific Islands Forum Secretariat. 2018. 49th Pacific Islands Forum Communique. https://www.un.org/humansecurity/wp-content/uploads/2018/09/49th-Pacific-Islands-Forum-Communiqu%C3%A9.pdf.

38 RNZ. Range of resolutions reached at Micronesian Islands Forum. 3 May 2018. https://www.radionz.co.nz/international/pacific-news/356539/range-of-resolutions-reached-at-micronesian-island.

(FSM), Maruha Nichiro Corporation, a major Japanese seafood company, opened a "katsuobushi" (dried bonito) processing plant in partnership with National Fisheries Corporation (NFC) of FSM. FSM President Peter M. Christian and FSM Resources and Development Secretary Marion Henry, among others, attended the ribbon cutting ceremony. The joint investment with Japan in fishing and on-shore seafood processing operations is expected to lead to job creation and value-added production activities. Continued private investment and technology transfer from Japan in the spirit of international cooperation will contribute to sustainable use of fishery resources and development of local communities.

③ Tourism in Palau

The Republic of Palau is an archipelago of over 340 islands. It is known for its beautiful landscape of islands that rise out of the ocean and a gorgeous sea where coral reefs provide habitats for marine life including mantas and sharks. Every year 100,000 tourists visit the country of about 20,000 population. The government of Palau enacted the Protected Areas Network Act (PAN) in 2003, designed to conserve nature, and has promoted management of protected areas. In 2009, a Green Fee for tourists was introduced, which is distributed as the PAN Fund to the various state governments to be used for monitoring of protected areas, controlling non-native species, infrastructure building, and promotion of tourism. In 2012, its Rock Islands Southern Lagoon was recognized as a World Cultural and Natural Heritage Site for its high concentration of marine lakes, rich biodiversity and cultural remains. In December 2017, Palau changed its immigration laws and introduced a requirement for visitors upon entry to sign the "Palau Pledge," a pledge stamped on their passports to act in an ecologically responsible way on the island. In fiscal year 2018, the number of visitors set a record high of about 168,000.

While efforts to protect the beautiful natural environment are being implemented, nature and the people's lives of Palau have been severely affected by climate change, such as rising sea temperatures and the intensifying impact of typhoons. Coral reefs in Palau have been damaged by massive coral bleaching events in 1998–1999 and by Typhoon Haiyan in 2013. At Jellyfish Lake, a major tourist attraction, the jellyfish population plummeted to almost zero due to the drought of 2015–2016, causing income from entrance fees to nosedive.

Palau's policy to promote environmental conservation in tandem with tourism is heavily influenced by political and economic factors. In fiscal year 2012, tourists to Palau came mainly from Japan, Taiwan, and South Korea. In fiscal year 2015, tourists from China increased drastically in number, reaching more than 90,000, exceeding the 59,000 total number of tourists from Japan, Taiwan, and South Korea. However, in July 2016, the Chinese government notified the travel industry of Palau that they were banning state-run package tours from visiting the country, with which China had no diplomatic relations. In fiscal year 2018, partly due to the slowing down of Chinese economic growth, the number of Chinese tourists to Palau tumbled to about 50,000. While the number of tourists from Japan and

South Korea decreased in fiscal year 2018 from the previous year, tourists from Taiwan increased about 20% year over year. Delta Air Lines decided to suspend direct service from Narita to Palau as of March 2018 due to declining demand to Micronesia destinations such as Saipan. Since it was a very popular flight among Japanese tourists to Palau, there is a concern that it would result in a decrease of visitors from Japan. Meanwhile, Skymark Airlines of Japan announced in March 2019 its plan to operate chartered flights from Tokyo to Palau and it was reported that scheduled service would begin in the summer of 2019.

Promotion of tourism in tandem with environmental conservation is an important policy measure for Palau. Since it could be greatly affected by several factors such as climate change, political, and economic conditions, it is essential to develop a framework which ensures stable long-term policy and implementation.

6 Outlook for Advancement of the Blue Economy and International Cooperation

A multi-pronged approach is required to advance the blue economy. Policy implementation administration should be reformed from traditional sector-driven ocean management to a system that facilitates cross-sector cooperation and pursues comprehensive resource management. Also, insufficient scientific understanding, data, observation and analytical tools, and relevant socioeconomic data on the ocean environment are factors hindering advancement of the blue economy. The building of frameworks for data collection, analysis and information sharing is also important, as are the sharing of best practices, such as Japanese initiatives that have contributed to the blue economy through scientific and socioeconomic research assessing the sustainability and economic ripple effect of natural capital and analyzing factors for success. Coordination among government agencies, business, and academics in Japan should be strengthened and frameworks developed to facilitate advancement of the blue economy both domestically and abroad. Leveraging the lessons learned from best practices to promote economic development

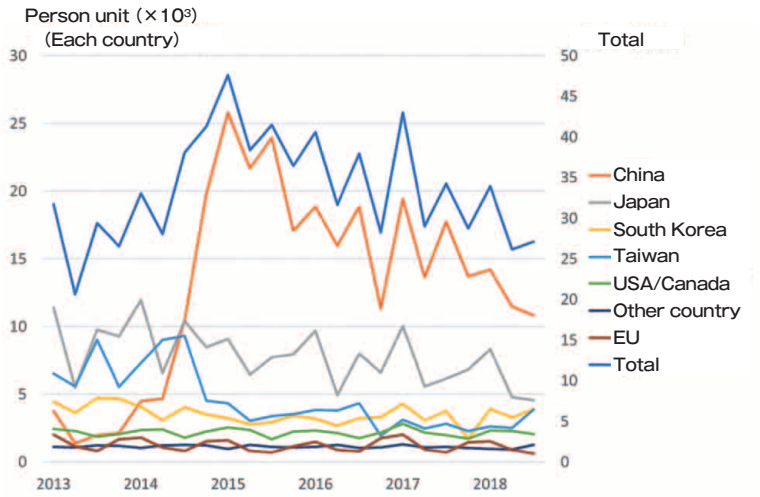


Figure 2-9 Visitors by country to Palau (Quarterly: 2013-2018)

Source: the Government of Palau (2019). The Figure of 2018 is the total of the first 3 quarters.

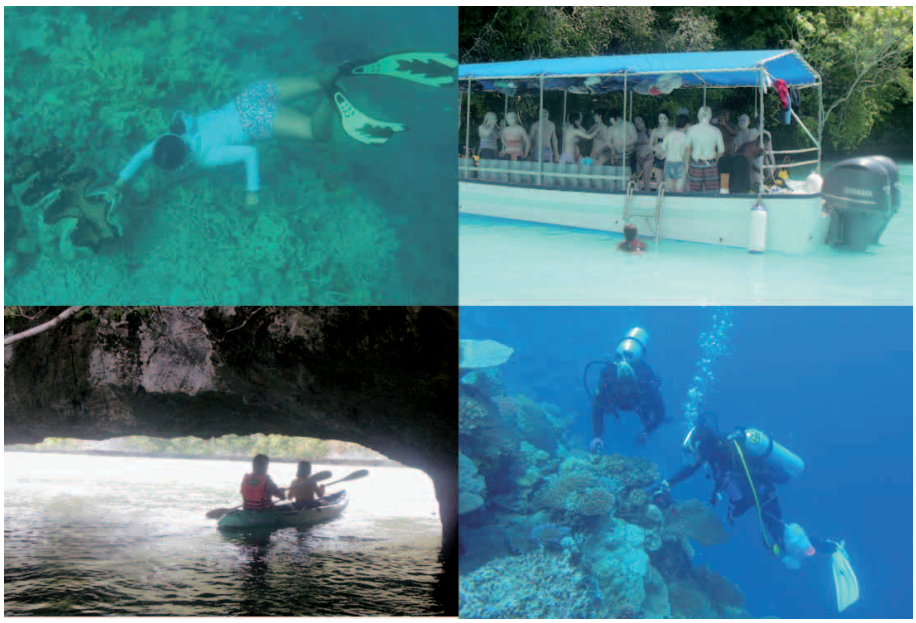


Figure 2–10 Palau's Ocean Based Tourism

Snorkeling, the Milky Way natural limestone mud baths (claimed to enhance beauty), sea kayaking, and diving are the main tourist attractions of Palau. Its coral reefs are important subjects of oceanographic research.

and local revitalization through conservation and sustainable use of ocean and coastal resources must continue.

(Masanori Kobayashi and Atsushi Watanabe)

2 The Second Taketomi Basic Ocean Policy — A town living in harmony with "churaumi" (beautiful ocean)

In May 2018, the *Third Basic Plan on Ocean Policy*, which was approved by the Japanese Cabinet, became the basis for oceanic policy. The Plan pursues the goal of the *Basic Act on Ocean Policy*, which is to realize a new oceanic state. At the same time, Taketomi Municipality had been working on the revision of the first *Taketomi Basic Plan on Ocean Policy* since fiscal year 2017. The revised *Taketomi Basic Plan* was sent to the town assembly and approved in June 2018. The revision lays out the ocean policy of the town and plays an important role for the policy of the region, which consists of many islands surrounded by the sea.

1 The Southernmost Local Government in Japan Surrounded by the Sea

Taketomi is a municipality in the Yaeyama Islands chain located at the southwesternmost point of Okinawa prefecture. It covers about 1,700 square kilometers of ocean area, stretching about 40km from north to south and 42km from east to west. It consists of 16 islands, including 7 uninhabited ones, whose total land area is 334 square kilometers. Its subtropical marine climate is warm and humid throughout the year. It is surrounded by a rich ecosystem. These islands provide habitats for rare animal species such as the Iriomote wild cat. All the islands are designated as Iriomote-Ishigaki National Park. Its coastal area, called Sekisei

Figure 2-11 Location of Taketomi Municipality and its islands (yellow green).

shoko, is one of the largest coral reef areas in Japan. The total area of coral reefs around and between the islands is 296 square kilometers, which is comparable to the total land area. The residents of each island have developed unique cultures that benefit from the natural abundance.

While a total of 1 million tourists visit the islands annually, it is actually a very hard place to live in. The municipality has challenges characteristic of any remote island community. Ferry services are the only means of transportation to and from the islands. It is rather expensive, and the service is limited. As its operation is heavily affected by the weather, the distribution cost of goods is high and its healthcare system can be adversely affected. There is no high school in the islands and educational settings are inadequate. The cost of infrastructure development is higher in general. Being in subtropical water makes the islands vulnerable to natural disasters and climate change. The ecosystems of the islands are also vulnerable to effects from human activity. Conservation of its natural environment and landscape is also a challenge.

2 Creation of the Taketomi Basic Plan on Ocean Policy (First Plan)

Taketomi Municipality created Japan's first local government-level Basic Plan on Ocean Policy in March, 2011. It was a plan the local government devised on a voluntary and autonomous basis in accordance with the *Basic Act on Ocean Policy*. It was developed as a tool for the municipality to independently address issues it faces involving the ocean, making appropriate use of the Basic Act on Ocean Policy, a law that sets out the national ocean philosophy and that stipulates the obligations of the national government, local public organizations, businesses, and the public.

Twenty-three policy measures were established in the Plan and various initiatives carried out related to the natural environment, living conditions, and promotion of local industries. A liquefaction system to turn polystyrene foam into styrene oil was installed to address the problem of debris washed ashore, with the goal to use the energy produced on the islands to create employment. Coral reefs provide Taketomi with fishery and tourism resources, waterways that function as highways and places where day-to-day life happens. Using this rationale, an appeal was made to the national government to include its coral reefs as part the area from which grants to local governments are calculated. The municipality has steadily implemented measures identified in the plan.

There are continuing challenges such as conservation of the natural environment, building safe and secure infrastructure, promotion of local ocean-driven industry, the passing on of the local heritage and culture fostered by the oceans, securing funds, and capacity building. A matter of the utmost concern is that the future population of Taketomi is expected to decrease unless people in their 20s continue to relocate to the islands.

Furthermore, new issues regarding the oceans surrounding the town have emerged since the creation of the first plan. These include : development pressures brought about by the increasing number of tourists both domestic and international ; impacts on the natural environment by visitors and the necessity to ensure security ; effects of global climate change on the natural environment such as increasing ocean temperatures and the necessity to ensure security ; increased friction with neighboring countries arising from territorial disputes ; and insufficient human and financial resources.

Moreover, Taketomi Municipality includes nine border remote islands, which serve as a basis to establish territorial seas, including inhabited islands (Kuroshima, Iriomotejima, Haterumajima, and Hatomajima) and uninhabited islands (Sotobanarijima, Uchibanarijima, Yonasone, Ushinokataishi, Nakanooganjima). The Basic Plan reaffirmed the significance of the Taketomi region, including the uninhabited islands, in securing Japan's territorial seas.

3 Revision of the Taketomi Basic Plan on Ocean Policy (Second Basic Plan)

It was necessary for the Plan to keep pace with these developments and take into account the national security role of border remote islands in the Taketomi region. The *Second Taketomi Basic Plan on Ocean Policy* was formulated with the primary objectives of passing on the nature and the culture nurtured by the oceans to the next generation, improving living conditions, and securing the remote border islands.

The Second Taketomi plan was developed in accordance with the Third National Basic Plan on Ocean Policy, recognizing the current state and key issues surrounding the oceans and islands of the Taketomi municipality.

The Second Taketomi plan has this basic philosophy : "a town living in harmony with churaumi (beautiful ocean) : new development and contributions to the

ocean state." The plan has five main themes and is made up of 21 relevant policy measures. It also strengthens the process of evaluating project performance by a regional committee that includes both regional people and a third-party panel of outside experts. It sets benchmarks for each project for proper progress management.

One of the main themes is "Conservation of the natural environment of the subtropical coastal area and islands and the rich bio-diverse ecosystems." It is not easy to conserve the natural environment of a municipality encompassing such a large area. The cost is huge. Therefore, one of the policy measures on this theme, "Creation of independent revenue for conservation of coral reefs and natural environment of the islands," lists the promotion of donations to natural environment conservation efforts through a hometown tax (a donation system in Japan that allows taxpayers who live in urban areas to contribute to rural areas in return for a credit from income residence taxes), continued efforts to appeal to the national government to include coral reefs in the area based on which the grants to local governments are calculated, and adoption of naming rights proposals as new sources of revenue. Seeking designation as a special area under the "Act on Promotion of Conservation of Natural Environment and Sustainable Use in a Local Nature Asset Area" is now under consideration in order to charge entrance fees and establish a national trust.

The Act was promulgated by lawmakers in June 2014 and went into effect in April 2015. As the name suggests, it encourages voluntary local efforts using private funding such as user fees and purchase of land rights with donated funds to promote conservation of natural environments and sustainable use in local nature asset areas.

Taketomi is working to be the first municipality to utilize the framework the act provides, preparing for the introduction of entrance fees within fiscal year 2019. It is in the process of developing a regional plan and drafting ordinances necessary for implementation, using Taketomi Island as a pilot program case with the hope of extending the program to other islands in the near future.

It is also an important theme of the Basic Plan to overcome the hardships unique to remote islands by creating safe and secure living conditions better able to withstand disasters. The Plan also seeks to enhance the educational environment, as well as to improve infrastructure, medical and welfare services to better the quality of life for Taketomi's residents.

The people of Taketomi have developed their culture by interacting with the natural resources and the ocean environment, and have a history of passing it down the generations. Being an island community, their festivals and traditional events have a long history that is strongly linked to the sea. Due to the absence of high schools, graduates from middle schools are forced to leave the islands if they choose to pursue further education. The region is thus developing its own educational program to enhance its educational environment. In partnership with collaborating educational organizations, it is drawing up an effective curriculum for each grade to establish a framework for ocean education that includes the natural

environment and traditional culture of the islands.

4 Making the Ocean that Separates Us the One that Connects Us

As part of the public relations campaign for the Basic Plan, Taketomi Municipality held a web symposium in January 2019 to connect border inhabited islands and other islands. It was an effort to "make the ocean that separates us the one that connects us." The ocean forum provided Taketomi's people residing on different islands an opportunity to attend public hearings and discuss issues without leaving home. They discussed the challenges and future of the region with an awareness of the importance of its coastal areas. As an educational program for primary and middle school students, a distance learning program was conducted among several islands, providing advanced education without the need to travel.

Figure 2–12 Nakanooganjima, an uninhabited border remote island

These efforts to implement policy measures based on the Taketomi Basic Plan are expected to contribute to a new development of Taketomi as a place living in harmony with churaumi (beautiful ocean), the building of a better future for its people, and the promotion of the ocean policy of Japan as a new oceanic state.

(Taichiro Touji)

COLUMN 2 Expectations for Blue Carbon

In 2009, the United Nations Environment Programme (UNEP) named the atmospheric carbon dioxide (CO_2) captured by marine organisms and stored in the oceans, "Blue Carbon".

The land and the ocean are major stores of the Earth's carbon. Mangrove forests in the subtropics' intertidal zone store a large amount of carbon per unit area at a high rate. Examination of the soil of mangrove forests reveals a dense root system and a layer of organic matter(Photo). It shows a high concentration of carbon in the soil. The sandy mudflat mud seaweed beds and salt marshes where seagrass, such as eelgrass, grow show a high annual carbon storage rate. However, the total volume of Blue Carbon, its carbon burial rate, and the mechanism of CO_2 exchange between the shallow sea and the atmosphere are not well known. Scientists around the world are vigorously studying this subject.[1)]

CO_2 captured and stored as terrestrial carbon in forestland is called Green Carbon. Where rivers connect lands and the oceans, part of Green Carbon runoff from the land is stored in the shallow sea near estuaries (Figure). The healthy linkage of lands-rivers-oceans allows seagrass beds in shallow seas and mangrove forests to capture and store Blue Carbon and Green Carbon, which helps to mitigate climate change. The importance of shallow seas as carbon sinks compared to land-based carbon sinks is in the fact that Blue Carbon and Green Carbon are stored in seafloor sediments for long periods (thousands of years). The generally anoxic condition of seafloor sediments inhibits decomposition of organic carbon by bacteria.

Effective use of shallow seas contributes not only to mitigation of climate change but also to other ecosystem services such as food provisioning, water purification, tourism/recreation, and disaster risk reduction. For example, for mangrove and seagrasses, the plant itself mitigates the effects of waves and movement of tidal waters. The vegetation reduces erosion should wind swells increase in intensity and frequency due to climate change. Slower movement of wave and tidal waters causes suspended matter to settle out of the water and to be stored in the ecosystem, which builds up mud bottoms that counter sea level rise from climate change.

Concrete coastal facilities built during the high economic growth period have become increasingly degraded and need to be rebuilt. For sustainable maintenance management of coastal facilities, it is necessary to extend the life of the facility and reduce costs. Recently, the concept of coastal protection using green infrastructure (nature) as well as gray infrastructure (man-made structure) is attracting attention. Disaster risk reduction through management of ecosystems is called Eco-DRR (ecosystem-based disaster risk reduction) and is gaining momentum as a climate change adaptation measure.

In 2016, a study was conducted to identify the number of countries that referred specifically to Blue Carbon and the use of shallow sea ecosystems in the Nationally Determined Contributions (NDCs) of the Paris Agreement[2),3)]. It found that out of 151 countries, 28 (19 %) made reference to the mitigation effect and 59 (39 %) to the adaptation effect of shallow seas and Blue Carbon. It is regrettable that Japan does not refer to either of them at this time.

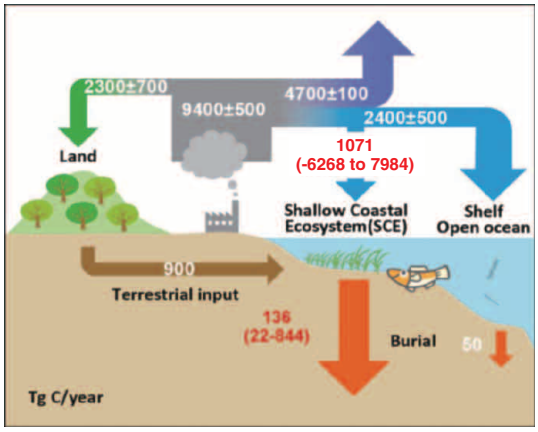
In this context, the Blue Carbon Panel, with the Ministry of Land, Infrastructure, Transport and Tourism, the Fisheries Agency, and the Ministry of the Environment participating as observers (being responsible for management of the coastal environment), is considering the idea of including shallow sea ecosystems as a carbon sink in Japan's global warming mitigation measures and specifying it in the NDC[4)].

Through using Blue Carbon, in addition to the previously unknown value of shallow seas, i.e. climate change mitigation, it is expected that other values such as food provisioning, water purification, and tourism and recreation will increase. In that event, it is expected that restoration of coastal natural environments, which has heretofore proceeded as public works projects using taxpayer money, might be carried out as private initiatives with private funding.

1) Kuwae T, Hori M (eds) Blue carbon in shallow coastal ecosystems: carbon dynamics, policy, and implementation. Springer Singapore.
2) Herr, D. and Landis, E.,Policy Brief. Gland, IUCN and TNC (2016).
3) Martin, A., et al.,GRID Arendal (2016).
4) http://www.wave.or.jp/bluecarbon/index.html

(Tomohiro Kuwae)

Mangrove Forests in Iriomote Island, Japan, and the soil.



Global atmospheric CO_2 absorption rate by shallow sea ecosystem and carbon storing rate into the ecosystem (adopted from reference 1.). About 1,400 million tons of carbon is stored annually in sea floor sediments in shallow seas.

3 New Trends in Ocean Industries

1 Fishery as a Growth Industry for Japan

On December 8, 2018, the Act on Partial Revision of the Fisheries Act and Other Purposes was approved in the House of Councilors and became law. In this article, the background of the latest revision of the Fisheries Act, which is intended to facilitate future growth of fisheries in Japan, is explained and the challenges for the future are outlined.

1 A Substantial Revision Made to the Fisheries Act for the First Time after 70 Years - the Limits of the Existing Fishery System

The year 2019 marks the 70th anniversary of the enactment of the current Fisheries Act, which went into effect in 1949, shortly after the end of World War II. It was a landmark fisheries law at that time. The purpose of the Act was to enhance productivity of fisheries and to democratize the fishing industry by establishing Fisheries Cooperative Associations. While minor revisions such as establishment of the Designated Fishery System and the Inland Waters Fishery System were made in 1962, the Act has remained the base of Japan's fisheries system for 70 years.

Meanwhile, the reality surrounding fisheries, especially fishery resources, fishing grounds, and markets, has drastically changed in 70 years. Just after the enactment of the Act, the San Francisco Peace Treaty was signed in 1951 and Japan was reintegrated into the international community. In 1952, the "MacArthur line,[39]" a geographic restriction placed on the movements of Japanese fishing vessels, was abolished and Japanese fisheries including deep-sea fishing made great strides.

Since the late 1970s, there have been several developments that impacted Japanese fisheries. A 200-mile Fishery Zone was recognized by many countries, the United Nations Convention on the Law of the Sea was adopted, and international management systems of fishery resources were established, including the moratorium on commercial whaling. The area allowed for Japanese fishing vessels decreased, which led to the rapid contraction of fishery production. In recent years, partly due to the fishery expansion policy of China, an increasing presence of foreign fishing vessels in waters around Japan, including those engaged in illegal, unreported and unregulated (IUU) fishing, is seriously threatening fishery resources around Japan.

Reflecting those changes, marine catches increased from 2.4 million tons in 1949 to more than 10 million tons in 1981, plateaued for the next 10 years or so, and then experienced a sharp drop. In 2016, marine catches were 3.26 million tons, a third of the peak volume and has since been on the decrease. On the

39 The geographic restriction on the movements of Japanese fishing vessels was placed by the Supreme Commander for the Allied Powers (SCAP) Directive 1033, *Area Authorized for Japanese Fishing and Whaling* after the end of WWII.

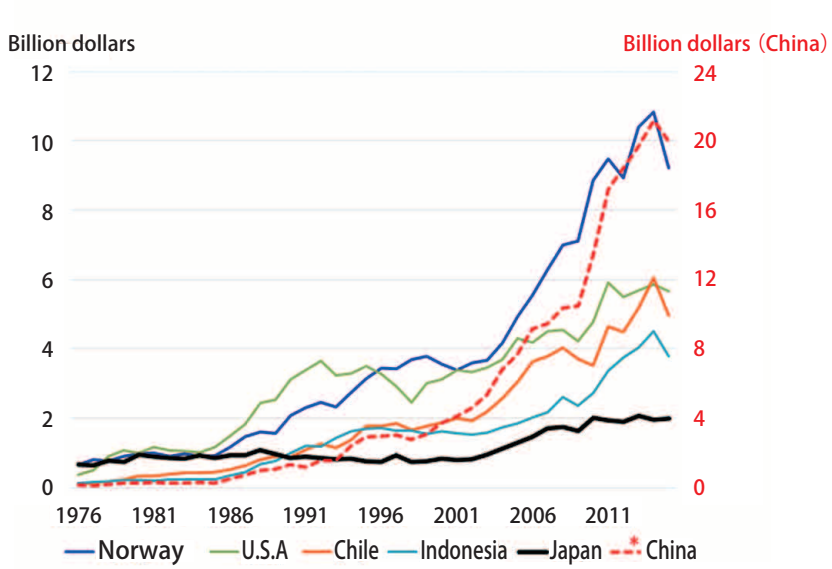


Figure 3-1 Historical Trends of Fisheries Products Export Values of Major Fishing Countries (Source : FAO)

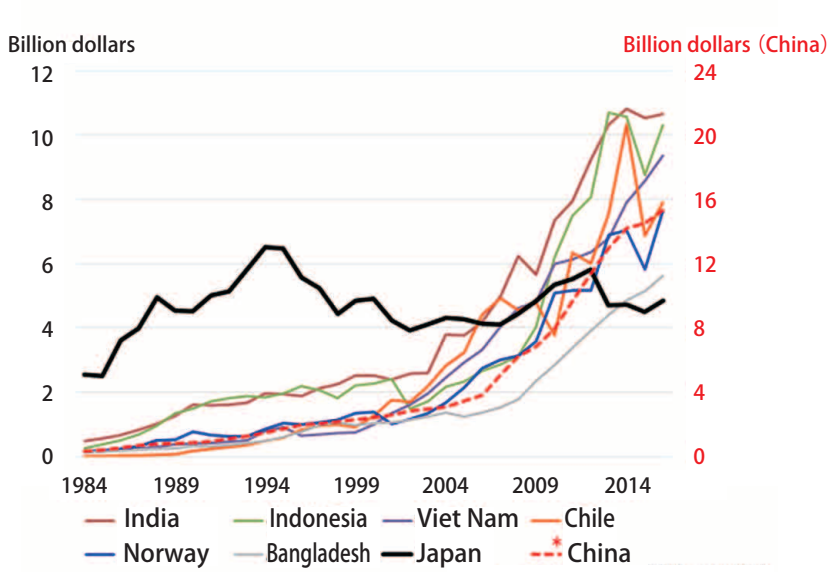


Figure 3-2 Historical Trends of Aquaculture Production Values of Major Fishing Countries (Source : FAO)

other hand, the production volume of marine aquaculture, which was 0.2 million tons in 1949, saw an exponential growth in pace with the rapid and high economic growth of Japan, reached 1 million tons in 1981, then kept steady and recorded 1.03 million tons in 2016.

The Fishery industry baseline production has been weakened, with the number of commercial fishermen decreasing from 713,000 in 1949 to less than a quarter, 153,000, in 2017, more than 60% of whom are age 55 and older. Moreover, fishery resources are in a critical condition. According to the fiscal year 2018 assessment of fish stocks in the waters around Japan published by the Fisheries Agency, out of 48 fish species and 79 groups surveyed (as of October 2017), 51% were identified as having a low population. With only 16% assessed to have a high population, there is no sign of reversing this resource decline. The contin-

ued decline of fishery resources along with the decrease of the number and the aging of commercial fishermen has been the negative driver of fishery production in Japan.

From the perspective of consumption, the calorie intake (per person per day) in Japan decreased about 10% in 70 years from 2,074 kcal in 1949 to 1,865 kcal in 2016, while the intake of animal protein (per person per day) increased by 2.4 times from 15.3 g to 37.2 g during the same period. It shows that the Japanese diet has shifted from a carbohydrate heavy one with rice as a staple food to one with protein rich side dishes, leading to a higher quality diet. However, detailed analysis of animal protein intake revealed that while the intake of protein from meat products increased dramatically from 1.8 g to 15.1 g in 70 years, the intake from fishery products slightly decreased from 12.8 g to 12.6 g. Accordingly, the consumption of meat products exceeded that of fishery products. It suggests that as the Japanese economy grows, consumers have enriched their diet by preferring meat and other animal-source products to fishery products for various reasons, such as value for money. Consequently, the relative position of fishery products to animal products has diminished.

While the Japanese fishing industry falters, both from the perspectives of production and consumption, China, Norway, Chile and other nations have advanced initiatives to make fisheries their growth industry. The historical trend of fishery products export values for the last 30 years shows that Japan saw only a 2.3 times increase, while Norway had 10.0 times and Chile an 11.4 times increase, with China even experiencing an astounding 74.3 times increase. Thirty years ago, China's fishery export value was equivalent to or significantly below the level of Japan. By 2016 it has increased to a level of 2.5–10.0 times that of Japan.

Productivity indicators, such as fishery catches per fisherman and indicators of the advancing aging crisis, such as the percentage of fishery workers 60 and over, showed unexpected trends. While simple comparison with the aforementioned countries is difficult, those statistics show objectively the hard reality Japanese fisheries face. All the stakeholders should see it as a serious warning and share the understanding that drastic policy reform is imperative to facilitate the growth of the fishing industry.

2 Path to Regulatory Reform

① Recommendations of the Regulatory Reform Council

The environmental changes surrounding fisheries and the hard reality the Japanese fishery industry faces, if left untended, would lead the industry to the point of no return. As regulatory reform requires an enormous amount of energy and the understanding of stakeholders, the *Basic Plan for Fisheries*, revised in April 2017, included stepped-up policy measures such as "to foster fishery managers with international competitiveness," "to facilitate business enterprises' participation in aquaculture," and "to enhance resources management through quota systems and to revise obsolete rules such as regulation on the size of offshore commercial fishing vessels." However, the progress was slow, and no additional funds were al-

located for these initiatives in fiscal year 2018. In fact, there were some incidents going against the unified effort to break free of the stagnation of the fisheries. For example, the tightening of the catch limit of Pacific Bluefin tuna, an internationally managed stock, deepened divisions among fishery sectors.

Under these circumstances, the Abe government announced a policy to place priority on fisheries reform, following the agricultural reform, and directed the Regulatory Reform Council, an advisory body of the prime minister, to consider policy measures to promote the growth of fisheries. The deliberation started in September 2017 and on June 4, 2018, the council included its recommendations in the *Third Proposal for the Regulatory Reform : The New Era to Come*, and decided to look at the process of implementation of the recommendations. The council recognized it was essential to establish a new resources management system to restore fishery resources and to make fisheries, especially offshore commercial fishing, attractive to young people and to increase international competitiveness. The recommendations include :

- As a general rule, the scope of the fish stock assessments should cover all the stocks important to commercial fisheries. Fundamental reform of the stock assessments is warranted, by expanding research on research vessels and improving data collection systems, such as catch reports.
- Change the way to set stock management goals to one based on maximum sustainable yield (MSY), which is the international standard.
- Expand species for which total allowable catch (TAC) is set, so that it covers 80% of the total catch as soon as possible.
- For the fisheries for which fishing permits are required, individual quota (IQ) is to be applied for each species that is a subject of TAC as soon as preparations are complete.
- Fundamentally revise existing regulations on fisheries that are ready for implementation of IQs, and repeal regulations preventing the use of larger fishing vessels, such as tonnage restrictions.

In addition, to contribute to the development of aquaculture and coastal fisheries, a reform of the management system of fishing grounds was recommended. To facilitate expanding the scale of operations and new entries in aquaculture, which are essential for the growth of the fishery industry, it is recommended to make the process of granting a fishery entitlement transparent and to clarify the content of the right.

Some stakeholders might think that the recommendations of the council were not grounded in realistic policy. However, it could be a rare chance for stakeholders to make a concerted effort to address the issues for the future of the fishery industry.

② Significant Revision of the Law

Article 1, the purpose of the Fisheries Act, was fundamentally revised. The revised Article 1 states that the purpose of the act is, "in view of fisheries' mission to provide fishery products to the people of Japan, to ensure sustainable use of

fishery resources by establishing measures for their conservation." It represents the direction of Japan's fishery policy toward the promotion of the growth of fisheries through proper management of resources. The key points of the revision were mostly in accordance with the Cabinet's proposal. The revisions related to resource management provide the following :

- In the light of promoting appropriate and effective use of fishing grounds, the Minister of Agriculture, Forestry and Fisheries shall set a target level for each stock based on a science-based stock assessment to maintain and restore the sustainable level. Stocks shall be managed by TAC, through allocation of IQ.
- The Minister of Agriculture, Forestry and Fisheries shall set a stock management target and a TAC for each stock to restore the stock to the target level.

To improve productivity and competitiveness and to make offshore commercial fishing attractive to younger people, the fishing permit systems are to be reformed. The regulations on sizes of vessels are to be revised to improve safety and habitability.

To promote aquaculture and coastal fisheries, fishing grounds management systems are to be reformed. To facilitate proper and effective use of fishing grounds while taking the existing fishing entitlement holders' concerns into consideration, when the existing fishing right holders are making proper and effective use of the fishing grounds, the fishing permits shall be given to the existing fishing rights holders, while in cases where no existing rights exist, the permits shall be given to the persons who would most contribute to the development of the local fisheries.

The revised Fisheries Act will come into effect within 2 years. Until then, existing permits and licenses will continue to be in effect.

3 Challenges for the Future Growth of the Fishery Industry

In preparation for the implementation of the new Fisheries Act, the Fisheries Agency of Japan started to prepare its fiscal year 2019 budget request to include funds to support fishery policy reforms envisioned in the revision. 7.5 billion yen for "Establishment of a New Resources Management System" to improve resource management by improved research and assessment, 17.2 billion yen for "High Priority Support for the Growth of Fisheries by Fishery Policy Reform" to improve competitiveness of the coastal fisheries and expand aquaculture were funded for the fiscal year 2019. The entire Fisheries Agency funding has increased from 177.2 billion yen in fiscal year 2018 to 216.7 billion yen. Supplemental appropriation of 87.7 billion yen for fiscal year 2018 brought the total to over an unprecedented 300 billion yen.

Now that the stage is set for policy reform in terms of both funding and regulation, it is important to implement initiatives leading to actual revitalization of the fishery industry. It shouldn't end as a pie in the sky. The government's plan, *Agriculture, Forestry, and Fisheries : Regional Activation Plan*, sets a goal for fishery

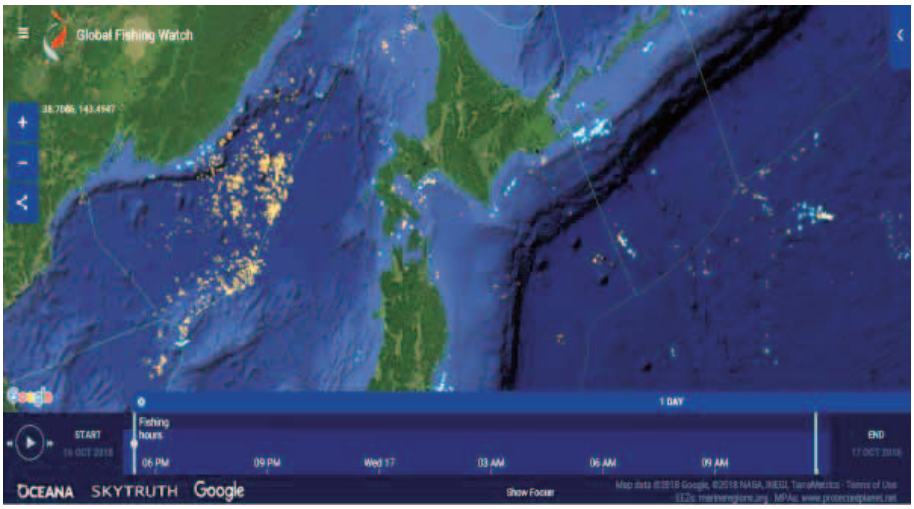
growth : to restore fishery production volume to 4.49 million tons (FY 2005 level) compared to 3.83 million tons in 2017 ; to increase export value of fishery products domestically produced to 350 billion yen (274.9 billion yen in 2017) ; and to increase consumption of fishery products per person per year to 29.5 kg (FY 2010 level), compared to 24.4 kg in 2017.

To achieve these goals, it is essential to appropriately manage our fishery resources. While stock management for domestic fisheries is to be improved, if the measures to address foreign fishing vessels in the waters around Japan are inadequate, the restoration of the resources would be jeopardized, and it could threaten the growth of the Japanese fishing industry. In addition, IUU fishing is of great concern. We should be aware that the success of the reform depends on how we address the issue of foreign fishing vessels.

Along with the aforementioned policy measures to promote the growth of the fishing industry, it is essential for Japan to step up its bargaining power to improve resources management at the North Pacific Fisheries Commission (NPFC), a regional fisheries management organization, and elsewhere. In addition, it is necessary to advance the development and enforcement of technology for monitoring of IUU fishing using satellites, etc.

To increase consumption of fishery products, broader efforts from product development to marketing, to increased domestic market share, are important. As domestic demands of fishery food products are virtually saturated, it is important to develop and provide attractive fishery products for overseas markets in order to expand the consumer base. Japanese didn't eat fresh salmon until Norway started to farm salmon suited for fresh consumption specifically for the Japanese market. Fish farming could hold a key for the success of Japanese fisheries revival.

The National Research and Development Agency, Japan Fisheries Research and



Yellow dots● : the night light vessel detections
Blue dots● : vessels in apparent fishing activities identified using AIS data

Figure 3-3 IUU Monitoring via Satellites

Fishing activities at night in waters around Japan the Global Fishing Watch, a U.S. non-profit organization, made accessible to the public. Name of the ships and the flag states can be identified on the map along with the tracks.
(Source : https : //globalfishingwatch.org)

Figure 3–4 *Sujiara* farming initiative by the National Research and Development Agency, Japan Fisheries Research and Education Agency

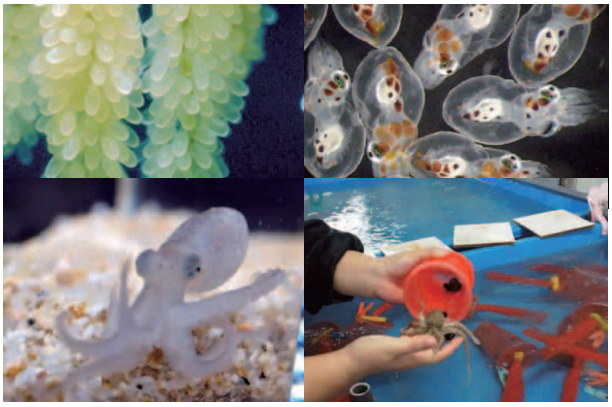


Figure 3–5 Development of technique for effective rearing of paralarvae Common Octopus by the National Research and Development Agency, Japan Fisheries Research and Education Agency

Education Agency (FRA) conducts research to develop and commercialize farming of species competitive with those of leading fishery countries in the international market. For example, in 2016 we succeeded in the complete farm-raising of *Sujiara*, a red grouper, in Ishigaki island, Okinawa. It is an up-market fish in high demand in China for celebrations due to its red color. To make it a prospective export product, the Japan Fisheries Cooperation mainly provides the operating body the technical assistance from hatching and raising to adult fish. A business model to export them to China is under development. Beautiful red *sujiara* are traded in China at about 20,000 yen per kilogram. It has great potential to be a profitable export product.

World demand for common octopus is notably increasing with the boom for Japanese cuisine, while the catch has been decreasing. In the pursuit of commercialization of cultured octopus, the FRA has just succeeded in developing techniques to make effective rearing of paralarvae[40] possible.

For the growth of the fishing industry, technology development to differentiate more profitable species as high quality Japanese products plays a major role. Advancement of substantial initiatives through government and business cooperation is expected.

(Masanori Miyahara)

40 Young cephalopods in the planktonic stages

Reference Materials

Articles from the “Ocean Newsletter”

Discussion: Innovation to Overcome the Dangers Facing Our Oceans

[KEYWORDS] protecting the oceans / Human Capacity Building Programs for Global Ocean Issues / diplomacy through science and technology

Yohei Sasakawa
Chairman, The Nippon Foundation
Atsushi Sunami
President, Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF) / Executive Director, The Sasakawa Peace Foundation
(Ocean Newsletter No. 418, 5 January 2018)

In 2018, a full 150 years since the start of the Meiji Period, there are increased expectations to take on new efforts in overcoming the growing dangers in our oceans. It is of utmost importance for Japan to take the lead in protecting this global common resource, by encouraging the international community to engage in innovative efforts such as promoting human capacity building and diplomacy through science and technology.

150 Years Since the Start of the Meiji Era

Sasakawa: "I would like to start by wishing a Happy New Year to you all. 2018 marks 150 years since the start of the Meiji period, marking one chapter in Japan's history. I believe that it is important to keep in mind the events of the Meiji Restoration when we consider what Japan should be doing now and into the future.

The Japanese people started the Meiji Restoration by shouting, "Revere the Emperor and expel the foreign barbarians!" as they fought to gain political control. As soon as they did gain control however, they immediately changed modes. This shows how quickly the people of Japan can change. Another example of this can be seen in the Second World War. Although there had been strong anti-American sentiment throughout the war, as soon as we were occupied by the United States, our attitude changed instantly and completely. When General MacArthur finally left Japan, it is said that he received tens of thousands of letters saying, "Thank you, Mr. MacArthur. Please don't leave." This leaves me with the secret suspicion that we Japanese are a frightening people.

So, let's think about what changes we'll see in 2018, 150 years after the changes of the Meiji Restoration began. There has been ongoing political turmoil in recent years, with the dissolution of Japan's House of Representatives taking place roughly every two and a half years. We also had a six-year period during which our prime minister changed six times. Only recently have we entered a long-term period of political stability. The world currently has high hopes for Japan as a nation. Last year I toured France, Georgia, Azerbaijan, and elsewhere. This made me realize just how important political stability is. Recently, when NATO Secretary General and former Norwegian Prime Minister Jens Stoltenberg visited Japan, he commented that, "Security in the future is no longer a regional issue. We now need to think about it from a global perspective. One aspect of this concerns cyber security, and another concern is our oceans." Japan is an oceanic state, so this may be a big opportunity to make use of the knowledge and various networks that have been built up to show Japan's presence in ocean related fields."

Sunami: "I have also participated in a number of international conferences related to the oceans in recent years. I came away feeling that other countries have high expectations for us."

Sasakawa: "I feel strongly that political stability is of great importance."

Sunami: "That is why we need to proactively communicate Japan's position regarding the oceans to the rest of the world."

Establishing a Comprehensive International Ocean Institute

Sasakawa: "While the government is saying that Japan is an oceanic state, it is a shame that our policies have not really caught up with that concept. If the public sector does not have the ability to do it, then the private sector should take the initiative. The government will then follow the lead of the private sector and put it on course. This is an age of role division, so we should not just complain about the

government. It has been 150 years since the Meiji period and 70 years since the end of WWII. As citizens, we have done nothing but assert our political rights. As a result, our country is now in debt by approximately ¥1,080 trillion (as of the end of March 2017).

Dying and leaving this for our children to deal with would make us a completely irresponsible generation. We cannot do this. But how should we go about paying back all this money? If we try to reach a balance between earnings and expenses and primary balances, we would need to immediately raise the consumption tax to 30%. But even raising it from 8% to 10% caused a huge public outcry. This is a crisis.

Besides debt, when we look at all the crises that Japan is facing, it is really only now that we are starting to hear people talking about the problems in the oceans. My dream is to build a unified, comprehensive international ocean institute. This is something that absolutely must be achieved. Our oceans are currently governed in silos. We have UNCLOS (United Nations Convention on the Law of the Sea) but matters concerning seafood are determined by the FAO (Food and Agriculture Organization of the United Nations). We only have one ocean. We need to protect it as a shared global asset.

The Republic of Malta was directly involved in the creation of UNCLOS. At the time, Arvid Pardo, a representative for Malta's government, made a speech where he stated that deep-sea resources should be used for peaceful purposes, and should be developed in such a way that they benefit the human race as a whole. This momentum led to the revision of international laws. When I made a speech at the UN Ocean Conference held in June 2017 about ocean governance, the Republic of Malta was the first state within UNCLOS to agree with my proposal. The Nippon Foundation and Malta are now cooperating to create a new framework for ocean governance. But Malta is a small country, so I think we also need to involve large ocean-based countries like Sweden and Norway. There is a lot of effort going on behind the scenes to make this a reality. But what do you think about this?"

Sunami: "Hearing about that led me to participate in the "Our Ocean" conference held in Malta in October 2017."

Sasakawa: "Is that right. What kind of discussions did you have there?"

Sunami: "Well, the participants were aware that these vertical divisions are problematic. This is a worldwide problem, of course, not just a Japanese one. The fact that there is no formal, UN authorized organization for tackling the current problems in our oceans is an issue. Everyone there voiced the same opinion that we need a proper organization to support conferences about the ocean. However, even though there was a shared awareness of this problem, it will probably be a private group, as opposed to a government-based group, that will take the initiative. I have high hopes that you, Chairman Sasakawa, will take the reins. Governments can only act upon formally decided matters. I felt that it is important to begin creating the necessary environment before we begin international negotiations for this."

Sasakawa: "For example, international conferences such as for UN-HABITAT (UN Human Settlements Program) are only held once every 20 years, but they continue to exist to this day. These programs have not been scrapped and rebuilt, so the organizations become more and more bloated, and for the most part are no longer functioning. It is a bit disappointing to think that resources are not being used effectively. I think that we need a slimmer solution for ocean-based problems, to avoid such an outcome."

Sunami: "I really hope this is a challenge you might accept."

Developing Personnel to Respond to Ocean Crises

Sasakawa: "I think we need to create an organization that takes action. However, when Western countries get involved, there is the north-south problem. That is, northern countries will not answer to the demands of developing southern countries. That leads to a situation where nothing gets decided. If Japan acts as a lead-off man, it might be easier to attain international coordination."

Sunami: "But don't you think Japan is working steadily with regards to the north-south problem? The Nippon Foundation has established capacity development programs in developing countries. For example, cabinet ministers who were visiting Japan from Cambodia had previously studied in Japan. As a result, they have come to respect Japan, which has created connections between our countries. It made me feel that Japan is in the perfect position to connect the advanced, northern countries and the developing southern ones."

Sasakawa: "Ocean governance requires coordination and cooperation among developing nations and small island states, as well as developed countries. However, developing nations, and in particular small island states, do not have the necessary expertise in the field of ocean governance. That is why The Nippon Foundation has been cooperating with leading international research institutes and universities, foreign governments, NGOs, and international organizations for its long-running program of "Human Capacity Building Programs for Global Ocean Issues." The program has nurtured 1,075 individuals from 129 countries. We are now putting forth even greater efforts. At present, the legal order on the oceans is becoming an increasingly important worldwide issue. We need experts who are knowledgeable in international law for this, so we are working with the International Maritime Law Institute (IMLI) and the International Tribunal on the Law of the Sea (ITLOS) to train legal experts. We are also cooperating with the UN to provide ocean-related training for senior government officials, administrative officials, and researchers."

Sunami: "This is exactly what we mean when we talk about innovations that will help overcome the crises in our oceans. The Nippon Foundation's contributions in this field are already well known internationally. I am really looking forward to the ongoing developments in regard to the "Human Capacity Building Programs for Global Ocean Issues."

Sasakawa: "Humanity has traveled from land, to sea, to the skies, and finally into space. We seem to be transfixed on space at the moment, but the oceans contain their own fair share of mysteries. One of these is the bathymetry of the ocean floor. Even though we have an overall understanding of the features of the surface of Mars, we have only explored 15% of the ocean floor. Gaining a better understanding of ocean floor bathymetry would be useful for a wide variety of fields. It would allow for analysis of tide mechanisms and resources on the ocean floor, better path predictions for tsunamis and the increasingly large-scale typhoons we are seeing, and changes in habitat distribution of ocean creatures caused by temperature increases.

The Nippon Foundation and GEBCO (General Bathymetric Chart of the Oceans) Guiding Committee have trained 78 fellows from 36 countries since 2004 in their Postgraduate Certificate in Ocean Bathymetry Training Program. In addition to these fellows, we are aiming to receive cooperation from 24 official bodies including NASA, the IHO (International Hydrographic Organization), and the National Geographic Society, as well as universities and public companies to analyze 100% of the bathymetry of the world's ocean floor by 2030. Unmanned ships are also something to pay attention to. More than 90% of the world's cargo is supported by ships. Making them unmanned would be an innovation in the distribution industry far beyond the invention of the automobile. In addition, most of the world's shipping accidents are caused by human error, so the creation of unmanned ships is also important from a safety perspective.

When we talk about making something unmanned, there are always those who are concerned about job loss, such as for crews on ships. However, such worries are misplaced. Regardless of the generation, there are always innovations that change the roles that human beings play. We need these changes. Research into these ships is progressing in the west, and Japan cannot just recoil from this. We need proactive industry-academic-government input as well as input from other fields, and to tackle this as a nation."

The Creation of a Japan that Protects the World's Oceans

Sasakawa: "In order to prevent crises in our oceans, it is essential that our country take the lead in guiding international society towards change. Japan has developed into the country it is today because of the bountiful gifts it has received from the ocean. We are now a nation that has a wealth of advanced technology and knowledge related to the appropriate management of living marine resources and the prevention of global warming. We need to change from being a country protected by the oceans, to being a country that protects its oceans, while also evolving to become a country that protects the world's oceans. Oceans should be treated as something of great importance. I think the time has come for Japan to be at the forefront in leading efforts to protect the world's oceans, which every living being on Earth relies on."

Sunami: "You are right. In order to save the oceans from crises, we need to foster coordination between science and policy measures, ensure the involvement of various stakeholders, and create a worldwide movement. The world has always had high hopes for Japan's scientific technologies. Our country is promoting efforts through science and technology diplomacy, which will lead to cooperation in these fields and other forms of exchange. By connecting the two different fields of scientific technologies and diplomacy, we can aim to solve the problems being faced by the world. Although the ocean is a theme that exists on a global scale, it still contains a variety of mysteries that science has yet to unravel. It is therefore essential for scientific technologies and diplomacy to work in tandem."

Sasakawa: "That is exactly right. We are planning to mobilize the wisdom of the world to create a prescription for mankind to address the crises facing the ocean. We will then host an international conference to debate and make decisions concerning this, work to communicate it to the world, and call on a broad range of sectors to facilitate its implementation. We are now pouring our efforts into preparing for an international conference to be held three years from now that will declare the promotion of a new form of ocean governance. I hope to have people with a deep understanding of the oceans, as well as a strong interest, collaborate on this plan."

Sunami: "The Ocean Policy Research Institute has also begun working to create an agenda for this international conference. For example: 1. "Passing the ocean on to future generations" through the recovery and preservation of its functions, 2. "Worldwide efforts towards tackling problems in the oceans" through recommendations for international ocean policies, 3. "The creation of a new international collaboration framework related to the oceans" through forming an international network, and 4. "Sharing our sense of mission to gain international cooperation" through proposing world ocean conferences, and other efforts. As the late Professor Elisabeth Mann Borgese, respected as the "mother of the oceans," often stated, "problematique and solutique (Comprehensive solutions are required for complex problems)." We need to construct an international platform that can create these solutions, and will continue to work with The Nippon Foundation towards this, with the Ocean Policy Research Institute playing a central role. Thank you very much for your time today." ■

The World Maritime University—Sasakawa Global Ocean Institute: A New Institute in a Unique University

[KEYWORDS] ocean sustainability / ocean governance / development of human resource capacity

Ronan Long
Director, WMU-Sasakawa Global Ocean Institute, World Maritime University
(Ocean Newsletter No. 442, 5 January 2019)

REMARKABLE SUCCESS

The sea covers two-thirds of the planet and modern State practice shows that a high degree of international cooperation is required to ensure peaceful and sustainable uses of ocean space and marine resources. Moreover, contemporary trends in the law of the sea demonstrates that the development of human expertise and scientific knowledge of the marine environment facilitates good decisions in ocean governance. An important milestone was achieved in capacity development with the establishment of the World Maritime University（WMU）in Malmö in 1983. The University has trained a whole generation of maritime and ocean experts over the past three decades and the remarkable success of the University in this regard can be gauged from the presence today of 4,654 alumni in 167 countries. Among its many distinguished alumni is the IMO Secretary General and Chancellor of the WMU, Mr. Kittack Lim, who studied maritime administration at the University in the early 1990s.

From left : Cleopatra Doumbia-Henry, President of WMU ; Yohei Sasakawa, Chairman of The Nippon Foundation ; Kitack Lim, WMU Chancellor and Secretary-General of the International Maritime Organization ; Isabella Lövin, Deputy Prime Minister of Sweden

NEW CHAPTER

A new chapter in ocean education, research and capacity-building commenced at the University with the inauguration of the WMU-Sasakawa Global Ocean Institute on 8 May 2018. The Institute operates within the framework of the Charter of the World Maritime University and is tangible evidence of the commitment of the University to implement the ocean related goals of the 2030 Agenda for Sustainable Development（the 2030 Agenda）, including most notably Goal 4 on Quality Education and Goal 14 on Life Below Water. In particular, the Institute is tasked with research and the delivery of capacity development programmes addressing some of most intractable problems concerning anthropogenic impacts on the ocean environment and the resources that it supports. Furthermore, the founding of the Institute is testament to the unrelenting commitment and vision of Chairman Sasakawa in the development of human resource capacity and the utilisation of education as a means to improve sustainable and peaceful uses of the ocean for the benefit of present and future generations.

EXTRAORDINARY PHILANTHROPY

The establishment of the new Institute has to be viewed within the wider context of the extraordinary philanthropy of The Sasakawa Peace Foundation and The Nippon Foundation in building human resource capacity and in supporting advanced academic research on complicated and contentious ocean issues. The scale and success of these endeavours can be measured from the broad spectrum of programmes the Nippon Foundation has supported since the 1980s. Thus, for example, it champions 30 fellowships per annum for students from developing countries pursuing MSc degrees at WMU. Other remarkable achievements include the Nereus Program, which is an inter-institutional partnership between 17 of the world's leading universities including the University of British Columbia, Princeton, Stockholm, Duke, Utrecht and Cambridge universities, all of whom are engaged in collaborative natural and social science research pertaining to the ocean.

The list of international bodies that have benefited from the largesse of the Nippon Foundation in capacity building is equally impressive and includes the International Tribunal for the Law of the Sea, the International Hydrographic Organization, the Division for Ocean Affairs and the Law of the Sea at the UN, as well as the International Maritime Law Institute（IMLI）in Malta, which has hosted over 150 fellowships.

The establishment of the new Institute at the WMU should not therefore be viewed in isolation, as it is intrinsically linked to the major contribution in capacity building made by the Nippon Foundation in assisting international efforts to pass on a sustainable ocean to future generations.

POSITIONING THE NEW INSTITUTE

Beginning with the UN 'family', many international organisations are shaping ocean governance decisions and fostering greater scientific understanding of human impacts on the marine environment. In particular, substantial capacity building and educational efforts in ocean affairs are undertaken by a wide range of UN System bodies through their technical cooperation programmes including those provided by the IMO, IOC-UNESCO, FAO, DOALOS and the ISA, among others.

In light of these initiatives and with a view to exploring how the new Institute can best complement existing public and private capacity building efforts, the University convened the WMU Global Ocean Conference on 8 and 9 May 2018. The conference brought together 240 participants from more than 50 countries, along with senior representatives from UN System bodies and selected states, as well as a diverse range of stakeholders and experts from industry and civil society including the Nippon Foundation and the Governments of Seychelles, South Africa, Indonesia, Sweden, Canada, Germany, Norway and Japan. The aim of the conference was threefold, namely：（1）to identify the many threats to the world's ocean ranging from land-based pollution to coral bleaching, overfishing, marine habitat degradation, ocean acidification and the impacts of climate change；（2）to explore how best to build transformative partnerships between public and private bodies for ocean sustainability in light of the Sustainable Development Goals（SDGs）; and（3）to identify research priorities for the future work programme of the new Institute.

The 2018 WMU Global Ocean Conference welcomed 240 participants from 50 countries, including from the Nippon Foundation, representatives from the governments of the Seychelles, South Africa, Indonesia, Sweden, Canada, Germany, Norway, Japan, etc., as well as a wide variety of stakeholders and experts from industry and civil society organizations.

For the purpose of promoting wide-ranging and inclusive discussions, the Conference was divided into six panels focusing on the theme of building transformative partnerships to implement the ocean-related goals of the 2030 Agenda from distinctive perspectives and constituencies. On the basis of two days of comprehensive deliberations, broad consensus emerged among the participants that the Institute should contribute to the implementation of international ocean governance instruments.

There is also universal support for the mission of the Institute, which is tasked with becoming an internationally recognised centre of excellence in ocean governance research, to act as a nexus and convergence point between diverse ocean stakeholders, while building global capacity in ocean governance and contributing to the implementation of Goal 14 of the 2030 Agenda. In realising its vision and discharging its mission, the Institute is informed by five guiding principles drawn from the 2030 Agenda pertaining to people, planet, prosperity, peace and partnerships. In keeping with these principles, the Institute will undertake research and related educational and outreach activities closely aligned with the ocean-related goals of the 2030 Agenda.

VOYAGE AHEAD

The changing geopolitical realities of the ocean are complex and demand constant scientific review and analysis from different perspectives. For this reason, the projects and extra-mural activities planned by the Institute are very much focused in taking a long-term perspective and looking ahead to intergenerational impacts of current activities,

as well as shorter term impacts over the next 20 to 30 years. The Agenda is directly linked to the Charter of the WMU, the extensive deliberations undertaken with key stakeholders across a broad spectrum of interests represented at the 2018 WMU Global Ocean Conference, as well as discussions with the principal sponsors from Japan, Sweden, Germany and Canada. The work of the Institute is needs driven and centres in many instances around the core mission of the WMU in assisting international organizations and States, particularly developing countries, as well as other ocean stakeholders in advancing sustainable development under the 2030 Agenda.

A key aspect is to work with non-traditional partners from other sectors with a view to developing innovative and radical solutions to some of the most pressing challenges in ocean governance. The work programme includes a spectrum of tailored project initiatives on the following : marine debris ; navigational rights and freedoms with an initial focus on the sustainable use of straits used for international navigation ; capacity building relating to areas beyond national jurisdiction in conjunction with the International Seabed Authority and the International Maritime Organization, especially in relation to governance issues and the institutional architecture for the implementation of a legally binding instrument under UNCLOS ; issues concerning greater convergence between the ocean and climate action legal regimes in line with Goals 13 and 14 of the 2030 Agenda, particularly in the context of sea level rise and the related challenges for the maritime boundaries of Large Oceanic States in the Pacific Ocean ; spatial governance of ocean space and ocean leadership in relation to the land-to-sea interface ; enduring and emerging challenges in ocean governance pertaining to gender empowerment, as well as concerning the application of new technologies and platforms for data acquisition and sharing.

Ronan Long, Director, WMU–Sasakawa Global Ocean Institute, at the Global Ocean Conference

The underlying premise of the work programme is that education, research and human resource development are vital catalysts for engendering a sustainable ocean for the benefit of humankind. This is acknowledged by the UN First Global Integrated Marine Assessment, which points out that achieving sustainability requires a strong understanding of the functioning and importance of the ocean by experts and the public alike. In many ways, the WMU is the embodiment of the axiom that education and capacity development are the twin-motors of sustainable development. Accordingly, as an integral part of WMU, the success of the Institute on the voyage ahead will be determined by how well it mentors a new generation of ocean governance leaders and builds transformative partnerships that make a difference on ocean sustainability worldwide. ■

50 Years Since the Start of Japan Meteorology Agency's Repeat Hydrographic Observations Along 137°E

[KEYWORDS] Japan Meteorology Agency hydrographic observations / repeat observations along 137°E / Jotaro Masuzawa

Toshiya Nakano
Japan Meteorological Agency / Head, Marine Environment Monitoring and Analysis Center, Global Environment and Marine Department
(Ocean Newsletter No. 402, 5 May 2017)

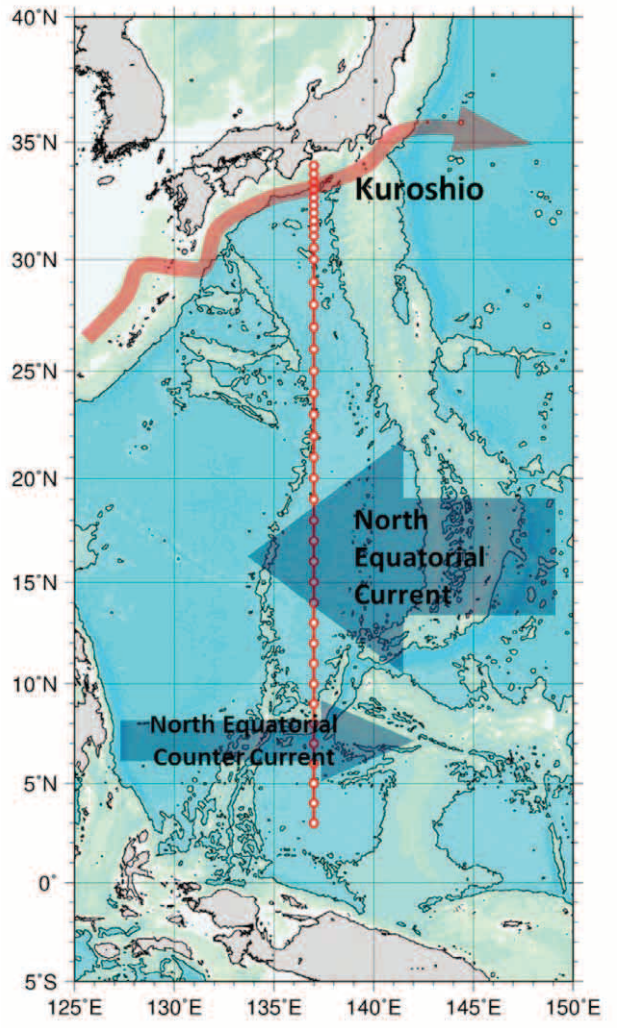
The Japan Meteorological Agency has conducted repeat hydrographic observations along 137°E since 1967, and launched the 51st observation with the departure of its research vessel on January 10th, 2017. Not only is the continuation of such a repeat observation unprecedented anywhere in the world, but the observation is also known, since the very first time, for releasing its entire data collection. These data are open for use by all researchers, leading to high acclaim from both domestic and international organizations working in the ocean field. We believe repeat observations along 137°E are invaluable assets that should be passed on to future generations.

Repeat hydrographic observations along 137°E

The Japan Meteorology Agency has established a repeat observation section in the Northwest Pacific Ocean, including the area around Japan, and conducts hydrographic observations along this section not only on the ocean surface but also below it [1]. The most representative of these repeat observation sections is the one going along 137°E (hereinafter the 137°E section). Observations along this section were started in the winter of 1967 (the year after Ryofu Maru II came into service), through our participation in the "Cooperative Study of the Kuroshio and Adjacent Regions (CSK)," planned as an official program by the Intergovernmental Oceanographic Commission (UNESCO-IOC). The aim of the program, in which Japan played a central role, was to observe ocean circulation in the West Pacific, including the Kuroshio. Dr. Jotaro Masuzawa, who served as both Director-General of the Japan Meteorology Agency and President of the Oceanographic Society of Japan in later years, explained the reason for selecting the 137°E section as follows: "A observation section that conveniently crosses the major ocean currents of the North Pacific such as the Kuroshio and the North Equatorial Current with little localized impact from islands, sea mounts, etc., enabling us to observe general variation in large-scale phenomena as much as possible." The line extends for about 3,900km from 34° N off the southeast of Cape Daio on the Shima Peninsula to 1° S off New Guinea [2].

Dr. Masuzawa was also a researcher who analyzed hydrographic observation data, and was responsible for coining the term "Subtropical Mode Water," an important concept for understanding climate change [3]. In *Kuroshio kyōdō chōsa (CSK) to watashi* ("The CSK and Me," Kaiyo Kagaku, 1978), published about ten years later, he gave an account of the time when observations were first carried out. As he recalls, "Even if the purpose was to investigate large-scale and long-term variation, I always suspected that not enough could be achieved by observing only once a year, and I felt that it would take about 30 years before we could make any value judgments." In fact, observation data on the 137°E section over the last 50 years have produced a wealth of knowledge through more than a hundred papers on the structure of the Northwest Pacific, El Niño and other climate change phenomena, ocean physics connected with variation in biogeochemical cycles, and long-term variation in biogeochemistry. This knowledge was even cited in "The Fifth Assessment Report of the Intergovernmental

■Hydrographic observation stations along 137°E
(thin lines are 4,000m isobaths)



The R/V Ryofu Maru II. Two research vessels are currently used for the observations – Ryofu Maru III, which came into service in 1995, and Keifu Maru II.

Panel on Climate Change (2013)". Our efforts have also been warmly praised at the international level; at the 2016 annual meeting of the North Pacific Marine Science Organization (PICES) held last November, for example, we were awarded the PICES Ocean Monitoring Service Award (POMA) for long-term ocean monitoring that contributes to the growth of ocean sciences in the North Pacific. Now that the advance of global warming and changes in the global environment are becoming serious social problems, one is again full of admiration for the forethought and vision of Dr. Masuzawa and the others who started observing the 137°E section from such a long-term viewpoint.

The parameters observed in those early days were water temperature, salinity, dissolved oxygen, nutrient salts and chlorophyll a, physical parameters and biochemical data that are still being collected today. In the 1980s, observations of ocean atmosphere and carbon dioxide in surface seawater were started in order to monitor greenhouse gases as a cause of global warming, reflecting social trends of the time. These data have also been accumulated for more than 30 years. Today, we also observe carbonate parameters in seawater (total carbon dioxide, alkalinity, pH) and Chlorofluorocarbons with the aim of further clarifying variation in the carbon cycle. These observation data are all published in *Kaiyō no kenkō shindanhyō* ("Marine Diagnosis Report") on the Japan Meteorological Agency website [4].

Surveys of the 137°E section in international projects

Our observations of the 137°E section have also played their part in national and international observation projects. The most representative of these was our participation in the World Ocean Circulation Experiment (WOCE) during the 1990s. In this project, the 137°E section was positioned as the one-time observation section "P9" in the Northwest Pacific area, and we conducted observations at all points going down to seabed level in 1994 ("P9" was one of just over 30 observation sections established in the Pacific Ocean). After this, we again conducted observations in 2010 and last year (2016), and are currently taking part as a high-frequency observation section in the Global Ocean Ship-based Hydrographic Investigations Program (GO-SHIP), and in the Global Ocean Acidification Observing Network (GOA-ON).

Future hydrographic surveys by research vessels

In recent years, the main players in hydrographic observations have been shifting to Argo floats [5] and automatic observing platforms such as space satellites. However, collecting observation data on physical parameters and many biogeochemical parameters to a high degree of precision from the ocean surface to the seabed still depends on observing by research vessel. With the advance of global warming and ocean acidification, long-term observations by research vessel will continue to be important in detecting minor but important variations in the oceans, as well as helping to clarify the situations and mechanisms of long-term variation and change. In fact, they will probably be used even more as data for verifying future prediction models of climate and the global environment. Our observation data on the 137°E section over these last 50 years should be preserved for posterity as a precious asset of mankind, and I hope they will remain at the center of hydrographic observations by the Japan Meteorology Agency in future. ■

1) See "Oceanographic and Marine Meteorological Observations by Research Vessels" in "Oceanographic Observation" on the Japan Meteorology Agency website (http://www.data.jma.go.jp/gmd/kaiyou/db/vessel_obs/data-report/html/ship/ship_e.php)
2) Currently goes as far as 3°N.
3) Subtropical Mode Water: Distributed broadly and thickly in the surface of the Northwest Pacific Ocean south of Japan, it transports heat, carbon dioxide and others from the ocean surface to the interior ("mode" is a term used in statistics to signify the value that appears most often in a set of data).
4) See http://www.data.jma.go.jp/gmd/kaiyou/shindan/index_obs.html
5) See http://www.jamstec.go.jp/J-ARGO/overview/overview_1.html

The Fire of Rice Sheaves and its Connection to World Tsunami Awareness Day

[KEYWORDS] tsunami / disaster risk reduction education / Goryo Hamaguchi

Koichi Sakiyama
Director, Inamura-no-Hi no Yakata (Fire of Rice Sheaves Center)
(Ocean Newsletter No. 414, 5 November 2017)

"World Tsunami Awareness Day," designated on November 5th, is connected with the events that followed the Ansei Earthquake in 1854, when a great tsunami overtook Wakayama Prefecture's Hiromura Village (present day Hirogawa Town). During the disaster, Goryo Hamaguchi lit fire to sheaves of rice in an effort to alert those who had not started running upland to safety, saving their lives in the process. On a proposal by Japan, the United Nations General Assembly unanimously designated November 5th as "World Tsunami Awareness Day." At Inamura-no-Hi no Yakata, we will continue to spread the story of the "Fire of Rice Sheaves," in an effort to ensure absolutely zero victims from tsunami disasters.

Examining how Tsunami-Based Disasters are Reported

On March 11, 2011, a huge tsunami hit the Tohoku region of Japan. Seeing such an event occur in our country shocked people throughout Japan. I remember sitting in front of the television as I kept watching the footage of the tsunami being broadcast.

Disasters occur every year, but tsunamis only occur once every few years, or once every few decades. The tsunami after the Great East Japan Earthquake is said to be of a class that only occurs once every thousand of years. While it is difficult to say how we should best go about ensuring that information about tsunamis is handed down between generations, the story about the "Fire of the Rice Sheaves" is one way we could help people learn about tsunami risk reduction.

The Fire of Rice Sheaves and the Inamura-no-Hi no Yakata

The main house of the wealthy Hamaguchi family was located in Hiromura, in Kii Province (modern day Hirogawa, Arida District, Wakayama Prefecture). The family had been producing soy sauce in the city of Choshi, located on the Boso Peninsula, since the mid-1600s. The main character of the Fire of Rice Sheaves, Goryo Hamaguchi, was the 7th generation head of the Yamasa Corporation. At the time he had been traveling to and from his hometown of Hiromura and Choshi. It was during one of his visits home in 1854, that one of the series of Great Ansei Earthquakes occurred, which was followed by a tsunami. He had heard that earthquakes were often followed by tsunamis, and so appealed to the villagers to move to the Hachiman Shrine, which was located on higher ground. This information had been handed down between generations based upon experiences from previous disasters.

In 1896, the writer Lafcadio Hearn received a report about the Sanriku earthquake. He combined this with information he had learned about the Ansei tsunami at the end of the Edo period, to write the book "A Living God." An elementary school teacher who read the book translated it into Japanese, rewriting it as a tale for his students as "Inamura-no-Hi." The book was adopted as part of the elementary school reading curriculum between 1937 and 1947.

In 2007 the Inamura-no-Hi no Yakata ("Fire of Rice Sheaves Center") was created as a facility that combines the Hamaguchi Goryo Archives and a Tsunami Educational Center [1]. The Inamura-no-Hi no Yakata uses the story as a way to raise awareness of tsunamis, based largely around the main character of Goryo Hamaguchi. The center uses exhibits, videos, and other forms of equipment to help visitors understand what kinds of disasters tsunamis create, and help them incorporate disaster risk reduction into their daily lives. The earthquake in 2011 led to a large number of people visiting the center who had realized that they could not just ignore tsunamis in their daily lives. Textbooks with information about tsunamis were printed the same year [2], with elementary school students now learning about tsunami risk reduction at school.

An image of the Inamura-no-Hi no Yakata. The Hamaguchi family's old residence was donated to Hirogawa town, leading to the creation of the center.

Recovery and Revitalization after a Tsunami

The tale of the Fire of Rice Sheaves aims to create a story out of the idea that tsunamis occur after earthquakes and that people need to evacuate to higher ground. To prompt people to evacuate, Goryo Hamaguchi set fire to sheaves of rice located next to the village headman's house. He did this knowing that the townspeople would quickly come to extinguish the fire, allowing them to be led to safety. His

The Hiromura Seawall created by Goryo Hamaguchi (national historical relic site)

quick thinking led to 97% of the town's 1,323 residents being saved. However, this is only the start of his story.

He not only provided leadership and guidance to quickly solve issues such as acquiring food, housing, and restoring lifelines for the evacuated residents, but also paid most of the costs involved. Unfortunately, the townspeople were concerned about the risk of another tsunami, and began to leave the town due to concerns about their livelihoods. This process had been repeated again and again throughout Hiromura's history. During the Muromachi period, Hiromura was a thriving castle town under the rule of the Hatakeyama clan, and had up to 1,700 households. The conquest of the Kii Peninsula by the Toyotomi clan and a tsunami that repeatedly hit the area led to the population being reduced to just 340 households in the Ansei era. Knowing this, Goryo felt a sense of impending crisis. He knew that if too many people left the village, Hiromura itself would cease to exist. This led him to consider the creation of seawalls. Hiromura already had seawalls in the form of the Hatakeyama seawall created in 1400, and the Wada seawall, located in the open water off the Kii Peninsula, which had been built based upon orders given by Yorinobu Tokugawa (the 10th son of Ieyasu Tokugawa), the first domain head of the area. However, neither of these had withstood the Ansei tsunami.

Goryo therefore planned to create an even larger seawall within the Hatakeyama seawall as a way of preparing for the next tsunami. Knowing that he could not rely on funding from the Kii Domain for its creation, he decided to pay for it himself. There was also support from another of the Hamaguchi households. Also knowing that he would need the permission of the Kii Domain to create it, he made his request by saying that "Creating the seawall would bring solace to a hundred generations of residents." After receiving permission, he hired victims of the disaster as laborers and paid them daily, thereby contributing to relief efforts.

Goryo Hamaguchi's Actions Lead to World Tsunami Awareness Day

After the Great East Japan Earthquake, the "Act on the Promotion of Tsunami Countermeasures" was enacted in June 2011, and November 5th became Tsunami Disaster Prevention Day. This led to awareness initiatives being implemented nationwide through evacuation drills, lectures, and other activities.

In March 2015 the 3rd United Nations World Conference on Disaster Risk Reduction was held in Sendai. At the conference, the Japanese government proposed that November 5th be named World Tsunami Awareness Day. Thereafter, the government and volunteers from the National Diet worked energetically to ensure this was enacted in countries around the world. The actions of the Japanese government led to 142 countries making a joint proposal at the 70th UN General Assembly held in the same year. The end result was that all UN member states agreed to this proposal. This unanimous vote showed that countries around the world truly understand the necessity and importance of disaster risk reduction.

This is where the connection between the Fire of Rice Sheaves and World Tsunami Awareness Day can be seen. However, having this Day enacted in itself is not enough. We must continue to reach out to the world, and realize that we are still at the starting line when it comes to the promotion of tsunami risk reduction. The first World Tsunami Awareness Day held last year led to projects being held around the world designed to mitigate tsunami-based risks. There were joint drills held between Japan, Chile, and other Central and South American countries, an educational campaign based on the Fire of Rice Sheaves was held in Indonesia, and female leaders from Pacific Island Countries visited our center for training sessions.

Aiming for Zero Tsunami Victims

The story of the Fire of Rice Sheaves, with its main character Goryo Hamaguchi, attempts to communicate to the world that "Tsunamis occur after earthquakes in coastal areas. If a tsunami occurs, run away to higher ground. If there's no higher ground in your country, try to get as far from the coast as possible." Japan, along with the Inamura-no-Hi no Yakata, aims to ensure that we have a world in which there are no victims of tsunamis. ■

1) Inamura-no-Hi no Yakata. https://www.town.hirogawa.wakayama.jp/inamuranohi/english/
2) In FY 2011, a biography of the life of Gihei Hamaguchi (Goryo) was written by Yoshiaki Kawata (associate professor at Kansai University, and Disaster Risk Reduction academic) under the title "Protecting our Hometowns in 100 years." This was published by Mitsumura Tosho Publishing in a Japanese (*Kokugo*) textbook aimed at elementary school students in fifth grade.

Ama Divers are Incredible!

[KEYWORDS] Ama divers / abalone farming / co-existence with the environment

Yoshikata Ishihara
Director, Toba Sea-Folk Museum
(Ocean Newsletter No. 415, 20 November 2017)

For close to 10 years now, we have continued in our efforts to have "Ama" divers placed on the UNESCO World Cultural Heritage List. Following their promotion in the NHK television drama "Ama-chan," the Ama divers, who dive for fish unaided by oxygen tanks, attracted attention and popularity at the Ise-Shima Summit last year. However, the number of Ama divers has decreased, along with the decrease in traditional fishing methods and festivals. Ama divers, who exemplify co-existence with the ocean through sustainable fishing, are exceptional examples of Japan's ocean cultural heritage. We would like for more people to know how incredible they are.

Initiatives Towards Registration as a UNESCO Intangible Cultural Heritage

We have already been working for almost 10 years to have the practice of Ama diving registered as a UNESCO Intangible Cultural Heritage. In November of 2016 female divers from South Korea's Jeju Island were registered on this list. One of the conditions for applying was that Ama divers had to be an important national cultural property. We were originally hoping to be registered at the same time as South Korea's divers, but we were not even able to apply. In March of this year Ama divers were finally designated as an Important Intangible Folk Cultural Property, which allowed the application process to begin.

At first, we were often asked what Ama divers were, but recently we are being asked how Ama divers can be listed as a form of world heritage. After the NHK drama series "Amachan" raised awareness of Ama divers, the "Ama divers who free-dive to fish" received attention from the world's media at the 2016 Ise-Shima G7 Summit, further increasing their visibility.

But why are they Incredible?

So why are Ama divers so incredible, and what value do they have to modern Japan?

The first point that makes them incredible is their amazing diving skills. We call the time that Ama divers spend submerged in the water a "50-second battle." This is the most time they can spend underwater harvesting seafood. They use their whole bodies to dive, with their entire focus being on finding the items they are searching for. They have to understand the movement of the water and stay aware of any dangers. This requires the use of all five senses throughout their dive. This requires high oxygen consumption, which limits the length of time they can remain underwater. Of course, there are differences between individuals, but generally the more experience they have, the larger their catch is. As well as diving techniques, their experience includes knowledge of the currents, tides, waves, and temperature of the ocean, as well as knowledge they have

Ama divers have ensured that the ocean's forests are protected.

accumulated about types of seafood, maturity, habitats, and breeding seasons. The acquisition of their abundant knowledge becomes their primary form of support when diving.

The fact that Ama divers are women also provides them with advantages in the ocean and when harvesting. In recent years, the number of male Ama divers is also increasing. The amounts they harvest in a single day are typically higher than the female divers. However, this difference becomes less obvious when looking at total yearly amounts. Female divers have endurance. They work persistently and persevere at their jobs. They also cooperate well with each other. They dive because they love doing it. The fact that they enjoy their jobs becomes the basis for what they do.

The second point is that Ama divers coexist with the natural environment in the ocean. While they believe in and rely on the abundance of the ocean, they also realize that the ocean is something that cannot be defied. The Ama divers pray to the gods of the ocean in each of the 27 districts they work in on the Shima Peninsula, hoping for abundant catches and for the warding off of calamities.

The divers say that their catches of abalone, turban shell, sea cucumber, and seaweed "well up out of the oceans." During the fishing season, the divers are aware of exactly where the most seafood will "well up," using their knowledge of the mysteries of nature. This helps them to get the

This poster "Ama divers are incredible!" was created when the practices of divers in Toba and Shima were designated as an Important Intangible Folk Cultural Property.

biggest catch possible. Ama divers have a deep instinctual awareness of the food chains and ecosystems that describe the interrelation between plants and animals in the oceans. If too much Arame seaweed is harvested, this will result in too much sunlight reaching the rocky ocean beds, reducing the food available for abalone and sea cucumber, leading to reductions in their numbers. This would mean the Ama divers would lose their catch. Their deep knowledge of this relationship means that Ama divers refer to communities of seaweed and algae as "the forests of the ocean" and take great care to ensure they do not over-harvest them.

However, there are certain overwhelming forces that prevent the Ama from doing their jobs - severe storms, typhoons, and strong seas/tsunami. In recent years, meteorological information has developed, and more detailed weather forecasts are available. However, as recently as a few decades ago sudden changes in ocean conditions led to many Ama divers losing their lives. Ama divers still live in awe of the ocean.

The third point is the role that Ama divers have as the cornerstone of the communal nature of Japanese fishing villages. Although Ama divers appear to work individually, they actually work as a community, and there are strong connections among them. Harvesting of seafood is performed on days when all of the divers from the villages in the area can participate. If one household cannot participate due to a funeral for example, no one dives on that day. This means that if there is a wedding, start of school ceremony, or birth in one of the villages, harvesting is not performed.

There are huts called "kamado" or "hiba" in the Ama divers' villages, with one hut shared by several individuals. On work-days, the divers use the huts to change clothes, warm themselves in front of a fire, shower, eat, and rest. More than anything else, Ama divers love chatting. Topics can include everything from the amounts of abalone that were harvested that day, to the price of items purchased the previous day on a trip to the city. There are also serious discussions about health, with topics including aches and pains in the legs and lower back, recent high blood pressure, or how good a certain doctor is. They also share information about their villages. This creates friendly relationships between the younger and older women who share these huts.

Traditional and Sustainable Fishing

The primary goal of the divers is to harvest as much seafood as possible. But this also includes ensuring that this is performed in a sustainable manner. This is their most important vow. This vow can also be seen in two of the terms they use: "open mouths" and "not big enough."

On days in which the abalone open their mouths, the divers try to collect as many as possible, but none are collected if their mouths are closed. For example, during the summer harvesting season in the area around Toba city in Mie Prefecture, at most there are typically only 30 to 40 days during which the abalone open their mouths. In Mie Prefecture, it is illegal to harvest abalone that have a shell length of less than 10.6 cm, which leads to the second term "not big enough". The size limit for the operculum (lid covering the opening of the shell) of turban shells is 2.5 cm. There are also a large number of other rules (conventions) for harvesting that the Ama divers follow. This is to ensure that they do not over-collect when harvesting. The fact that these rules were agreed upon by the divers and have been followed is precisely what has allowed them to exist for such a long time.

However, the practice of Ama diving is now at risk of dying out. This is due both to aging amongst the divers, and a lack of successors. At the peak of Ama diving in 1965, there were almost 3,000 divers working around the Shima Peninsula. This has now decreased to 700 and the average age of the divers is now almost 70. If this continues, the practice of Ama diving will end within 10 years, leading to the end of a 5,000-year-old practice.

Ocean-based cultural practices are disappearing one at a time from all four sides of the Japanese archipelago. The depopulation of seaside villages is leading to the extinction of traditional forms of fishing, festivals, and other customs. I hope that the Ama divers are protected as a final bulwark against this extinction. This is not just about ensuring that old customs are retained. I hope that the revival of the Ama divers is supported in a way that makes them a standard-bearer for protecting the ocean's environments, and that they will help to both revive and recover primary ocean industries. ■

Putting "Dreams and Spirit" into Shrimp Crackers

[KEYWORDS] shrimp / confectionery / fishing industry

Toshio Mitsuda
President and Representative Director, Keishindo Corporation
(Ocean Newsletter No. 428, 5 June 2018)

Since the founder of the Keishindo Corporation, Keisuke Mitsuda, perfected the first shrimp cracker (ebi senbei) in Japan more than 150 years ago, the company has continued to refine its flavor. The company has always placed importance on nature and the changing seasons, the Japanese spirit of valuing each of the four seasons, and the native traditions and culture cultivated by preceding generations. Through creating flavorful shrimp crackers, we hope to contribute to lasting prosperity in the shrimping industry, and also communicate the Japanese spirit to future generations.

The Shrimping Industry's Lack of Successors

An explanation of Keishindo's background is required to discuss this problem. When our company was initially founded, the waters around Chita Peninsula in Aichi Prefecture contained so many small Akasha shrimp that it was as if the sea was boiling with them when they were caught. These shrimp were cooked with minced fish, then dried in the sun to create a form of preserved food known locally as Chinkara. When Keisuke Mitsuda, the company's founder, moved to the area from Mino (current-day Gifu Prefecture), he began to improve on this recipe to make it tastier, but it was nothing like a confectionery at the time. Thinking about it, having a confectionery that uses seafood as a raw ingredient is a rarity throughout the world. Even in Japan, Aichi Prefecture is responsible for about 95% of the production of shrimp crackers, making them a highly localized food item.

To return to the topic of the current state of the shrimping industry, in 2005 1,114t of shrimp were caught in Aichi Prefecture. In 2015, this had dropped to 815t, reduced to approximately 73% of its former value. By comparison, although there were 5,304 individuals involved in the fishing industry in 2003, by 2013 the number had dropped to 4,319, reduced to approximately 80%. Looking at a breakdown of ages, approximately 70% of workers were 50 or older, with 25% aged older than 70. This aging in the fishery industry is becoming a serious problem. In Yoichi, Hokkaido, one of our primary areas of supply for raw ingredients, the lack of workers means that more and more deep-water shrimping boats are going out of business. The aquaculture industry is also seeing similar issues. The peak of kuruma shrimp production in Japan was 3,000t in 1988. This has now shrunk by approximately 47%.

Keishindo has been in business for seven generations, or more than 150 years, thanks to the blessings of Japan's bountiful seas, and the support of fishermen. Our company uses approximately 300t of shrimp every year. We place a great deal of importance on our relationship of trust with fishermen, and hope that a spirit of mutual support will ensure that both our business and the shrimping industry continue into the future.

Meeting the Demands of the Ingredients

Keishindo makes a confectionery called "Ama Ebi Odoriyaki" (lit. live baked deep-water shrimp). The name comes from the concept of eating live seafood (known as "odorigui" in Japan). Our company invented the product to see if we could create a form of confectionery with the same beautiful and colorful shape as the deep-water shrimp. The product is only available during the winter months. Our company had been producing a similar product for several years based on the kuruma shrimp, and we had collected information about how the product should be baked. We therefore believed that producing a confectionery based on the deep-water shrimp would be relatively

Ama Ebi Odoriyaki

Deep-water shrimp: The raw ingredients

simple. However, experimental production showed that there were issues with the required feel, color, and texture. We attempted to work out the possible causes, including size, sex, and area of production of the raw ingredients, but could not find anything definitive. The only other possible cause we could think of was freshness, but the deep-water shrimp were transported by air in temperature-controlled conditions from Hokkaido to Nagoya. This meant that all possible consideration had been taken in regard to this factor. In addition, there were no problems with K values, breaking strength, color tone, and other indices relating to the freshness of seafood when they were compared to our company's standards. With the factory being in Nagoya and the area of production being Hokkaido in the north or in the Hokuriku region, it seemed like there wasn't really anything else that could be done. Just as we were about to give up, one of our staff members came up with an interesting proposal: "Why don't we make a factory in the area of production?" We immediately requested that a small amount of still living deep-water shrimp be sent to Hokkaido from Hokuriku, and began performing baking experiments under the assumption that the factory would be situated in the area of production. These experiments led to the conclusion that the shrimp still being alive was the most important factor. We built our deep-water shrimp processing plant in Yoichi-cho, Yoichi-gun, Hokkaido, nine years ago.

This may be a slightly different concept from that of "locally produced for local consumption," but it is an excellent example of the importance of meeting the demands of the ingredients as opposed to having the ingredients meet the demands of production.

The Change from Shrimp Crackers to Shrimp Confectionery

At our company, we call our confectionery "works" not "products." That is because we place importance on the story behind each item, and the thoughts of those who actually made them. This change in thinking began when we could not come up with an idea for a new product to sell in one of our new stores. This change also helped us escape from our preconceived notions regarding what shrimp crackers are. Despite producing multiple trial products based on the desire to create a delicious shrimp cracker, we were not able to come up with a satisfying result. We were looking for some kind of a hint. When an individual in charge of department store sales asked us for a report on our development status, he commented that, "Just attempting to create a delicious product won't lead to any changes. Why not try adding a sense of seasonality or some kind of narrative to the product?" This caused the scales to fall from our eyes.

This idea, to use an analogy, was a form of evolution similar to when sea creatures evolved into amphibians that could live on land. In addition to delicious flavors, we needed to aim for additional factors such as appearance, ingredients, and a sense of seasonality. This led to us evolving from being a shrimp cracker manufacturer to a shrimp confectionery manufacturer, and is what put Keishindo on its current path.

Darwin's theory of evolution states that, "It's not the strongest or smartest creatures that survive, instead it's the creatures that are most able to adapt to their environments." We will continue to protect our traditions as a long-standing company, without fearing change, and produce confectionery most suited to the current era.

To conclude, I would like to express my gratitude to Japan's beautiful changing seasons and its bountiful seas. ■

A variety of limited edition products are planned per season. The previously sold "Summer Festival" product.

Contributors

Tomo Shioiri : Ocean Policy Research Institute of the Sasakawa Peace Foundation

Mai Fujii : Ocean Policy Research Institute of the Sasakawa Peace Foundation

Toshio Yamagata : Japan Agency for Marine-Earth Science and Technology

Takashi Kikuchi : Japan Agency for Marine-Earth Science and Technology

Eiichi Sakata : Remote Sensing Technology Center of Japan

Yoshihisa Shirayama : Japan Agency for Marine-Earth Science and Technology

Masanori Kobayashi : Ocean Policy Research Institute of the Sasakawa Peace Foundation

Atsushi Watanabe : Ocean Policy Research Institute of the Sasakawa Peace Foundation

Tomohiro Kuwae : Port and Airport Research Institute

Masanori Miyahara : Japan Fisheries Research and Education Agency

Naoko Maruyama : Ocean Policy Research Institute of the Sasakawa Peace Foundation (Editing)

Tomohiko Tsunoda : Ocean Policy Research Institute of the Sasakawa Peace Foundation (Editing)

John A. Dolan : Ocean Policy Research Institute of the Sasakawa Peace Foundation (Editing)

Sachiko Oguma : Ocean Policy Research Institute of the Sasakawa Peace Foundation (Editing)

Yosuke Itagaki : Seizando-Shoten Publishing Co., Ltd. (Design)

Junko Ujiie : USJ Consulting LLC (Translation)