– Selections –

White Paper on the Oceans and Ocean Policy in Japan

2020

Ocean Policy Research Institute,
Sasakawa Peace Foundation

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2020 White Paper on the Oceans and Ocean Policy in Japan
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FOREWORD

The Ocean Policy Research Institute of the Sasakawa Peace Foundation has published its *White Paper on the Oceans and Ocean Policy* every year since 2004 in an effort to support comprehensive and interdisciplinary initiatives on Japan's ocean issues. We published the first English edition of the White Paper, "Selections: White Paper on the Oceans and Ocean Policy in Japan" in 2018. Since then we have been 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 both Japanese and English versions.

International discussions on sustainable use of the oceans have taken place under the legal framework of the United Nations Convention on the Law of the Sea, which came into force in 1994. It originated from a policy framework of the comprehensive plan of action for sustainable development, Agenda 21, of the 1992 Rio Earth Summit. While the United Nations Framework Convention on Climate Change and the Convention on Biological Diversity were adopted after the Rio Earth Summit, international discussions on the oceans mainly took place individually in each sector, such as fisheries and shipping, and comprehensive discussions were very limited until about 2010.

We saw a major turning point in 2012–2015. The United Nations Conference on Sustainable Development in 2012 (Rio+20) spurred discussion on Sustainable Development Goals (SDGs). The SDGs, including SDG14 (Life Below Water), were set in 2015. Adoption of the Paris Agreement stimulated further discussion on the oceans. As a part of this trend, forums for comprehensive discussion such as the "Our Ocean Conference (OOC)" (inaugurated in 2014) and the United Nations Ocean Conference (inaugurated in 2017) have been formed.

2020–2021 are unprecedented years for ocean issues, with both the triennial United Nations Ocean Conference and the biennial UN Biodiversity Conference (CBD–COP) having to be postponed until 2021 due to the COVID-19 pandemic. New (Post-Aichi) Biodiversity Targets for 2021–2030 will be set at CBD–COP15, which will replace the Aichi Biodiversity Targets for 2011–2020 adopted at CBD–COP10 in 2010. This is a once-in-a-decade opportunity. At the 25th Conference of Parties to the United Nations Framework Convention on Climate Change (UNFCCC) held in December 2019, the link between the oceans and climate change was mentioned for the first time in the COP Decisions, and is expected to be a focus of discussion at COP26, rescheduled for 2021. As illustrated by coral bleaching, climate change and biodiversity of marine life are issues closely related to sustainability of the oceans, so the UN Ocean Conference, CBD–COP15, and COP26 can also be considered a series of conferences dealing with ocean issues.

In addition, the 7th "Our Ocean Conference" is scheduled to be held in this December in Palau, a country with close ties to Japan, and the 3rd Arctic Science Ministerial will also be held in Tokyo. You may recall that the issue of ocean plastics was discussed at the G20 Osaka and the "Osaka Blue Ocean Vision" was adopted. It is now expected that Japan will contribute actively to a Blue Recovery of the oceans, from conditions created by pandemic.

While they also had to be postponed due to the COVID-19 pandemic, 2020 was to be the year of the Olympic and Paralympic Games for Japan. Ocean related events

such as sailing, surfing, and the triathlon were to be held. These outdoor sports have in common that they require athletes to come into direct contact with nature. The 2020 Tokyo Games might thus provide glimpses into issues such as the water quality problem in Odaiba, the venue for the triathlon events, beach erosion of the Kujukuri Beach, and the issue of marine debris drifting on to beaches. In our *White Paper 2020*, we showcase these events in the opening feature article entitled "The Ocean Legacy from the Tokyo 2020 Games" and in a graphic illustration, and at the same time introduce oceans issues related to Japan.

For our children and our children's children to enjoy the benefits of the diversity and richness of the oceans, it requires cross-sector efforts, participation, and coordination by various stakeholders, including not just national and local governments and international agencies, but all people in civil society, the business/private sector, and scientists/academia. Nothing would please us more than to know that the *White Paper 2020* 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 2020

Atsushi Sunami
President, The Sasakawa Peace Foundation
President, The Ocean Policy Research Institute

Opening Interview

Tokyo 2020 Olympics Ocean Legacy

What I've learned though open water swimming

Dr. Daichi Suzuki is the Commissioner of the Japan Sports Agency. He was a gold medalist at the Seoul 1988 Olympics. He served as Executive Director and then Chairman of the Japan Swimming Federation, and was a professor at Juntendo University. He holds a Ph.D. in Medicine.

Interviewer: **Minako Takizawa**

Commissioner Suzuki, you were a gold medalist at the Seoul Olympics. Today I would like to focus on your relationship with the oceans.

When you were Executive Director of the Japan Swimming Federation, you oversaw open water swimming (OWS), a long distance swimming discipline that takes place in natural bodies of water such as open oceans, rivers and lakes. How did you come to get involved with OWS?

Daichi Suzuki

OWS, also known as marathon swimming, was added as an official Olympic event in the

Beijing 2008 Olympics for the first time and the world's swimming community has come to see it as a serious sport. As the number of Olympic events ballooned, there has been a move toward decreasing the number of sports and events in recent years. However, OWS was added in spite of this streamlining trend, reflecting its widespread popularity around the world.

I was on the faculty of Juntendo University, my alma mater, when OWS was made an Olympic event. Even after it became an Olympic event, there were very few research findings and papers on OWS at the time. So I decided to conduct my own study. I enlisted members of the school swimming team and collected various physical data, using EKG, etc. I had team members enter an OWS race, and to my surprise they won first place without any specialized training. As it happened to be a qualifier for the world championships, those students at Juntendo University became members of the Japanese national team and I accompanied them as manager. That is how I got involved with OWS.

During my competitive career, I considered using open ocean swimming as a training method. Of course, as a competitive swimmer I trained in pools, which sometimes became monotonous and repetitive, so I wanted to figure out alternative ways of training to break up the monotony.

For example, marathon training could consist

Athletes competing in an OWS race (Source: Ocean Newsletter No.256)

of running around a track multiple times or running cross-country style through woods, on a beach, or on a road on a remote island with no traffic signals, allowing the runners to enjoy the changing scenery along the way. In the same way, I thought of the possibility of training for long distance swimming not only in a pool but also in open water. While I myself couldn't make open water swimming part of my formal training regimen, OWS being officially added to the Beijing 2008 Olympic Games sparked my interested in OWS, leading me to undertake research on it.

Back in those days, when I invited swimmers through the Japan Swimming Federation to participate in OWS events, I encountered considerable reluctance. They said that unlike pool water, ocean water was not clean and that they were afraid of swimming in open water. They didn't want to swim in the ocean even though they were strong swimmers.

I thought we had to change the perception that the ocean was not clean, so I decided we would do what we could to make the ocean environment better. We started to clean the beach where races would be held. Sometimes we saw empty bottles. If I were a competitive swimmer, I would not be comfortable walking on such a beach. We did our best to improve the environment so that athletes would be willing to swim in the ocean. After about 10 years, today's long-distance swimmers willingly participate in OWS events.

As a person involved with OWS, it is not enough just to promote swimming. It is understandable that athletes prefer swimming in a clean ocean. Visually, it would be exciting if we could telecast athletes swimming in the ocean with fish swimming all about them. Promoting OWS is also important because it leads to thinking about drifting debris, marine pollution, and beach preservation.

Takizawa

Can you tell us about your experience of promoting swimming in developing countries? What is your take on it?

Suzuki

As an Olympic gold medalist, I had opportunities to visit various countries and regions in the world. I found quite a few countries where people were hard-pressed even to have access to drinking water. Swimming may be a privileged sport in such countries. When you don't have access to drinking water, how could you dare to swim as a sport?

I won the gold medal in swimming. It meant I was recognized as the fastest swimmer in the world. However, I couldn't help wondering if I was really the fastest. For example, anybody can take up running. Anyone can play football if you can find a ball-shaped object

to play with. Swimming, however, requires a sanitary environment to swim in. It may be called an inequitable sport, as disparities in training environments could mean the difference between winning and losing. I have engaged in the promotion of swimming out of a sense of responsibility to make it a true world sport. My goal is to make swimming a more equitable sport by further improving swimming environments around the world.
Swimming is not only a sport but also a physical activity that could help to solve human problems such as poverty and hunger. For example, if you live near the ocean and can swim, you can find food by catching fish and shellfish. In case of accidents and disasters near water, being able to swim could save your life. I also want to take this up as a theme when promoting swimming globally.

Takizawa

There are many Olympic and Paralympics events that are held in the ocean, such as sailing, surfing, triathlon, marathon swimming, and rowing.

Suzuki

These events' venues are not confined to Tokyo. Sailing will be held in the Sagami Bay in Kanagawa Prefecture, and surfing in the ocean off of Kujukuri Beach in Chiba Prefecture. I think it is a great opportunity to convey the appeal of Japan's ocean waters to people around the world. While it will entail considerable effort, we are positive about hosting this global event as it will lead to the future development of local ocean areas. Of course, the Sports Agency is responsible for successfully managing all the games, held in the ocean or not.

Takizawa

It would be exciting for children to have an opportunity to see world-class athletes compete right before their eyes.

Suzuki

Definitely. The Olympics and Paralympics will bring dreams and hopes to children and young people. Hosting the Games is an investment in the future of Japan.
Surfing has been added as a new event for Tokyo 2020. It is a sport that appeals

Sailing swiftly before the wind (Ministry of Foreign Affairs Facebook)

especially to the young. I expect this to be a great opportunity to promote and disseminate the appeal of sport among youth.

Takizawa

What is your view of the Paralympics?

Suzuki

Traditionally, the Olympics and Paralympics had been organized separately until the Tokyo Organizing Committee of the Olympic and Paralympic Games was established in preparation for Tokyo 2020. The Olympics and Paralympics will be presented as integrated games for the first time to the world at Tokyo 2020.

At the same time, the Paralympics presents an opportunity to think about an inclusive society. For example, it could be a model for a barrier-free society, where physically disabled people, such as users of wheelchairs, can live, play or watch sports without restrictions. I hope this concept, along with a "barrier-free mind," will spread throughout the country.

When I made an observation tour of the Rio de Janeiro Paralympics, I found the Paralympic facilities were not necessarily 100% barrier-free. I saw able-bodied people casually lending a hand when needed. It is not just about Paralympic facilities. It is very difficult to attain 100% accessibility in many circumstances. What we need is a society where no one has to think twice about lending a hand.

I would also like everyone to focus on the level of competition at the Paralympic Games. Do not make the mistake of underestimating the performance of disabled athletes. For example, a wheelchair tennis player first moves the wheelchair where the ball is to fall, no small feat in itself. Then they have to return it. There are more actions involved than in regular tennis. While the ball may bounce up to two times, moving in wheelchairs around the court to hit a ball demands a very high-level of athleticism. I would like everyone to witness and experience the amazing performance of Paralympic athletes. I have no doubt you will feel admiration for them. Tokyo 2020 will provide great opportunities to watch such high level games up close.

Takizawa

What should the legacy of Tokyo 2020 be? You've already raised the subject of the environment. How about from the perspective of marine leisure and tourism?

Suzuki

The Sports Agency is promoting sports tourism to revitalize regions and economies through sports. Outdoor sports is one of the major themes. Tokyo is no match for the countryside

"Cycling through Shimanami Kaido," a promotional video for sports tourism produced by the Japan Sports Agency.

in this regard. The natural features of the local regions in Japan, with their oceans, mountains, rivers and dams, have great potential as a paradise for sports activities.

We aim to promote inbound sports tourism. There are many cases where the local residents do not know the potential of the sports resources that they have. People say, "Our village has nothing but the ocean and mountains." Those are exactly what attract inbound visitors. I hope they will take full advantage of their local resources to promote sports.

For example, the Japan Swimming Federation organizes the OWS Circuit Series. A series of OWS competitions starts in May or June every year. The races are held in various locations throughout Japan. By participating in the races, athletes accumulate points. Top point-getters qualify to participate in the Japan national championships. This is just one example. Japan has many places of scenic beauty that include the ocean. I would like local people to explore the potential of marrying sports and tourism.

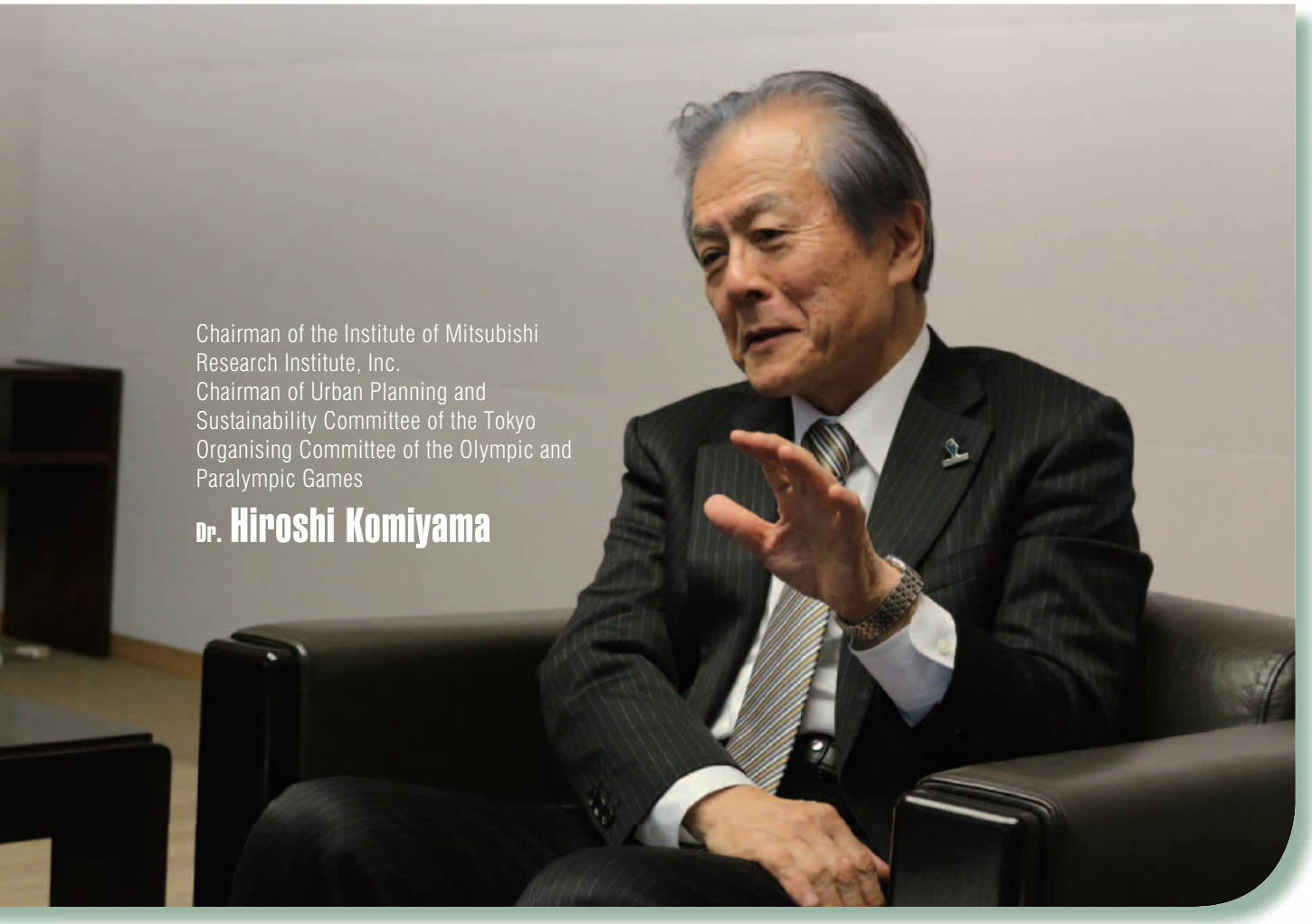
A topic in the news at the time of the Rugby World Cup in 2019 was the scenes of Japanese spectators, cleaning up the stadium after a game. This practice has taken root in Japanese sports culture. I personally pick up trash on the beach. I would be happy if Tokyo 2020 contributes to the improvement of Japan's seaside environment through surfing, marathon swimming (OWS), and other events.

Takizawa

Thank you for the fascinating conversation.

Interviewer: (Left) Ms. Minako Takizawa, Science Journalist / Member of editorial committee for "White Paper on the Oceans and Ocean Policy"

Make Tokyo 2020 a Showcase for Sustainable Society



Chairman of the Institute of Mitsubishi Research Institute, Inc.
Chairman of Urban Planning and Sustainability Committee of the Tokyo Organising Committee of the Olympic and Paralympic Games

Dr. Hiroshi Komiyama

Dr. Hiroshi Komiyama is Chairman of Urban Planning and Sustainability Committee of the Tokyo Organising Committee of the Olympic and Paralympic Games. Currently he serves as Chairman of the Institute of Mitsubishi Research Institutes, Inc., Advisor to the Japan Society of Ocean Policy, Chairman of the Platinum Society Network, and Advisor to the Japan Association for University Athletics and Sport (UNIVAS). He held a Professorship in Chemical Engineering at the University of Tokyo and served as a Director, Vice-President, and then the 28th President of the University of Tokyo.

Interviewer: **Yuri Takeda**

Dr. Komiyama, you have led discussions on city planning and sustainability in the Tokyo Organising Committee of the Olympic and Paralympic Games. Today I would like you to talk about the Games, including issues related to the oceans. When the Games were last held in Tokyo, in 1964, Japan was a developing nation. This time Japan hosts the Games as a developed nation. What do you think will be different?

Hiroshi Komiyama

It will leave a whole new legacy. The last Tokyo Olympics built momentum to construct the Shuto (Metropolis) Expressway, the Meishin (Aichi-Hyogo) Expressway, and the Tokaido Shinkansen (the bullet train). The rapid improvement of the hard

infrastructure supported the subsequent economic development of Japan. There were some complaints, saying, "We should not waste hard-earned money on these things." However, in general, I think Japan as the first Asian country to host the Olympics evoked a feeling of uplift.

Today as a developed nation, it's not likely that Japan's economy will reap much benefit from hard infrastructure construction. Sustainability is now a matter of world concern. I would like to promote a vision of a sustainable society in concrete shape at the Tokyo 2020 Games. I would like to make Tokyo 2020 a showcase for sustainable society.

Takeda

I heard that as a child you often visited Tokyo Bay. During the period of high economic growth, Tokyo Bay was seriously polluted. After more than half a century, we now see significant improvement. What is your view of this transition?

Komiyama

When I was a boy, while Tokyo was still economically challenged, its rivers and the ocean waters were quite clean. My father often took me to Tokyo Bay for goby fishing. We would catch a bucketful of goby and my mother happily deep-fried them tempura-style for our dinner. Back in those days, it was a common practice to catch foodstuffs by yourselves for family dinners.

Then we entered the high economic growth period. There were no considerations regarding effluent treatment. Various kinds of factories built along upstream sections of the Sumida River and Tama River were discharging untreated factory and household effluents. In no time the clear water became contaminated. The water in the Tama River was bubbling with gas. The same was true with the Sumida River. From 1962 to 1977 the water pollution was so severe that the annual Sumida River Fireworks Festival had to be cancelled.

Air pollution was also significant. Cities on the Pacific coastal belt frequently experienced

Tama River in the vicinity of Futakotamagawa. The water quality is so improved that you can witness ayu swimming upstream.

photochemical smog. The sky was always gray. It is possible to improve the air quality if we stop emitting air pollutants for a couple of days. In the case of the Beijing Games, they had factories stop operating in advance of the Opening Ceremony and temporarily restored the blue sky. That is not possible with water. Sludge and wastewater accumulation make it difficult to improve water quality in a short period.

It would take decades to restore the water quality of our rivers. Today you can see ayu (Japanese sweetfish, said to inhabit only unpolluted waters) return from Tokyo Bay to the Edo River, Sumida River, Tama River and others. Annually, 10 million ayu now swim up the Tama River. It took a long time to restore the environment of these rivers. The situation began to change probably in the 1990s. With the oceans, it takes longer. Polluted water having run into Tokyo Bay from the rivers needs to flow out of the Bay. It was not until well into the 21st Century that the water quality of Tokyo Bay was restored. Now sushi restaurants serve fresh fish caught in Tokyo Bay.

We should show the world the rivers and ocean areas around Japan at Tokyo 2020. It is important to show the natural beauty of Japan and let the world know how we restored the rivers and the oceans to their current healthy condition. A ten-minute train ride from Shibuya, a bustling district, will take you to the Futakotamagawa station area (Setagaya Ward, Tokyo), where you can enjoy ayu fishing. Many people are suffering from pollution in the world. We can offer them hope that it is possible for them to restore their environment.

I expect "society co-existing with nature" will be Tokyo 2020's legacy and it will persist in social systems as well as in the minds of individuals.

Takeda

The water quality in Odaiba Marine Park, the venue for the Tokyo 2020 triathlon event, is generating concern.

Komiyama

Sewage treatment systems underlie the Odaiba issue. Since early on, in the Meiji era (1868-1912), Tokyo adopted sewage systems modeled on the systems of London and Paris. Since the population was much smaller then, the system requirements were low, and the combined sewer system design, which mixed stormwater runoff with sewage, was adopted. Since then, the population has significantly increased and the combined sewer system is presenting a challenge. Heavy volume of stormwater runoff overwhelms the treatment system and untreated sewage may be

discharged into Tokyo Bay. Since the venue for the triathlon event is located near the outfall, a significant amount of coliforms may be detected after heavy rainfalls as the result of untreated effluent being discharged. Under normal conditions it is within the agreed upon limits.

Now many cities in the world adopt separate sewer systems, which treat sewage and runoff separately. While it is desirable for Tokyo to replace its sewage systems with separate systems, the combined sewage systems in place are extensive and the cost to upgrade them is prohibitive. We need to find feasible solutions to this problem. It's a challenge that requires civil and urban engineers' serious commitment. I expect Tokyo 2020 will set in motion a series of innovations to modify the existing system.

Takeda

At the G20 held in Osaka last year, marine plastic debris was one of the major issues discussed. How about Tokyo 2020?

Komiyama

Concern about plastic debris may be the most important contemporary problem. While measures to reduce plastic waste by eliminating excessive packaging and other means are necessary, a total ban on plastics is unrealistic. I think it is difficult for most of us to give up the convenience. Instead of giving up the convenience of plastics, we should find ways to move forward.

Conscientious chemical companies are truly committed to solving the plastics problem. However, the issue of marine debris, such as fishing lines and plastic bottles that have drifted into the ocean, remains. Even when we collect plastics for recycling, some parts of consumer goods are always washed away into the environment as debris. To prevent the debris from causing damage to the environment, we should make a shift to biodegradable plastics.

While we won't be able to find solutions to the issue of marine plastics by the time of Tokyo 2020, the issue have a symbolic importance.

Odaiba, where Triathlon events will be held.

Tokyo 2020 The Podium Project joint press briefing

Make Tokyo 2020 a Showcase for Sustainable Society

The Podium Project, a Tokyo 2020 initiative to manufacture medal podiums entirely of recycled plastic collected in Japan is underway.

Takeda

For example, the Organising Committee coordinates beach cleanup events on Tsurigasaki Beach in Chiba prefecture, the venue for surfing events, with Olympic athletes' participation.

Komiyama

Celebrities such as athletes can lead the way. For example, I believe the culture of donation is essential for developed countries. However, in Japan donation is yet to be popularized. On one occasion, professional football star players made donations in cooperation with the Japan Football Association. It generates excellent publicity. I hope it will go beyond activities of a few and add momentum to a larger drive.

Takeda

You mean that Tokyo 2020 could provide the momentum.

Komiyama

Exactly. Momentum is the key. Obviously, hard infrastructure such as roads and railways will remain after the Games. The beach cleanup movement and the urban mining initiative to collect unused mobiles and other electrical appliances to extract precious metals for Olympic and Paralympic medals could lead the way to a sustainable society. They should not end as ad-hoc solutions. We should keep the momentum going. Recycling mobiles can be a successful business. Data erasing services for collected mobiles have already been emerging. These movements, if sustained, could become a soft infrastructure for resource-circulating societies. Hard infrastructure remained as a legacy of the last Tokyo Games in 1964. Tokyo 2020's legacy should be these soft infrastructures for a sustainable society.

Takeda

It's been great talking to you. Thank you for your time.

Interviewer: (left) Ms. Yuri Takeda, Environment Journalist / Member of editorial committee for "White Paper on the Oceans and Ocean Policy"

Illustrated Guide to the Ocean Events in Tokyo 2020 Games

Triathlon

This outdoor event made its Olympic debut at the 2000 Sydney Games.
A triathlon is a single race consisting of a 1.5km swim, a 40km cycle, and a 10km run, consecutively. The word triathlon is of Latin origin, from "tri" for three and "athlon" for competition.
The Paratriathlon event, first held as a Paralympic event at the 2016 Rio Games, is a three sprint race, at half the distance of the Olympic triathlon. Athletes use handcycles or racing wheelchairs or are supported by same-sex guide runners or handlers according to the athletes' physical impairments.

Marathon Swimming

This outdoor event made its Olympic debut at the 2008 Beijing Games. Athletes compete in a 10km swim in open oceans, rivers and lakes. It doesn't require a specific stroke. Competitors are not disqualified by standing up during the race unless they walk. Usage of wetsuits and fins, that add buoyancy, are prohibited. Goggles, nose grips, and earplugs are permitted.

Japan Beach Volleyball Federation

Beach Volleyball

This outdoor event made its Olympic debut at the 1996 Atlanta Games. It is played on a sand court on a beach, which is narrower and shorter by 1m than a regular Volleyball court. A match is played by two teams of two players in three sets. The first and second sets are won by the first team to reach 21 points; only 15 points is needed in the third and deciding final set.

Odaiba Marine Park
Minato-ku, Tokyo

Shiokaze Park
Shinagawa-ku, Tokyo

Enoshima Yacht Harbour
Fujisawa-shi, Kanagawa

Ministry of Foreign Affairs of Japan

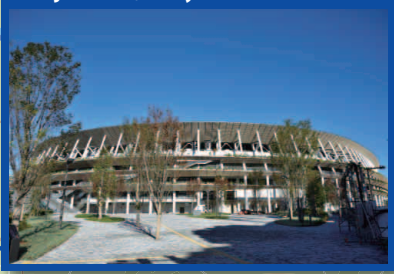
Sailing

This historic event has been an Olympic sport since the 1869 Athens Games. Small sailing boats powered by the wind race a course set in the ocean, competing in speed and technique.
The race is run over set laps on a course marked by a number of buoys in specific sequence, and scores are given according to the order of arrival. The smaller scores represent higher rankings. Olympic sailing competition has 8 classes: the RS:X, 470, Laser, Laser Radial, 49er, 49erFX, Finn and Nacra17, according to the size of the sail boats, size of crews, and rules.

Kawagoe
Hidaka
Koshigaya
Saitama
Saitama
Hanno
Sayama
Iruma
Tachikawa
Tokyo
Shinjuku
Tokyo
Shibuya
Koto
Minato
Setagaya
Hachioji
Sagamihara
Kanagawa
Ota
Tama River
Kawasaki
Hiratsuka
Minami-Ashigara
Yokosuka
Futtsu
Minami-Boso
Tateyama
Shizuoka

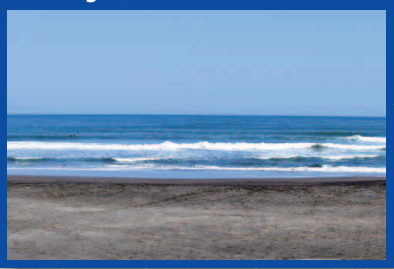
Ushiku
Inashiki
Ibaraki
Kashiwa
Narita
Sakura
Tomisato
Chiba
Sammu
Togane
Oami-shirasato
Ichihara
Chiba
Sodegaura
Mobara
Kisarazu
Kimitsu
Isumi
Katsuura

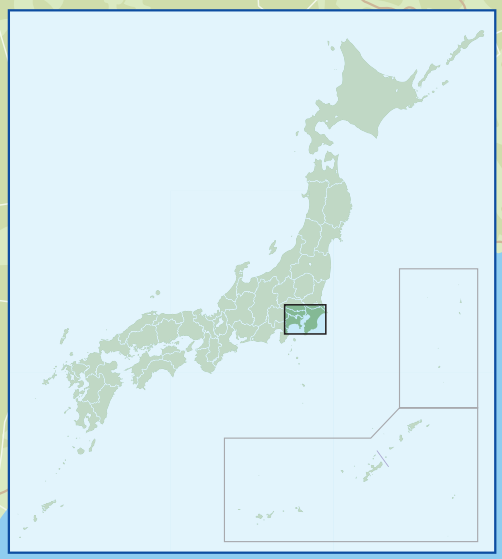
Japan National Stadium (Olympic Stadium)
Shinjuku-ku, Tokyo



Sea Forest Waterway
Koto-ku, Tokyo

Tsurigasaki Surfing Beach
Chosei-gun, Chiba





Japan Canoe Federation

Canoe Sprint

This event has been held since the 1936 Berlin Games (women's event from the 1948 London). Multiple canoes take off at once, with each canoe paddling on straight flatwater courses to race each other to the finish. Two types of boats are used: canoes and kayaks, and the distances of races are 200m, 500m, and 1,000m. Kayak events are held in Singles, Pairs and Fours competitions. Canoe events are in Singles and Pairs. Paracanoe made its Paralympic debut at the 2016 Rio Games. Paracanoe races are individual events in three different classes, depending on the classification of an athlete's impairment. Va'a (an outrigger canoe) races will be added from the 2020 Tokyo Games.

Japan Rowing Association

Rowing

This historic event has been an Olympic sport since the 1900 Paris Games (women's events were introduced at the 1976 Montreal Games). Races take place over a 2,000m straight flatwater course, using oars to propel the boats. There are sculling and sweep races. In sculling events the rower holds two oars, while in sweep events the rower holds one oar. Sculling events are held in Singles, Doubles, and Quadruple competitions. Sweep rowing events are in Pairs, Fours, and Eights.
Para-rowing made its Paralympic debut at the 2008 Beijing Games. Para-rowing classes include men's single sculls, women's single sculls, mixed double sculls, and mixed coxed four. Coxed four is a competition with two mixed pairs and a coxswain (steersman).

Surfing

Surfing will make its Olympic debut in the 2020 Tokyo Games. A rider rides a wave on a surfboard and competes in technical difficulties, performance, and originality. Surfing as a sport is divided into two classes according to the size of the board used: the longboard (longer than 9ft/274cm) and shortboard (around 6ft/183cm). Shortboards will be used at the 2020 Tokyo Games. In the set time, each athlete will be allowed to ride around 10 waves and their two highest scoring waves will count toward their total.

※Data as of March 2020.

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Japan and the World's Ocean Initiative

1 The Oceans and Climate Change

Global warming is greatly affecting the oceans. It affects the ocean ecosystem and coastal zones and people living in coastal zones. With rising seawater temperature, the increase of density stratification, acidification, oxygen deficiency, and change in net primary production (NPP)[1], the oceans are facing an unprecedented future.

In 2019, the Intergovernmental Panel on Climate Change (IPCC) cast a renewed light on these scientific findings, and issues of "oceans and climate change" have become the focus of attention. The Special Report on the Ocean and Cryosphere in a Changing Climate (SROCC) was published by the IPCC in September. The 25th Conference of Parties (COP25) of the United Nations Framework Convention on Climate Change (UNFCCC), also known as Blue COP, was held in December. This article summarizes the discussions that took place in 2019 concerning the oceans and climate change.

1 Net primary production is the rate at which all the photosynthetic autotrophs in an ecosystem produce net organic material from CO_2 in the atmosphere.

1 The IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

1 Key Findings of SROCC

In September 2019, the IPCC published SROCC, which was its first report specifically on climate change and the ocean and cryosphere (polar regions and high mountain areas).

104 experts from 36 countries participated in the writing of the report and as many as 6,981 papers were referenced. More than 30,000 comments were received and the draft was revised multiple times based on the comments. At the 51st session of the IPCC panel convened in Monaco from September 20 to 24, 2019, discussions were held every day until late at night to work out important details. It took until noon of September 24th, the last day of the session, for participating countries to approve by consensus the Summary for Policymakers (SPM) of SROCC and accept the underlying report.

The message of SROCC is clear. Alarming events suggest a tipping point has already been reached for certain ocean ecosystems. The oceans and even the earth itself are in perilous condition, and the report cautions, "choices made now are critical for the future of our ocean." [2]

It is particularly worth noting that the projection of sea level rise has been revised upwards significantly. In the IPCC's Fifth Assessment Report (AR5) published in 2013, there was not enough scientific knowledge about the water input from ice sheets in Antarctica, and its contribution was underestimated[3]. In the latest projection, the contribution of the Antarctic ice sheet to sea level rise was revised upwards to improve the reliability of the assessment. As a result, it is projected

2 September 25, 2019, IPCC Press Release, https://www.ipcc.ch/site/assets/uploads/2019/09/srocc-P51-press-release.pdf

3 IPCC AR 5 WG1, Figure 13.13

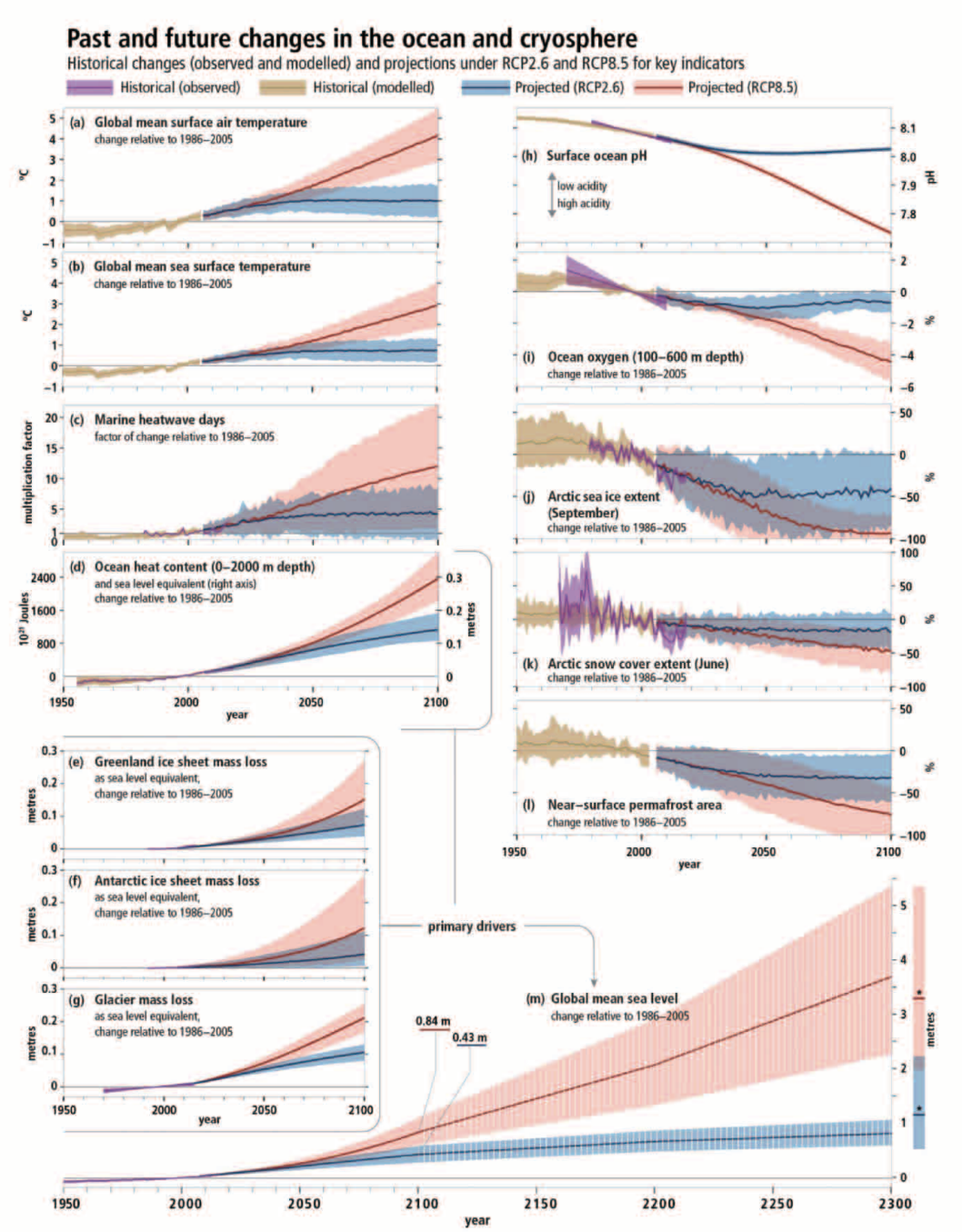


Figure 1-1 Past and Future Changes in the Ocean and CryosphereSource
(SROCC Figure SPM.1)

that sea level rise could reach up to 110cm in 2100, and the mean sea level rise for the period between 2081–2100 could be up to 92cm, 10cm higher than the assessment in AR5.[4]

In addition, the projection goes far beyond 2100. SROCC clearly shows that climate change is already irreversible, that the oceans will continue to change in the long-term, and that the degree of change will depend on the degree of success of policy measures which will be implemented from now on (See Figure 1-1). Comparing historical and projected future changes under a low greenhouse gas (GHG) emissions scenario (RCP2.6) and high GHG emissions scenario (RCP 8.5), the gap widens over time for every indicator. Under the high emission scenario, it is projected that sea levels will continue to rise beyond 2300. We are in-

4 IPCC SROCC Summary for Policymakers (SPM), B 3.1; AR5 WG1 SPM Table SPM.2

deed standing at a crossroads where “choices made now are critical for the future of our oceans.”

Compared to AR5, more accounts from the humanities are found in SROCC, including accounts of lives of indigenous populations of the Arctic region and coastal communities. SROCC introduced the term “climate literacy” to highlight the importance of developing and leveraging knowledge on climate change. The importance of promoting climate literacy, leveraging local knowledge from coastal communities and indigenous communities in the Arctic and combining them with scientific knowledge was emphasized.

2 Policy Recommendations Based on the Findings of SROCC

Three weeks after the official release of the SROCC, the Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF) held the “Symposium on the Special Report on the Ocean and Cryosphere in a Changing Climate” on October 15, 2019, and issued a policy recommendation based on the findings of the report to promptly disseminate the scientific findings of SROCC and their significance to the public.

The OPRI-SPF proposal was composed of emergency recommendations on the following 10 topics:

1. Ocean-based mitigation
2. Blue Carbon
3. Disaster prevention and adaptation measures
4. Comprehensive measures to combat climate change as well as land-based pollution
5. Fisheries management
6. Marine Protected Areas
7. Scientific research
8. Innovation
9. Education and climate literacy
10. Business sector


IPCC 海洋・雪氷圏特別報告書を受けた 10 の提言

Figure 1-2 10 recommendations based on IPCC SROCC

This is a message from OPRI-SPF to the various stakeholders, beginning with the Japanese government, involved with oceans and fisheries and climate change countermeasures. For details, please refer to “OPRI’s Policy Recommendations based on findings of IPCC SROCC.” [5]

5 https://www.spf.org/en/global-data/opri/news_191015_IPCC_Rec-en.pdf

2 The Oceans in the United Nations Framework Convention on Climate Change and the 25th Conference of Parties (COP25)

1 The Oceans in the United Nations Framework Convention on Climate Change

As SROCC shows, the oceans are inextricably linked to climate change. However, the language of the United Nations Framework Convention on Climate

Change (UNFCCC) makes very limited reference to the oceans. In UNFCCC, the oceans are mentioned only in the preamble and Article 4 section 1(d) on sinks and reservoirs of greenhouse gases. In the Paris Agreement, "the importance of ensuring the integrity of all ecosystems, including oceans, and the protection of biodiversity" is noted in the 13th paragraph of the preamble, while there is no mention of the oceans in the text itself.

However, some articles involve the oceans without directly referring to them. For example, Article 5 of the UNFCCC, "Research and Systematic Observation," requires the Parties to support and further develop research and systematic observation (Article 5(a)) and to support international efforts to promote access to and exchange data obtained from areas beyond national jurisdiction (Article 5(b)). The Global Climate Observing System (GCOS), established in 1992 to support the UNFCCC, has been promoting cooperation for observation of climate systems, including the oceans. Under many articles about adaptation and support for small island nations, ocean related issues are discussed to varying degrees.

In recent years, global dialogue has been actively promoted on the topic of the oceans and climate change. A large variety of issues are attracting attention, including the important roles the oceans play in the climate system, mitigation measures related to the oceans such as emission reduction, adaptation of coastal regions (especially on an ecosystem basis), relocation of people due to the rising sea level, and support for small island nations and capacity building. While some are discussed as existing agendas under the framework of UNFCCC, others do not have formal forums for discussion in the present state of affairs. However, several informal ocean related groups under the UNFCCC have been driving discussion on the issue of oceans and climate change. The "Because the Ocean Initiative" (informally launched at COP21) and "The Ocean Pathway" (launched at COP23 in 2017 under the leadership of Fiji, the host country) are signatory nation-driven initiatives. Based on the COP21 decision[6], the Marrakech Partnership for Global Climate Action was launched at COP22. It is a mechanism to facilitate participation of non-state stakeholders. "The Roadmap to Oceans and Climate Action (ROCA)" has taken up one of the eight themes of the Marrakesh Partnership, oceans and coastal zones. OPRI-SPF participates in ROCA.

Greenhouse gas emissions from international shipping is also one of the issues relevant to the oceans and climate change. As it has heretofore been discussed exclusively at the International Maritime Organization (IMO), it is often overlooked in discussions at the ocean forums of the UNFCCC. However, it is important to ensure cooperation between the UNFCCC and IMO. IMO's efforts to address GHG emissions should be taken up at the Global Stocktake in 2023, which is conducted every five year to access progress toward the Paris Agreement's goal, according to Article 14.3 of the Agreement.

2 Conference of the Parties 25 (Blue COP)

Two months after the IPCC published SROCC, COP25 was held in Madrid, Spain from December 2nd to the 15th 2019. The session was extended for two days

6 UNFCCC Decision 1/CP.21, paras 133-134

Figure 1-3 COP25 Venue and a scene from the plenary session

past the scheduled end. The government of Chile, the presidency holder, conceived the summit as "the Blue COP," to focus on the oceans and cryosphere, with more than 100 ocean-related events at the summit. The government of Chile announced the launching of the Platform for Science-Based Ocean Solutions (PSBOS) as a "blue accomplishment." In government-level talks, countries such as Fiji, Costa Rica, and Indonesia urged highlighting the issues of the oceans and climate change. While details of the negotiations are not publicly available, for the first time "the importance of the ocean, including as an integral part of the Earth's climate system" was mentioned in COP Decisions[7]. It was decided that a dialogue on the ocean and climate change should be convened at the 52nd session of the Subsidiary Body for Scientific and Technological Advice (SBSTA), to be held in October 2020. Parties and non-Party stakeholders were invited to submit input by March 31st 2020.

7 UNFCCC Decision 1/CP.25, para 30

OPRI-SPF hosted the two-day Oceans Action Day event at COP25. At this year's Oceans Action Day, the Marrakech Partnership for Global Climate Action Oceans and Coastal Zones Action Event was held on the afternoon of the 6th, and 5 events followed on the afternoon of the 7th : (1) Oceans and Climate Nexus, (2) Incorporating Ocean-related Options in Nationally Determined Contributions (NDCs), (3) Adaptation and Displacement Solutions, (4) Galvanizing Support for Oceans and Climate Action and (5) the Reception. Over the two days of events, 80 speakers and panelists took the stage representing international organizations, governments, research organizations, and NGOs involved in oceans and climate change, with more than 400 people in attendance. Discussions were held on a variety of issues, including adaptation and mitigation strategies from an ocean perspective, ocean science, funding, and displacement and immigration.

3 Enhancing Use of the UNFCCC Forum

SROCC finds that the ocean and cryosphere are already experiencing alarming changes, projects that the change will accelerate in the future, and raises an alarm over the critical condition of the entire earth. It is said that there will be a huge difference in the effects and risks that climate change could pose to humans and the ecosystem at 1.5℃ and 2.0℃ above pre-industrial levels of global warming. Countries around the world including Japan adopted the Paris Agreement and agreed on the decarbonization of society. Even when the measures

based on Nationally Determined Contributions (NDCs) are fully implemented, the global temperature could rise to 3℃ above pre-industrial levels by the end of the century, thus failing to achieve the goals of the Paris Agreement. An unwavering will to implement the measures to achieve the goals is essential.

As the link between the oceans and climate was mentioned for the first time in COP Decisions at COP25, the importance of the oceans in climate change issues is now being recognized more and more. On the other hand, Japan's dependence on coal fired power generation is under increasing international criticism and it was taken up for discussion on and off the floor at COP25. Japan, as an ocean state, should be committed to adaptation of coastal zone and fisheries management, as well as lead the world by leveraging the oceans to mitigate GHG effects. Specifically, taking advantage of its technological capability and experiences as an ocean state, Japan should initiate a global climate change strategy focusing on the oceans, and adapt as a country in appropriate ways to the changing ocean environment.

Local governments and businesses, as well as national governments, are important stakeholders. In recent years, COP of UNFCCC has served not only as a forum for inter-governmental negotiations but also provided opportunities for local governments, businesses, NGOs, and researchers to gather together for networking and for presentation and promotion of their efforts. Aiming to decarbonize society, more and more local public entities in Japan have declared initiatives toward net-zero CO_2 emission by 2050 (Zero-carbon city). As of January 2020, 33 local governments including Tokyo, Kyoto City, and Yokohama City have made this declaration.

There are also international networks and initiatives all over the world being driven by business sectors to address climate change and SDGs. Under the Science Based Targets Initiative, 321 companies' targets are validated and listed as of November 2019. 58 Japanese companies are listed with validated reduction targets. The Japanese shipping companies NYK Line and K Line set targets to reduce GHG emissions by 50% by 2050.

Japan is an ocean state with the world's 6th largest exclusive economic zone (EEZ) and a long coastline. People of Japan have lived close to the ocean and the country has developed enjoying its bounties. The lives of Japanese people could be deeply affected by current and future changes in the oceans. It is important that the whole country should commit to address issues related to the oceans and climate change, involving the national government, local public entities and business sectors. For that purpose, it is necessary to enhance understanding of the findings of IPCC and leverage UNFCCC. We have to understand clearly that choices made now are critical for the future of the Earth as well as Japan.

(Mai Fujii)

COLUMN 01 A New Horizon for Blue Finance

Blue Finance refers to any financial instrument or investment issued in exchange for conservation of the ocean environment through promotion of Blue Economy (the economic activity through sustainable use of the oceans). The concept is gradually attracting attention. In October 2018, the Republic of Seychelles issued the world's first sovereign "blue bond," a pioneering financial instrument for Blue Finance. It was a 10-year bond designed to support sustainable marine and fisheries projects, which raised US$ 15 million from international investors. Blue bonds are derived from green bonds, financial instruments intended to support marine environmental preservation projects which have recently come into the spotlight. While guidelines for green bonds are established and burgeoning across the world, blue bonds are not yet internationally defined, and only recently appeared as a relatively novel concept. The blue bond that the Seychelles issued was primarily supported by the World Bank and the Global Environmental Facility (GEF).

Emergence of Blue Finance

In March 2018, the European Investment Bank (EIB), in cooperation with the European Commission and the World Wildlife Fund (WWF), published the Sustainable Blue Economy Finance Principles. These principles set out investment guidelines to promote Blue economy and are endorsed by the World Bank and the United Nations Principles for Sustainable Insurance (PSI), as well as a growing number of financial institutions and NGOs.

Following Europe's Blue Finance wave, Multilateral Development Banks (MDBs) are investing in ocean related projects. In September 2018, the World Bank announced establishment of PROBLUE, a new multi-donor trust fund, aiming to support fisheries and aquaculture, efforts to address marine pollution, and other activities to achieve Sustainable Development Goal (SDG) #14, "Conserve and sustainably use the oceans, seas and marine resources for sustainable development." Donors include the United States, European Commission, and other countries. In 2019, the Asian Development Bank (ADB) also launched the Oceans Financing Initiative, which aims to expand investment to US$ 5 billion over the next five years to promote marine plastic pollution control, preservation of ocean resources, ocean ecosystems and other issues in Asia and the Pacific. Furthermore, the Nordic Investment Bank (NIB) and The Nature Conservancy (TNC), announced their intent to fund ocean conservancy efforts through issuing blue bonds.

While more and more public aid organizations have started to invest in sustainable development and conservation of the oceans, mobilizing private investments in this area remains a challenge. Private funding schemes specifically targeting the oceans are needed. At its meeting held in December 2019, the Asia Pacific Economic Cooperation (APEC) advocated creating an initiative platform for public-private partnerships (PPP) for environmental preservation of the oceans and sustainable development of ocean energy. In addition, the Blue Finance Project supported by the United Nations Environmental Programme (UNEP) has started efforts to establish PPP for management and sustainable financing of Marine Protected Areas in the Caribbean, South East Asia, and elsewhere. International frameworks for public funding with private financing participation are being put in place. To encourage and facilitate the participation of the private sector in Blue Finance, establishment of legal and regulatory incentive mechanisms are necessary.

Looking Forward

As illustrated by the case of the Seychelles, to finance ocean conservation efforts, especially in developing nations, partnerships among countries, international organizations, and financial institutions are essential. The Ocean Policy Research Institute (OPRI) of the Sasakawa Peace Foundation launched a project to design a blue finance framework through support of evidence-based research. OPRI intends to be a guide for Blue Finance by providing analytical assistance regarding ocean risks as well as sustainability evaluations.

(Nagisa Yoshioka and Michael C. Huang)

Proposed Blue Financing Mechanism

2 The Nippon Foundation-GEBCO Seabed 2030

The Nippon Foundation–GEBCO Seabed 2030 (Seabed 2030) is a collaborative project between The Nippon Foundation and the Guiding Committee for the General Bathymetric Chart of the Oceans (GEBCO) to map the world's entire ocean floor. Initiated in 1903 by Prince Albert I of Monaco, GEBCO, an international project comprising experts in seafloor mapping, has been providing the most authoritative publicly available bathymetry of the world's oceans.

Although bathymetric information compiled and provided by GEBCO as well as other ocean floor maps appear to illustrate the world ocean floor in detail, only 6% of the bathymetric data is from actual measured value. The rest was supplemented with calculated values based on surface gravity value which is obtained by satellite altimetry. On the other hand, topographic maps of the Moon and Mars show details with 100% coverage. When a Malaysian airplane went missing in 2014, the search team initially prepared bathymetric survey equipment based on the water depth data of GEBCO. However, the actual depth turned out to be far deeper than was indicated by GEBCO resulting in a delay in action being taken.

In recent years, the need for a more accurate bathymetric dataset than that currently provided by GEBCO has become apparent in addressing a wide range of issues ranging from global climate change, seafloor earthquakes, tsunamis, storm surges and other natural hazards, ecosystem and biodiversity issues, search and rescue operations at sea, exploration and development of underwater resources, navigation, and marine spatial management among others. Against this backdrop, in June 2016, The Nippon Foundation and the GEBCO Guiding Committee jointly held the "Forum for Future Ocean Floor Mapping" in Monaco in order to discuss a vision for the future of bathymetric charts. Taking into account the findings at the Forum, The Nippon Foundation and GEBCO Guiding Committee made a decision to launch Seabed 2030 and announced the inauguration of the project at the United Nations Ocean Conference in July 2017.

Seabed 2030 aims to produce the definitive map of the world's ocean floor by 2030. The GEBCO Grid is a topographic grid model of the global sea floor at 30 arc-second (30 seconds in degree of latitude ; about 900 m at the equator), which provides water depth for each grid. When Seabed 2030 started, only 6% of grids had

Figure 2-1 Seabed 2030 project event held in October 2019

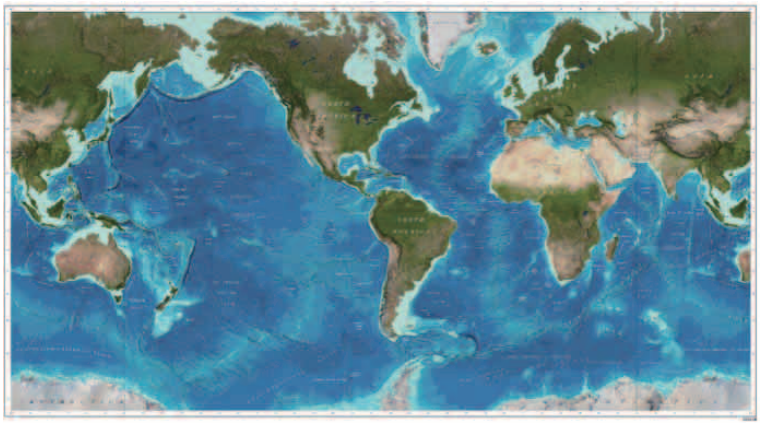


Figure 2–2 The GEBCO Ocean Map

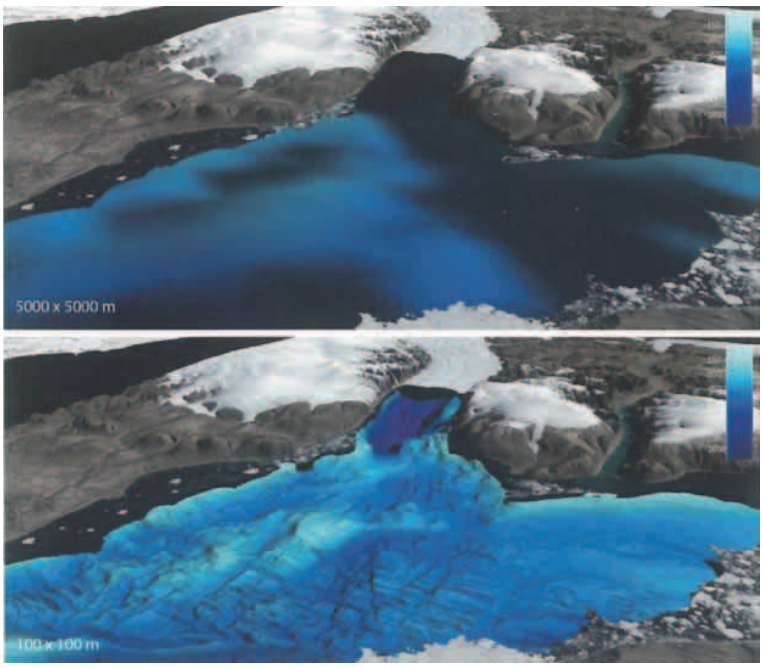


Figure 2–3 Bathymetry around fjord
(Comparison between Resolution 100 × 100m and 5000 × 5000m)

at least one actual measured value per grid. Led by Seabed 2030, the percentage more than doubled to 15% within 2 years.

To acquire at least one actual measured depth value for each grid, Seabed 2030 is reaching out for existing data as its first step. Seabed topography has been measured for installation of undersea communication cables, exploration of oil, gas and underwater mineral resources, and various other purposes. However very few of these data have been released for use by GEBCO. Seabed 2030 has established four Regional Centers, who reach out to data owners and carry out individual negotiations for data contribution. Fugro, a world leading geo-data specialist, and the National Oceanic and Atmospheric Administration (NOAA) of the United States are among 106 companies, research institutions and governmental agencies which have so far enlisted as data contributors.

Even if all the existing data is made available, there remains a vast area of the ocean where depths have never been measured. The search area of the missing

Malaysian airplane was one such area. Nonetheless, vessels do transit these areas. These vessels only need to be fitted with data-gathering equipment to measure the depth of uncharted water. Cruise ships and cargo vessels on regular courses have great potential for this, as do others, including fishing vessels. Some are already equipped with fish finders and do have depth measurement capability. By installing data loggers slightly larger than a pack of cigarettes, bathymetric information could be obtained from areas where survey ships have never been, without placing extra workload for the mariners or fishermen. This initiative is called "crowd-sourced bathymetry" and is already in progress. Furthermore, development of innovative depth measurement solutions entirely different from the existing ones is expected.

Seabed 2030 's four Regional Centers and a Global Center are realizing these objectives through networking within their designated regions, with industries, and across regions. What was not possible before Seabed 2030 with only members of GEBCO operating without full-time staff has now become possible with the establishment of this global structure and dedicated staff coordinating efforts to speed up the process of gathering ocean floor data across the world.

One of the networks supporting Seabed 2030 at its base is the network of

Figure 2-4 Autonomous seafloor mapping system developed by GEBCO-NF Alumni Team

Figure 2-6 GEBCO-NF Alumni Team members and The Nippon Foundation staff celebrating winning the grand prize at the XPRIZE award ceremony

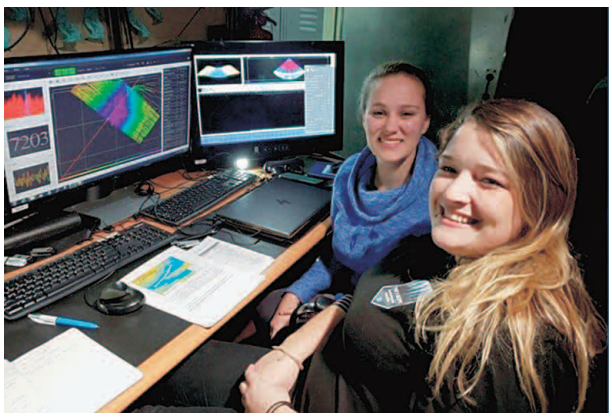


Figure 2-5 GEBCO-NF Fellows analyzing survey data

Figure 2-7 GEBCO-NF Alumni Team members reporting winning of the grand prize of XPRIZE to the Prime Minister

alumni of The Nippon Foundation–GEBCO training program on ocean bathymetry data (GEBCO–NF Fellows). The GEBCO–NF Fellows not only participate actively at the Regional Centers, but have comprised the GEBCO–NF Alumni Team who became the grand prize winner of the Shell Ocean Discovery XPRIZE, an international competition for autonomous ocean exploration technology. The technology developed and used by the Alumni Team, which enables bathymetric data to be obtained autonomously with very high horizontal resolution even in deep water, is one example of the aforementioned innovative solutions.

More participation and technology innovation are required to attain the goal by 2030. In October 2019, a Seabed 2030 event was convened at The Royal Society in London to mark its progress and examine plans to address future challenges. In cooperation with diverse partners, The Nippon Foundation and GEBCO will continue to work towards realizing the dream of mankind to uncover the mysteries of the world's ocean floor.

(Shin Tani)

COLUMN 02 Toward Our Ocean Conference (OOC) 2020 Palau

In recent years, an increasing number of international conferences have been organized to comprehensively address ocean issues. It was planned to convene the second United Nations Ocean Conference was June 2020 in Lisbon though it has now been postponed due to the COVID-19 virus.

The Our Ocean Conference (OOC) is another conference that is given great importance. The seventh OOC was scheduled to take place on August 17-18, 2020 in Palau, but is rescheduled for December 7-8, 2020 due the same reason. The OOC has evolved over the past six years. The first OOC was held in 2014 in Washington D.C. under the initiative of Mr. John Kerry, then Secretary of State of the United States in the Obama Administration. The OOC is intended to motivate stakeholders to address threats to the ocean such as illegal fishing, ocean acidification caused by the increasing concentration of greenhouse gases in the atmosphere, coral bleaching, and the decrease of marine biodiversity. The 5th OOC was held in Bali, Indonesia in 2018 followed by the 6th in Oslo, Norway in 2019. The OOC will be held for the first time in a small island developing state in Palau in 2020.

At the 2019 Oslo Conference, H.E. Mr. Ola Elvestuen, Minister of Climate and Environment of Norway, made a voluntary commitment to take a lead in the process to develop by 2023 an international convention to effectively halt the inflow of plastics into the oceans. The commitment was praised as outstanding, as it aimed to address a very arduous and urgent task by developing a global policy framework.

While no declarations or action plans are adopted at the OOC, it does catalyze voluntary commitments through a mechanism similar to the one used for the United Nations Ocean Conference. A total of 1,345 commitments have been registered at the OOC over the past six years. Youth leadership summits and various side events have also been held at the OOC to encourage diverse stakeholders to engage in lively discussions.

Significance of the OOC 2020 in Palau

The Republic of Palau is implementing progressive ocean policies under the leadership of President Tommy Remengesau Jr. The Palau National Marine Sanctuary Act, enacted in 2015, is a good example as it designates 80 percent of Palau's territorial water and exclusive economic zone (EEZ) as a marine sanctuary, that is, a no-take zone where all extractive activities (such as fishing) are prohibited. In 2019, the Act was amended to relocate the fishing zone and allow exemptions to the requirement of landing fish in Palau. The revised Act came into full effect on January 1, 2020.

The Rock Islands Southern Lagoon located in southern Palau, the most popular tourist destination, was designated a UNESCO World Heritage Site in 2012. Many tourists visit there to enjoy snorkeling and diving. Eve in that area, however, coral reef damage and bleaching were reported due to the 2012-2013 typhoons and recent rise in sea water temperatures.

President Remengesau is at the forefront of international efforts to promote a sustainable ocean economy and take actions against climate change. He co-chairs with H.E. Ms. Erna Solberg, Prime Minister of Norway, the High Level Panel for a Sustainable Ocean Economy (HLP). HLP was established in 2018 by the government of Norway, and includes H.E. Mr. Shinzo Abe, Prime Minister of Japan, as a member. At the OOC 2020, it is anticipated that Palau will mobilize the perspectives of island ocean states, which are most susceptible to the degradation of the marine environment and vulnerable to climate change. It is expected that President Remengesau will unite the leaders of these states in order to bolster the global coalition and invigorate efforts to tackle the marine environment degradation and climate change and to promote international cooperation for promoting a sustainable blue economy.

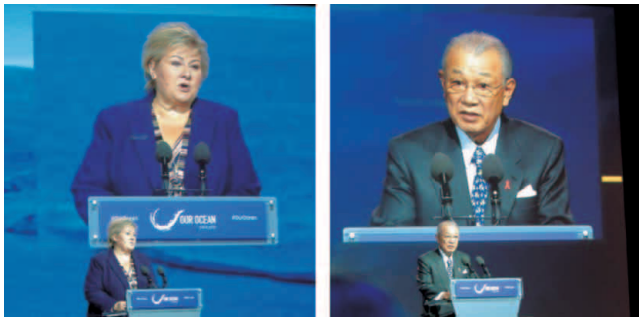
The OOC 2020 Palau and Japan

Seven yachts sailed across the Pacific from Yokohama to Palau for 12 days in the Japan-Palau Goodwill Yacht Race that started on December 29, 2019. The Race was to celebrate the 25th anniversary of Japan-Palau diplomatic relations. This reminds us that Japan and Palau are connected through a vast ocean. Japan and Palau are in a unique position to promote the conservation and sustainable use of ocean and marine resources and to foster a sustainable blue economy.

Japan-Palau cooperation in ocean fields is developing in manifold ways. For example, the Nippon Foundation has provided a new marine surveillance vessel and berth, the Sasakawa Peace Foundation supports the training of crews to operate the surveillance vessel, and the Japan International Cooperation Agency (JICA) has supported the reconstruction of the Palau Mariculture Demonstration Center. Also, the Ocean Policy Research Institute of the Sasakawa Peace Foundation supports the Government of Palau in planning policy dialogues and analyzing voluntary commitments in the process to prepare for OOC 2020 and to ensure its success

Japan and Palau are geographically and historically interlinked and promote bilateral cooperation and cultural exchange. It is hoped that the two ocean states will play a leading role in advancing exemplary policies at the international level to achieve a sustainable ocean on our planet.

(Masanori Kobayashi)



Erna Solberg, Prime Minister of Norway (left) and Yohei Sasakawa, Chairman of The Nippon Foundation (right) addressing OOC 2019 in Oslo.

3 Promotion of Scientific Research in the Arctic

1 Background

The Arctic can be defined geographically by latitude (the polar region north of the 66° 33'N where the midnight sun occurs), or by temperature and vegetation (the area combining the Arctic tundra zone -- where average temperature for the warmest month is above 0℃ and below 10℃ – and the Arctic Ocean). The Arctic Ocean is often defined by average ocean surface temperature and distribution of sea ice.

Until the end of the 20th Century, the Arctic was heavily ice and snow-bound. While it attracted scientific and cultural interest, it was unlikely to be the subject of international territorial conflicts. However, global warming (Figure 3-1) has caused sea-ice retreat (Figure 3-2) and permafrost thaw has caused changes in the terrain and vegetation. The Arctic, once considered an undisturbed and remote place, is now more accessible, resulting in world-wide interest in its potential economic and industrial value.

In September 1996, the Arctic Council was established to promote cooperation and coordination on issues such as sustainable development and environmental protection of the Arctic. The Arctic Council is a high-level intergovernmental forum, whose members include eight Arctic States[8] and six Permanent Participants representing the indigenous people of the Arctic. Currently, the Council conducts its activities through six working groups: Arctic Contaminants Action Program (ACAP), Arctic Monitoring and Assessment Programme (AMAP), Conservation of Arctic Flora and Fauna (CAFF), Emergency Prevention, Preparedness and Response (EPPR), Protection of the Arctic Marine Environment (PAME), and Sustainable Development Working Group (SDWG).

In 2011, Japan launched "Rapid Change of the Arctic Climate System and its Global Influences," a research project within the framework of GRENE (Green Network of Excellence), a new national strategy for growth. It helped Japan to earn Observer Status in the Arctic Council in 2013. At around the same time, Japan's Second Basic Plan on Ocean Policy was formulated and authorized. It clearly stated that comprehensive and strategic measures should be taken to address issues surrounding the Arctic, such as promotion of research and survey activities, promotion of international coordination and cooperation, and assessment of the potential of the Arctic Sea Route. The meaning and significance to Japan of research and study of the remote Arctic region has been changing ever since.

In September 2015, following the formulation of the Second Plan, the Arctic Challenge for Sustainability (ArCS) research project was launched by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). In October 2015,

8 Canada, Denmark, Finland, Iceland, Norway, the Federation of Russia, Sweden, and the United States

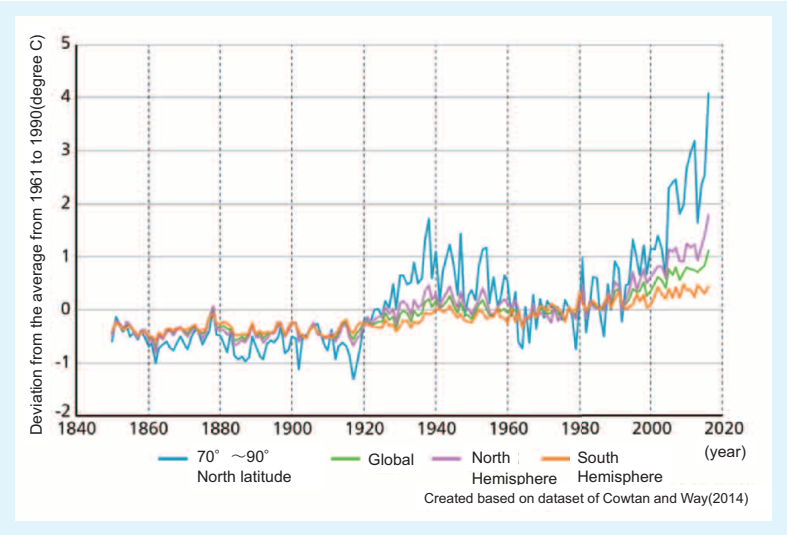


Figure 3–1 Trend in Average Global Surface Temperature
(Courtesy of Dr. Tetsuo Sueyoshi)

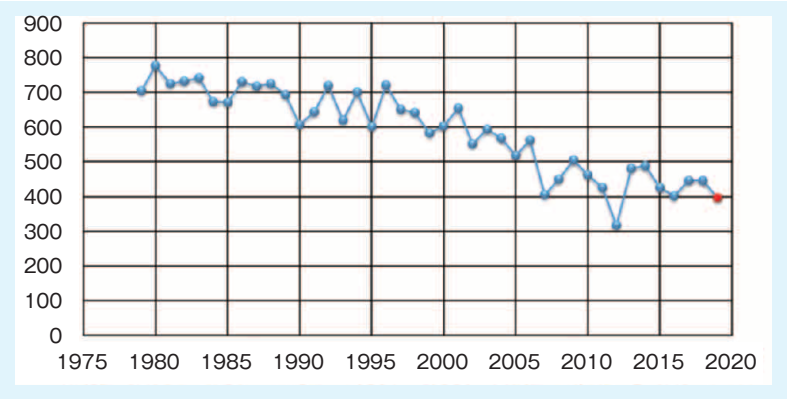


Figure 3–2 Minimum Area of the Arctic Sea-Ice (10,000km²)
(Courtesy of Dr. Tetsuo Sueyoshi)

Japan formulated an Arctic policy that outlined ArCS's mission to make sustainable use of the Arctic region possible by enhancing Japan's capability to lead the international discussion and to contribute science and technology to the world's effort, especially to the Arctic States, at which Japan excels.

Millennium Development Goals (MDGs), based on the Millennium Declaration adopted at the United Nations Millennium Summit in September 2000, were concluded in 2015 and replaced with Sustainable Development Goals (SDGs) adopted within the 2030 Agenda. The 2030 Agenda identified three dimensions of sustainable development : economic, social and environmental, and the proper balance necessary to sustain development of society and to ensure the dignity of mankind.

Japan's Artic Challenge for Sustainability project was initiated against the backdrop of these circumstances surrounding the Arctic.

2 Structure and Purpose of ArCS

Since its inception, ArCS has assumed the mission of providing scientific find-

ings in an easy-to-digest manner for policy makers, decision makers in the private sector, other stakeholders such as the indigenous people of the Arctic, and the Japanese people in general.

Findings and data obtained from six natural sciences and engineering research projects in the International Collaborative Researches Program are compiled in Arctic Data archive Systems (ADS)[9] managed by the National Institute of Polar Research and shared with the humanities and social science study project, which then process the data to produce socially relevant information to be disseminated to domestic and international stakeholders.

In the beginning, ArCS set out to gain the public's understanding of the significance of Japan's research on the Arctic. To generate interest in the Arctic amongst the general public, ArCS put an emphasis on public relations efforts, such as giving public lectures. From the second half of fiscal year 2018 to fiscal year 2019, ArCS also took on a project to illustrate the current status and future vision of the Arctic from the viewpoint of the natural environment, the Arctic Sea Route, the Arctic ecosystem, and the life of the indigenous people. This resulted in publication of an easy-to-read booklet entitled *The Future of the Arctic*, which reported findings of the projects to policymakers and the public.

9 Arctic Data archive System, https://ads.nipr.ac.jp/.

3 Activities of ArCS

1 Scientific Findings

To complement the Arctic policy of Japan and the world as well as to support the PDCA (plan-do-check-act) cycle of future Arctic policy, we should maintain diversity in Arctic research. We need research that communicates to society adequate scientific findings and projections on the natural environment, ecosystems, and the vulnerability of the indigenous people of the Arctic. As a national research project, ArCS is expected to produce outcomes that directly contribute to the national interest. Nonetheless, to avoid a situation where the subjects of study are limited and the scientific findings are few, ArCS has made a conscious effort to take on a broad range of subjects.

2 Research Infrastructure

ArCS has built up its research infrastructure by expanding research and observation stations(Figure 3–3), sending researchers to overseas research facilities, dispatching experts to international meetings, and broadening data management.

As a result, the number of research and observation stations and partner countries have both increased, and Japan has established an international presence in Arctic study. At each station, Japanese ArCS and Arctic States researchers are engaged in collaborative study. Dispatching experts to the working groups within the framework of the Arctic Council and research activities in the Arctic States has provided us opportunities to discuss the activities and outcomes of ArCS. Our data management program has established the Arctic Data archive System(ADS)

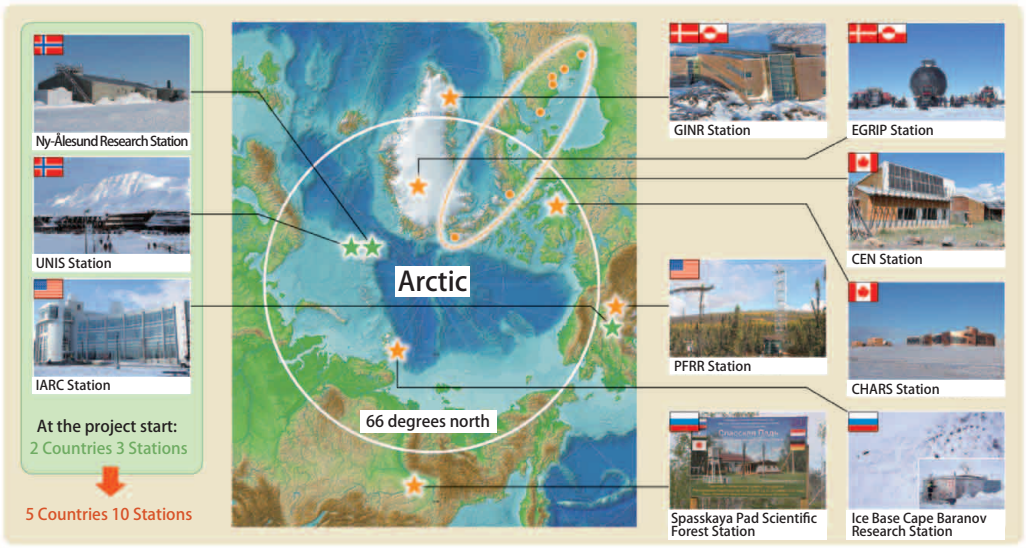


Figure 3–3 Research and Observation Stations

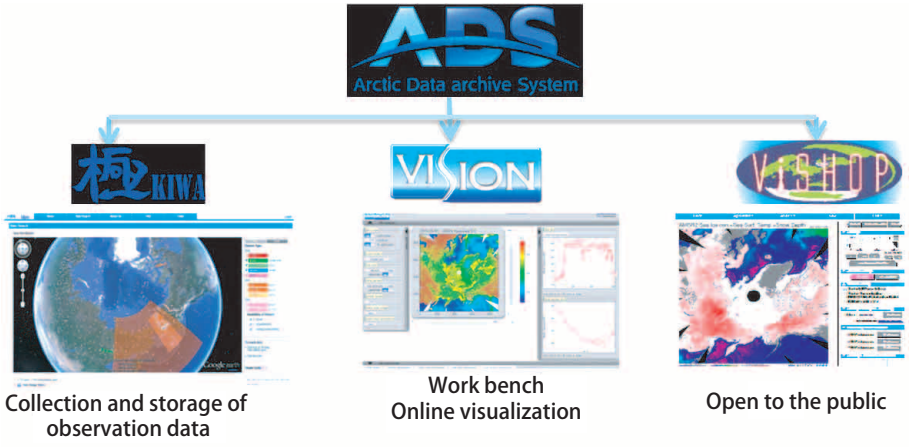


Figure3–4 Operations of ADS

(Figure 3–4), which compiles various data from observations and research conducted in the Arctic region, and serves as an online "work bench" where all the data from the project can be visualized and made publicly accessible.

3 Project Outreach

ArCS's outreach efforts include administration of the project website[10] (Figure 3–5), publishing e-mail newsletters, and giving lectures for the general public. We established an International Advisory Board with prominent domestic and international members and a council whose membership includes people not involved in Arctic research. In the second half of fiscal year 2018, the fourth year of the project, we published a booklet on the Arctic, *The Future of the Arctic*, targeting non-specialist readers.

At the International Advisory Board meetings, we discussed the scientific progress of ArCS and its international contributions. The council served as a forum for the project participants and the public to exchange views. It contributed to the visibility of Arctic research and improvement of ArCS's social standing. *The Future of the Arctic*[11], published to provide information to the public, showcased some

10 https://www.nipr.ac.jp/arcs/e/index.html

11 https://www.arcs-pro.jp/about/pamphlet/booklet201903b.pdf

Figure 3–5 Website of ArCS

Figure 3–6 The booklet, *The Future of the Arctic*

ArCS research themes with an emphasis on the future of nature and human life in the Arctic.

4 Social Effects (Outcome)

ArCS's accomplishments include not only the publication of scientific papers and books, and presentations at conferences, but also the dispatching of experts to attend Arctic-related meetings and to contribute to Artic-related reports, as well as the expansion of overseas research and observation stations. As a whole, ArCS integrates individual findings into relevant information and discloses it to the public. In this way, ArCS intends to change public perceptions, and drive Japanese Arctic policy forward. Japan will be co-hosting the 3rd Arctic Science Ministerial (ASM3) with Iceland in 2021 in Tokyo. Japanese mass media now often reports the significance of the Arctic. The relative proportion of the Arctic issues in the Third Basic Plan on Ocean Policy formulated in 2018 has increased. Japanese presence in Arctic research is now much more visible.

Japan's Arctic policy is expected to be revised and the outcome of ArCS's efforts to influence current Arctic policy will likely be reflected in the revision. This was the anticipated outcome of ArCS being promoted as a national project.

4 Challenges for the Future

ArCS will be concluded at the end of fiscal year 2019. The succeeding national project on Arctic research should build upon the lessons learned from ArCS. Top priority must be placed on informing policymakers about the past, present, and possible future of the Arctic in an accurate and easily understood manner. Chal-

lenges are as follows:

- Financial support structure making it possible for more researchers to participate.
- Establish a research institute or research organization to conduct comprehensive Arctic study for Japan, and enhance administrative support for research projects.
- Develop human resources who have global and panhuman views and encourage them to participate in Arctic research.
- Promote social implementation of scientific ideas, and take advantage of researchers with an engineering perspective.
- Establish an effective framework to provide policymakers information on which Arctic policy could be based.

None of the challenges above can possibly be accomplished overnight, but as Japan continues Arctic research as a national project, steady advance on each challenge is expected.

Existing Arctic research efforts, including ArCS, have focused on participation in the working groups under the auspices of the Arctic Council and on contributions to the Arctic Council and Arctic States through collaboration with the indigenous people. In the future, the aforementioned five challenges are important for Japanese Arctic research to stay internationally competitive while remaining rooted in Japanese society, and are important in making Japan's participation in Arctic governance welcomed and appreciated not only by Arctic States but the world at large.

(Masao Fukasawa)

COLUMN 03 The Seventh Tokyo International Conference on African Development (TICAD) was held in Yokohama

The Tokyo International Conference on African Development (TICAD), is a conference led by the government of Japan and co-hosted by the United Nations, the United Nations Development Programme (UNDP), the World Bank Group, and the African Union Commission (AUC) to facilitate cooperation for sustainable development among government and business leaders in Japan and African countries. The first TICAD was held in Tokyo in 1993 and is now held every three years, alternately in Africa and Japan. The seventh TICAD (TICAD7) was held on 28–30 August 2019 at Pacifico Yokohama, Yokohama, Japan, with more than 10,000 attendees, including representatives from 53 African countries, of which 42 were heads of state or government, representatives from 52 development partner countries, 108 heads of international and regional organizations, representatives of civil society and the private sector.

Discussions Concerning the Oceans at TICAD7

Prime Minister Abe co-chaired the conference with President El-Sisi of Egypt, and Deputy Prime Minister Aso, Foreign Minister Kono, and relevant ministers and heads of government agencies of Japan were also in attendance. Under the theme, "Advancing Africa's Development through People, Technology and Innovation," six plenary sessions and five thematic sessions were held. At the closing ceremony, *Yokohama Declaration 2019* was adopted with an accompanying document, *Yokohama Plan of Action 2019*.

As for oceans issues, Foreign Minister Kono chaired a thematic session on Blue Economy. In his opening remarks, Mr. Kono showcased Japan's efforts to promote Blue Economy in Africa, such as strengthening of physical and institutional connectivity, development of ocean energy resources, utilization of marine and fishery resources including inland aquaculture, and enhancing maritime security, including anti-piracy measures. He also announced Japan's initiative to provide training for 1,000 people to support Blue Economy in Africa.

There were many side events pertaining to the oceans. Japan Agency for Marine-Earth Science and Technology (JAMSTEC) held a workshop on climate studies in South Africa. The Ocean Policy Research Institute of the Sasakawa Peace Foundation (OPRI-SPF) held two official side events on Blue Economy and on Blue Carbon. In addition, OPRI-SPF held an informal event, the High-Level Roundtable Meeting on Blue Economy in Africa. The roundtable meeting was intended to strengthen partnerships among governments, businesses and other stakeholders in Japan and African countries and received a great response.

Yokohama Declaration 2019 and looking forward

Yokohama Declaration 2019 adopted at TICAD7 includes a notable statement from the perspective of ocean governance, which underscores "the need to galvanize bilateral, regional and international stakeholders' collaboration in maritime security, including the fight against piracy, IUU (illegal, unreported and unregulated) fishing and other maritime crimes, and maintaining a rules-based maritime order in accordance with the principles of international law." Acknowledging a Japan-driven initiative that Prime Minister Abe called for in his keynote address at the last TICAD, the declaration also included the statement that "we take good note of the initiative of a free and open Indo-Pacific announced by Prime Minister Shinzo Abe at TICAD6 in Nairobi."

TICAD 8 will be held in 2022 in further grown Africa, where it is expected to further advance strategic partnerships between Africa and Japan, starting from the TICAD7 discussions.

(Teruaki Aizawa)

Discussion at TICAD7 (Source : MOFA website)

Speakers and others at the side event, "Sustainable Blue Economy in Africa"

4 New Development in Ocean Education

In recent years, new developments have been seen in ocean education in Japan. For example, in 2019, the Center for Ocean Literacy and Education (COLE) was established in the Graduate School of Education of The University of Tokyo. With a coalition of researchers in scientific, engineering and educational fields, COLE is advancing ocean education through a new curriculum in school and social education. COLE is the successor of the Research Center for Marine Education (RCME), Ocean Alliance, the University of Tokyo, which was launched in 2010. RCME was a part of the Ocean Alliance, a cross-disciplinary network at The University of Tokyo founded in 2007 with the support of The Nippon Foundation for cross-disciplinary and comprehensive educational research on the oceans. RCME promoted ocean education in primary and secondary schools for nine years. The Nippon Foundation also supports the activities of the newly established Center. This article outlines the activities of COLE and presents ocean education concepts developed by RCME and the philosophy behind them.

1 COLE Ocean Education Projects

① Joint Development of Ocean Education Curricula

Succeeding RCME's program, the Center develops tailored ocean education curricula in partnership with local school boards, schools, local governments, and social education facilities all across Japan. One of the outcomes of the project is the publication of *Ocean Education Style Book in the Era of the New Government Guidelines for Education : Practical Guide to Link Communities and Schools* (*Shogakukan Inc., 2019*), which compiled model cases of ocean education.

② Development of Original Ocean Education Materials

Drawing on the expertise of education and oceanography teachers and researchers involved with the Center, COLE develops innovative ocean education materials. Another fruit of the project is the publication of *The Root of Ocean Education in Japan— (Post War Era) Science* (Ichigeisha Inc., 2019). It uncovers the historical fact that in postwar Japan excellent educational materials on the oceans were used in school education, and discusses its significance.

③ Policy Recommendation on Ocean Education

In addition to publishing books, the Center issues policy recommendation briefs on subjects such as the historical context of ocean education, the future of ocean education, and the latest oceanographic findings, in order to make policy recommendations to education and general administration agencies. One of the major outcomes is the *Ocean Education Policy Brief Series*. So far, COLE has published six issues.

Figure 4-1 A scene from the Children's Summit on Ocean Education

④ Ocean Education Colloquium Series

The center convenes a number of meetings in partnership with The Nippon Foundation and the Ocean Policy Research Institute of the Sasakawa Peace Foundation. The most prominent of these meetings is the annual National Ocean Education Summit, which enters its seventh year in 2020. Since 2016, the Center has convened the Children's Summit on Ocean Education, which is planned and managed mainly by local school children. The Children's Summit is currently held in the Tohoku and Kyushu regions, and is expected to expand to other regions.

⑤ Training of Teachers of Ocean Education

To encourage locally initiated, regionally tailored ocean education and to address global issues such as ocean warming and increasing marine debris, the Center started the Training Program for Teachers of Ocean Education in 2017 and offers training to teachers and education administration agency personnel who are in charge of development or delivery of ocean education curricula.

⑥ Supporting Development of Ocean Education Curricula

In 2016, the Center, in cooperation with The Nippon Foundation and Ocean Policy Research Institute of the Sasakawa Peace Foundation, started the *Ocean Education Pioneer School Program*[12] to encourage and support development of ocean education curricula by individual organizations. The center also conducts *Learning from the Oceans : Lifelong Learning Project* for social education facilities.

12 https://www.spf.org/pioneerschool/

2 Sections and Categories of Ocean Education

While the Center took over projects from its predecessor and expanded them, it is currently in the process of restructuring its program by setting pragmatic objectives for ocean education with a long time horizon.

1 Activity Sections

① International Networking

This section promotes cooperation with international organizations such as the United Nations and UNESCO and plans and administers events and international academic conferences on global issues concerning the oceans. In fiscal year 2019, COLE started to coordinate with the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) to present papers at each other's events.

② Academic Research

Researchers of the Center, in collaboration with outside researchers and teach-

ers of oceanography and education, conduct basic academic research to develop innovative ocean education curricula. This includes educational research to formulate "Japanese Style Ocean Literacy".

③ Curricula Development

This section expands the curriculum/program development projects of the former Center. As one outcome, in fiscal year 2019 we published *Teacher's Guide for Ocean Education — Guidebook for Learning from the Ocean at school : Primary and Secondary School* (Dainippon Tosho Co., Ltd., 2019).

④ Communications

This section is in charge of disseminating outcomes of ocean education nationally and internationally. It compiles and edits outcomes of other sections as well as plans and produces original popular content. In fiscal year 2019, it produced *The Oceans — A Journey following the Cycle of Life*, an animated short film (Director : Yosuke Omori, Production : Crafter Studio, 2019).

2 Subject Categories

Three categories — *life*, *environment*, and *security* — are not stand-alone categories but are interconnected through three cross-categorical disciplines — global, socioeconomics, and cultural. They constitute a model of ocean education. Subcategories of the model are also interconnected (Figure 4–2).

The description of ocean education added in the revised *General Policies Regarding Curriculum Formulation Government Guidelines for Education* only covers the discipline of "security" from the ocean education model in Japan. It is true that to assure Japan's security, consideration of Japan's territory, territorial seas, exclusive economic zone (EEZ), and sea lanes is needed. However, if we conduct ocean education emphasizing only that perspective, the oceans will continue to be regarded as no more than an object of possession (as will be discussed later).

For the first time, the current edition of *General Policies Regarding Curriculum Formulation* includes a preamble, in which the intent of the revisions is stated.

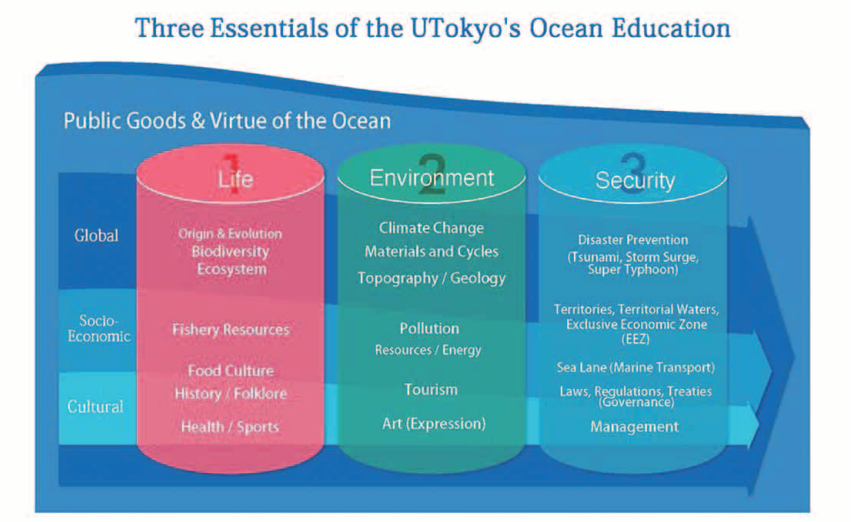


Figure 4–2 Three Essentials of Ocean Education of The University of Tokyo
Three Pillars of Ocean Education of Tokyo University
The Oceans as Public Property

"Cultivating creative drivers toward sustainable society" is one of the educational purposes it sets. Based on this educational purpose, ocean education should be defined as education that positions the oceans as the cornerstone of habitability ; constructs educational practices based on the three subject categories of *life*, *environment*, and *security* to address current issues emerging both regionally and globally ; and cultivates "creative drivers toward sustainable society."

However, existing ocean education in Japan has several challenges. First of all, an interdisciplinary approach is needed, especially between "Social Studies" and "Science." For example, while aquaculture and global warming are subjects taught under "Social Studies" in primary schools, their scientific aspects — for example, marine ecosystems and mechanisms of global warming — are taught at secondary schools under geology. It could lead to a situation where primary school children learn about the oceans without knowing the causal links in place and their background. The "*life cycle*" of oceans affects the ocean *environment* through the materials cycle, and ultimately affects our *security*. Marine debris, tsunamis, torrential rains, expansion of ocean dead zones, and heat waves are subjects to be taught and learned integrally in the context of social studies with a scientific knowledge base.

The second challenge is compartmentalization of ocean related fields. Oceanography is specialized into fields concerning *life* such as marine biology, marine ecology, and fisheries science ; fields concerning *environment* such as physical oceanography, chemical oceanography, marine geology, and marine engineering ; and fields concerning *security* such as coastal works, disaster prevention, law of the sea, and maritime affairs. Each field has its own academic society, and the purpose and terminology varies from one field to another. This presents a challenge when we attempt to teach school children the latest findings in an easy-to-understand format. The gap between oceanography and the study of education is greater than that among the various fields in oceanography. The study of education currently leans toward academic development and tends to focus on educational methods. Originally, education was an academic discipline separated from philosophy to encourage character building and social reform. The current study of education has not totally lost interest in character development and social reform, however. For example, environmental education places emphasis on the issue of global warming and aims at a "decarbonized society." However, in many cases, ocean warming, which causes natural disasters, is not discussed. For better ocean education, an interdisciplinary approach not only among specialties in oceanography but also between oceanography and the study of education is essential.

The third challenge is that ocean education must face the question for which there is no single correct answer : *what kind of society do we envisage and how should we live?* Ocean education should be more than teaching school children the mechanisms of ocean warming, or providing them opportunities to experience the mysteries and marvels of deep ocean dwellers. For example, children themselves have to think about the consequence of living in natural disaster-prone areas, and about the way to address risks, including evacuation, mitigation, and re-

Figure 4–3 Children playing on a beach

construction. It is not enough to teach them to address global warming by saving energy just because they are told to do so. We should guide them to reflect on the problems of social structure and lifestyles behind global warming, and to work for reform.

In searching for answers to "the question with no single correct answer," it is important for our children to recognize the oceans not only as public property which belongs to everyone but also as a public good (*res publica*), and to appreciate and care about all life that is gifted and bestowed by the oceans. In other words, our most urgent challenge is to position the concepts of *public good* and *bestowal* (*the giver and the given relationship*) as philosophies that ocean education should aim for, and to bridge the gap among various specialties of oceanography and between oceanography and the study of education.

3 Philosophies of Ocean Education

While both *public property* and *public good* originate from the Latin term *res publica*, these are two separate concepts. *Public property* means a physical object that can be owned. On the other hand, we cannot own a *public good*, as it is a denotation. While the oceans as a physical presence are owned by States, the oceans as a public good cannot be owned since the oceans are the historical origin of all life, including human beings. As the term, "Mother Ocean" suggests, life first emerged from the pristine oceans and we human beings evolved from this first life form. The oceans are the matrix of all life.

Another reason the oceans as public good cannot be owned is because they are the foundation for the existence of all life. A habitable environment, in which air, water, food, and proper temperature exist, are required for any life to exist. It is the oceans that support this habitable environment. Ocean warming is causing extreme weather events such as heat waves, torrential rains, and super typhoons, as well as undermining the biodiversity of the oceans and thus threatening habitability. The oceans are essential for an environment that supports all life, including human beings.

If we accept the fact that the oceans are our matrix, our origin, and the essential condition for habitability, they assume a surpassing existence and should thus be considered an object of awe. Our life is a gift given and sustained by the oceans. In this giver and receiver relationship between the oceans and people, we

are not autonomous individuals but collective human beings, who must unconditionally appreciate and value the gift, which are the oceans themselves.

The study of education has advocated making us more human through ethical education. From now on we should advocate making human beings more human in ocean education, too. What we should teach children is not only engineering approaches to realize a sustainable society, but also the humanity to sustain a habitable world, which is the prerequisite for a sustainable society.

Ocean governance without this humanity might remain a mere vision. People who appreciate and care about others, and people who appreciate and value the oceans as the matrix of life are the two sides of the coin of education. It is the goal of ocean education to embrace both sides.

(Satoshi Tanaka)

COLUMN 04 Marine Plastics Research Project and Promotion of Ocean Literacy in Collaboration with Japan-Palau Goodwill Yacht Race

There is only one ocean. Regional destruction of marine ecosystems, either by the effects of climate change or direct environmental load of human activities, is inextricably linked to global issues. Such global issues defy unilateral solutions. Through international collaboration, it is the responsibility of the ocean science community to collect and share scientific evidence with society to support effective policymaking. However, establishment of a global observation system requires a continuous injection of substantial resources. The capacity of existing research organizations is insufficient. For this reason, an effort to develop ocean observation networks in collaboration with commercial vessels (such as ferries and tankers) and the pleasure boating community (such as yachting) is attracting attention.

The Japan-Palau Goodwill Yacht Race celebrating the 25th anniversary of diplomatic relations between Japan and the Republic of Palau was held from the end of 2019 to the beginning of 2020[1]. The planning committee expressed their desire to take this opportunity to contribute to the conservation of the ocean environment as a group of ocean-loving sailors. The Japan Agency for Marine-Earth Science and Technology (JAMSTEC), in collaboration with the racing yacht TREKEE and escort sail training ship MIRAIE, conducted marine plastic observations during the race. Unlike research vessels, these ships cannot be equipped with conventional observation facilities. It requires a small, easy to use, and affordable monitoring system for non-research vessels to conduct marine plastic observation. In this project, subCtech's microplastic sampler[2] was installed on both ships. It will exponentially accelerate data accumulation and global comparative analysis of the data when more and more in the pleasure boating community choose to install such samplers.

The significance of the project does not stop there. Collaboration with various sectors is leading to promotion of ocean literacy. To build a bridge of friendship with Palau, six children from Palau, who excelled in the OP Dinghy[3] lessons arranged by the yacht race planning committee, were invited with their families on board the MIRAIE, where the JAMSTEC team conducted a series of ocean literacy programs for them. The children, who were between ages 8 to 14, experienced various activities: studying on the deck under a blue sky, observing Neuston Net's sampling, helping process the samples collected, and carrying out microscopic observations in a meeting room that was turned into a make-shift laboratory. The lessons included advanced subjects such as "What is Marine Protected Area?" and "Let's create an eco-friendly city" (which required creativity and imagination). It made us happy to witness their passion to learn, high level of awareness, and wealth of knowledge about ocean environment issues. Is it because the lives of the people of Palau are intimately involved with the oceans? We have a lot to learn from them and it made us think about what it means to live in an island nation. President Remengesau of Palau reiterated that these children were "the future of our country." I hope they will grow up to be a leading force for the future of the oceans internationally.

JAMSTEC conducted this project as its commitment toward the achievement of SDG 14.1 "Reduction of Marine Pollution," SDG 17 "Partnership for the Goals," and SDG 5 "Gender Equality." In addition to SDG 14.1, whose relevance is obvious, Palau will address SDG 17 by hosting the *Our Ocean Conference*, a high-level policy conference concerning the oceans in December 2020 for the first time as a member of the Small Islands Developing States (SIDS). Both Japan and Palau benefit heavily from the oceans. It is expected that the relationship between the two countries will be deepened through ocean science and marine sports.

As for SDG 5, the research team was made up solely of women from various backgrounds, including the author, Ms. Holly Griffin from the UN Environment Programme World Conservation Monitoring Centre (UNEP–WCMC), a specialist in ocean literacy, and Ms. Yurie Seki from Yamaha Motor Co. Ltd., an international-class sailor. Women's participation in ocean science in Japan is far behind in comparison with the global standard. We strongly hope that more women will actively participate in ocean science in greater numbers in the future.

(Sanae Chiba)

* The project was conducted in partnership with Mitsui O.S.K. Lines and Yamaha Motor Co. Ltd.

Note 1 : https : //japan-palau-yachtrace.com/

Note 2 : subCTech's Microplastic sampler was adopted in the Volvo Ocean Race 2017–2018. Its operability on board racing yachts sailing in rough waters on the high sea is demonstrated.

Note 3 : A cabin-less yacht for 1 or 2 crew with a length of 2.31m and width of 1.13m.

Children of Palau having lessons on the deck of the sail training ship MIRAIE.

Research Team members (Ms. Seki, the author, and Ms. Griffin) and the project flag.

5 New Developments in Japan's Marine Information Management

The ocean offers an extremely broad range of information that covers all phenomena arising in the ocean, such as waves and currents, water quality, marine organisms, marine minerals, and ship behavior. Due to this characteristically diverse and widely varying mixture of information, even information that has been acquired with the government's budget has been difficult to manage in a centrally integrated manner to date. In addition to the diverse nature of the information, the poor demand for sharing information that each ministry and agency has been collecting and using for their own respective purposes is another reason for the lack of progress in consolidating ocean information.

In response to the Basic Act on Ocean Policy enacted in April 2007, Japan finally took its first steps towards integration of its ocean information. In April 2019, the Japan Coast Guard commenced the operation of MDA Situational Indication Linkages (MSIL), an information service that superimposes and displays satellite information, marine weather information, and other ocean information collected and held by the government, on Web-GIS. This article provides an overview of the background leading up to the integration of ocean information and the future outlook, while introducing the categories of ocean information and Maritime Domain Awareness (MDA) system.

1 Three Categories of Ocean Information: Cadastre, Nature, Human Activities

1 Social Information of the Ocean

The foundation of ocean information is comprised of social information, which offers a spatial indication of the boundary of rights and interests in the ocean. This includes port areas and mining areas, fishery rights, and training waters. Overseas, a system known as Marine Cadastre was developed in each country from around the year 2000 along with the advancement of the Geographic Information System (GIS) (Tsunoda et al, 2010[13]). In Japan, reviews for a cross-ministerial platform commenced with the enactment of the Basic Act on Ocean Policy in 2007, and this platform was launched by the Japan Coast Guard in the form of the Marine Cadastre system in 2012. It is characterized by its ease of management on GIS due to the small volume of information (volume of data) and few temporal variations.

13 Tomohiko T., et al. "Towards the Development of Marine Cadastre" in *Kayiyo Monthly No.53*. 2010.

2 Social Information of the Ocean

The second category of information, conversely, has a large information volume and significant temporal variation. This is natural science information. Tsunoda et al (2010) have presented this as information obtained through oceanographic sur-

veys, such as physical information, chemical and environmental information, and biological resource information of the oceans. For example, hydrographic conditions, which are shown in Figure 5-1, are not as simple as the current charts presented in an atlas. There are many eddies with a scale of about several tens to several hundreds of kilometres, and this changes from day to day. Variations in the flow channel, such as the well-known direct flow or large meander of the Kuroshio, is also a type of eddy activity, and can have an impact up to a water depth of about one hundred to several hundred meters. For those engaged in fishery activities, the natural science information of the ocean is vital not only for safe operations, but also for understanding their fishing grounds such as the junction where two ocean currents meet.

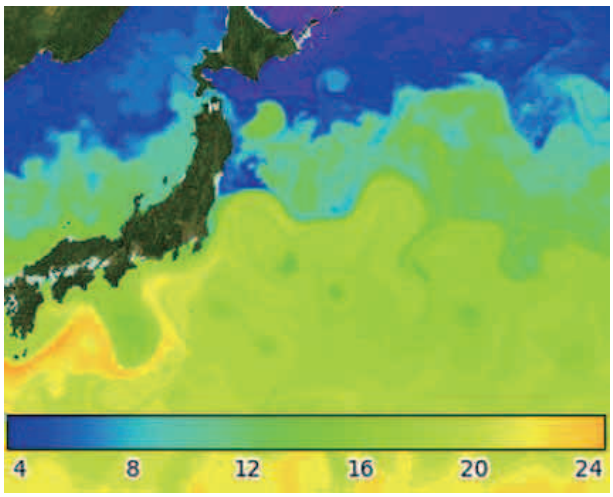


Figure 5-1 Estimated hydrographic conditions in May, 2019 (temperature at a depth of 50m)
(Source : https://www.marinecrisiswatch.jp)

In order to capture such natural science information of the ocean, survey activities are carried out through observation vessels and other means. The long-term observation study conducted for more than 50 years by the Japan Meteorological Agency along 137 degrees east longitude is one such famous example, and basic data from the monitoring of the climate is provided worldwide. Aspects that cannot be adequately captured by vessels alone are also covered through the use of

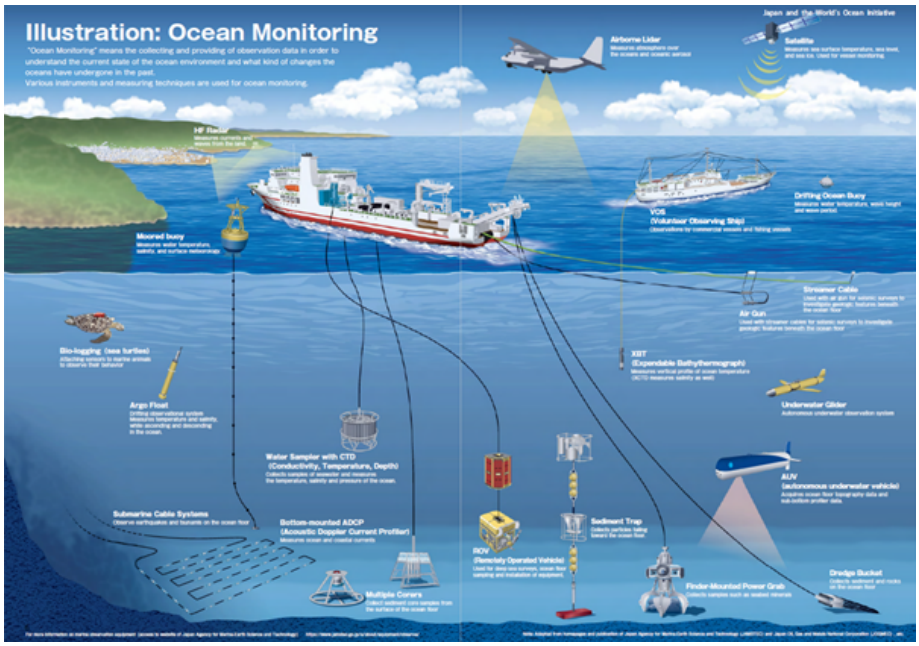


Figure 5-2 Overview of ocean monitoring
(Source : White Paper on the Oceans and Ocean Policy in Japan 2019)

data collected by artificial satellites and automated observation equipment, including Argo Floats. An overview of such marine monitoring is shown in Figure 5–2. Furthermore, numerical forecasting, known as the "ocean forecast," is also carried out by incorporating such observation data into numerical simulations of the ocean. This makes it possible to predict the conditions of the ocean around Japan, including the Kuroshio, approximately one month in advance, in a way that is similar to a weather forecast.

3 Information on Vessels

Finally, the third category of information is a type of ocean information that has recently been attracting attention. This is information that is related to vessel activity, which changes every day. While it had been difficult to comprehensively capture the movements of vessels that move on the seas (such as fishing vessels, commercial vessels, and navy vessels), the situation was drastically transformed with the emergence of a system known as the Automatic Identification System (AIS), which automatically transmits and receives vessel information such as vessel name, position, and destination through VHF-band radio waves to facilitate the exchange of information between vessels, and between vessels and land facilities. When it first became mandatory for vessels that meet a certain criterion to be fitted with the AIS under the International Convention for the Safety of Life at Sea (SOLAS), which entered into force in 2002, this system was used as a tool to ensure safety of navigation in congested waters, etc., in line with the objectives of the SOLAS. However, as it enabled anyone to receive vessel information that is transmitted through VHF band, AIS became a means of capturing vessel movement.

Moreover, two forms of technological innovation in recent years have dramatically propelled the monitoring of vessel movement forward. The first is artificial satellites, which not only made it possible to analyse the movement of vessels around the world through the receipt of AIS information seamlessly from satellites, but also enabled the monitoring of vessels at high frequency through the use of satellite information, alongside the launch of a large number of small satellites that can capture images of the sea. Images of the sea are useful for monitoring suspicious vessels that are operating with their AIS switched off. The second technological innovation is artificial intelligence (AI). The massive volume of AIS information, which can no longer be adequately processed by humans

Figure 5–3 Example of how vessel movement is captured through the AIS (around the Osumi Peninsula)
(Source : 10th Regional Coast Guard Headquarters)

alone, as well as images of the sea, can be efficiently and effectively analysed through the use of the latest AI technology, and applied for monitoring purposes. By comparing this information with the vast volume of past vessel data that has accumulated, it is possible to extract information on vessels with abnormal behaviour through AI technology.

2 Maritime Domain Awareness (MDA) and Consolidating Ocean information

1 Advancement of MDA in Japan

According to the Basic Plan on Ocean Policy, which is revised by the government every five years, Maritime Domain Awareness (MDA) is defined as "The efficient understanding of situations associated with the oceans while bearing in mind how to handle the effective collection, consolidation, and sharing of diverse information about the ocean that contribute to maritime security, ocean environmental protection, marine industry promotion, and science and technology development." As this is a concept developed in the United States in response to the synchronized terrorist attacks on September 11, 2001, MDA tends to be perceived as a concept with security implications. However, it involves the collection, consolidation, and sharing of a broad range of ocean information, such as information on the marine environment. As explained earlier, information about the ocean is diverse and of a wide variety, and capturing information accurately, even for general information such as data on the waves and ocean currents, can have great significance for security. From this perspective as well, it makes sense for MDA to target a wide range of ocean information, and it is possible to understand MDA from a dual-use viewpoint.

In Japan, reviews on MDA commenced with the establishment of a liaison and coordination council for MDA-related ministries and agencies in May 2015, in cooperation with the National Security Secretariat and the Secretariat of the Headquarters for Ocean Policy (now the National Ocean Policy Secretariat) under the Cabinet Secretariat. This liaison and coordination council published a concept paper in October 2015, in which it establishes that the ideal vision of MDA in Japan is not limited to the area of security, but includes a wide range of objectives such as natural disaster measures, and comprises information and systems with a basic three-tier structure. Furthermore, the document on strengthening the capacity of MDA approved by the Headquarters for Ocean Policy in July 2016, presents a structure headed by the National Security Council, the Secretariat of the Headquarters for Ocean Policy, and the National Space Policy Secretariat as the three "control towers," with the Japan Coast Guard managing and operating systems in the first and second tiers. Here, the three tiers are established as follows: the first tier is information systems that can also be used by the private sector; the second tier is information and systems that are shared among government agencies; and the third tier is the real-time sharing of information between ministries and agencies that are related to security. The review of MDA in Japan became

more in-depth in response to these decisions, and MDA was upgraded as a new item in Chapter 2 of the third Basic Plan on Ocean Policy, approved by the Cabinet in May 2018. MDA is positioned as a measure that serves as a "foundation for contributing to reinforcement of maritime security," which is also clear from the positioning of "Comprehensive Maritime Security" at the beginning of the Basic Policy in the third Basic Plan on Ocean Policy. Reviews and the development of systems related to MDA are progressing based on this Basic Plan.

2 Start of the Operation of Information Systems to Handle MDA

In April 2019, the government consolidated the ocean information collected and held by itself, and commenced the operation of MDA Situational Indication Linkages (MSIL), an information service that superimposes and displays the information on Web-GIS. This service targets the first and second tiers of MDA that the Japan Coast Guard is responsible for, and information from the first tier is made widely available to the general public through the Internet.

The main characteristic of MSIL is that it consolidates the wide range of ocean information managed by the relevant ministries and agencies, and integrates both the social information and natural science information of the ocean on the same central platform. While there is also much information that has not been included in the first tier, such as vessel movements, the consolidation of Japan's ocean information has finally reached its starting point with the operation of this system. Through MSIL, there are also plans to actively apply this ocean information, which is also a public asset, to the maritime industry.

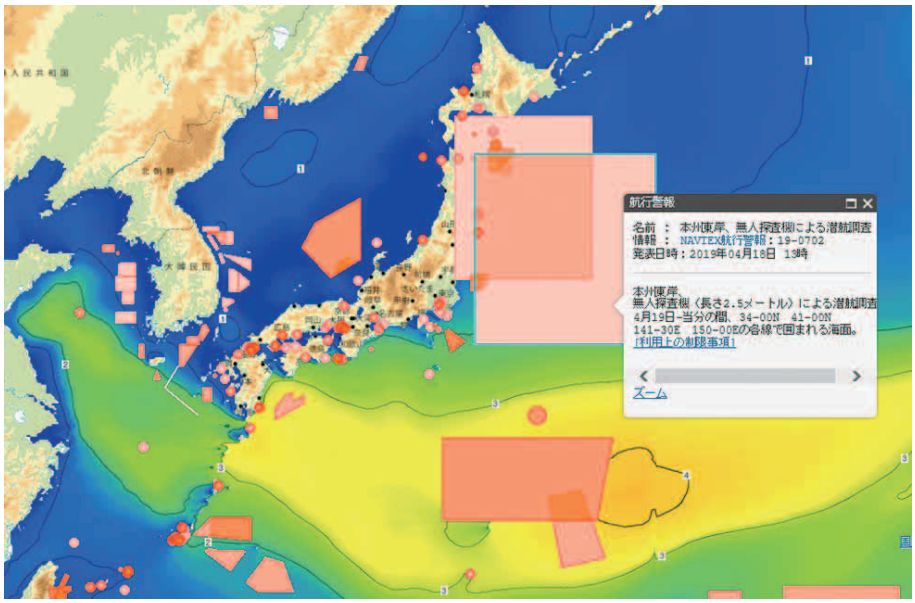


Figure 5-4 Example of information display on MSIL
(Superimposition of navigational warning zones on a wave map)
(Source : Prepared based on https://www.msil.go.jp)

3 Ocean information in the Future —Towards Ocean Information Ventures

As explained above, the positioning of MDA initiatives as a "foundation for contributing to reinforcement of maritime security" in the third Basic Plan on Ocean Policy played an important role in the realization of the consolidation of ocean information through MSIL, which had previously been difficult to realize. We could say that MDA has created a major demand for the sharing of information. Meanwhile, in addition to this policy-related perspective, a technological perspective that covers the aspect of the advancement of information technology is also vital. In other words, Geographical Information Systems (GIS) and the data processing technologies that support GIS have advanced by leaps and bounds over the last decade, enabling the real-time handling of natural science information, which is characterized by vast information volume and significant temporal variations. Technological innovation is gradually bringing about significant changes to the world of the ocean. In the near future, how will it impact ocean information systems?

For example, autonomous operation technology is developing in the shipping sector just as it has advanced in the automotive sector, and demonstration experiments of these ships are being conducted around the world. As autonomous-operating ships need to share a large volume of navigation-related data with the land, there is the possibility that ship information could move swiftly in the direction of Big Data in the future. The fisheries industry has also changed its direction significantly towards becoming a "profitable fishery industry," in response to the amendments to the Fishery Act in December 2018. The highlight of these amendments is the IoT fishery industry, underscoring the fact that the information revolution is advancing even in the fishery industry, including in the aquaculture industry. Furthermore, moves to establish offshore wind farms have also accelerated with the entering into force of the Act on Promoting Utilization of Sea Areas in Development of Power Generation Facilities Using Maritime Renewable Energy Resources[14] in April 2019.

There have also been advancements in the development of technology for collecting information. For example, Planet Labs, Inc. has achieved daily monitoring through high-resolution images produced by using close to 200 small satellites. VHF Data Exchange System (VDES), a next-generation AIS, may commence operations during the 2020s, and is expected to function as base communications infrastructure on the seas. Other forms of technological innovation include the development of ultra-compact marine observing buoys and technology for understanding ecosystems known as "Environmental DNA," and the list of new and innovative technologies goes on. The organization that embodies such ocean information management in the near future is Google, the giant of the IT sector. Global Fishing Watch, an international non-profit organization established in June 2017 with the support of Google, harnesses AI to eradicate illegal fishing. By analysing a vast volume of information about fishing vessels through means such as artificial satellites and AIS, it visualizes fishery activities around the world and releases this

14 Tsunoda T., "Towards the Popularization of Offshore Wind Power Generation — The Enactment of the Act to Promote Offshore Use by Offshore Renewable Energy Facilities" in *Ocean Newsletter No. 448*. 2019.

information to the public. The actual situation with regard to fishery activities that had been kept within a “black box” till now, has been brought to light through Google.

Going forward, ocean information will become a mixture of wheat and chaff, and will be accessible to anyone who has the means and skills to do so. It will be up to the user to make it into worthless trash, or to transform it into a treasure trove. MSIL is one such mixture, and motivated initiatives by the private sector will stimulate the further utilization of ocean information. Information ventures will also emerge in the maritime sector, just as in various other industries. These will promote new uses of the ocean, and the creation of a virtuous cycle for ocean information and utilization of the ocean is anticipated.

(Tomohiko Tsunoda)

Reference Materials

Development of an Underwater Floating-type Ocean Current Power Generation System and the Demonstration Sea-trial

[KEYWORDS] ocean current turbine / Kuroshio current / Kairyu

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(Ocean Newsletter No. 437, 20 October 2018)

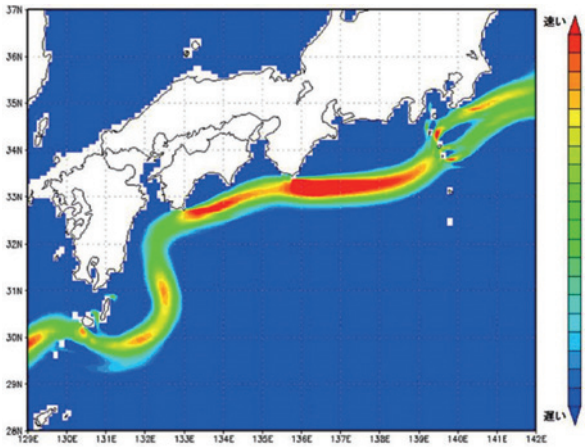
Ocean current power, an example of ocean renewable energy, is a renewable energy technology that aligns well with Japan's aims for effective utilization of the "Kuroshio" current. In August 2017, IHI Corporation and the New Energy and Industrial Technology Department Organization (NEDO) conducted an experimental test off the shore of Kuchinoshima in Kagoshima Prefecture, and gained data that can be utilized for future operationalization. The 100kW device is one of the largest devices for ocean currents in the world. Here, I will give an overview on the world's first floating offshore ocean current power system.

Power Generation Using the Kuroshio Current

Japan's territorial waters and exclusive economic zone (EEZ) are the sixth largest in the world, and the use of marine renewable energy in the EEZ is being actively promoted from the viewpoint of energy security and reducing greenhouse gas emissions. In particular, the Kuroshio current (Fig. 1), which flows in the waters near Japan, is one of the strongest ocean currents in the world, in which it is estimated that an enormous 205 GW of energy exists[*1*2]. Enabling power generation from the Kuroshio current would make it a very useful renewable energy source for Japan.

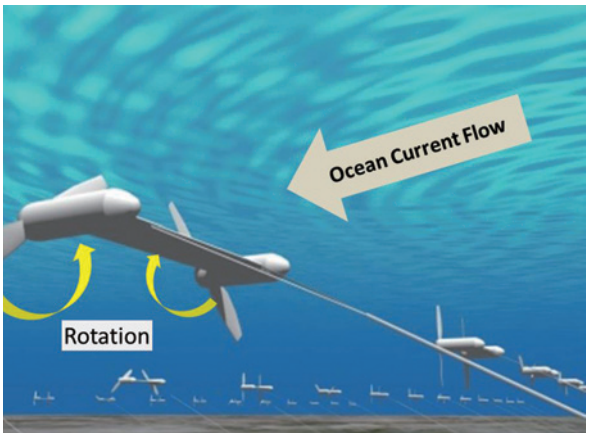
With respect to this ocean current power generation, the author and others started research and development of an underwater floating-type ocean current power generation system (Fig. 2) for a NEDO project in FY2011 as an efficient power generation device that has low power generation costs, and a power generation demonstration test in the Kuroshio area was completed in the summer of 2017. This article introduces an outline of it.

■Fig. 1: Example forecast by numerical analysis of the Kuroshio current's axial distribution



The Kuroshio current passes through the Tokara Strait and enters the Pacific Ocean.

■Fig. 2:Image of a large-scale power generation farm using underwater floating-type ocean current power generation systems



Features of Underwater Floating Ocean current power Generation Systems

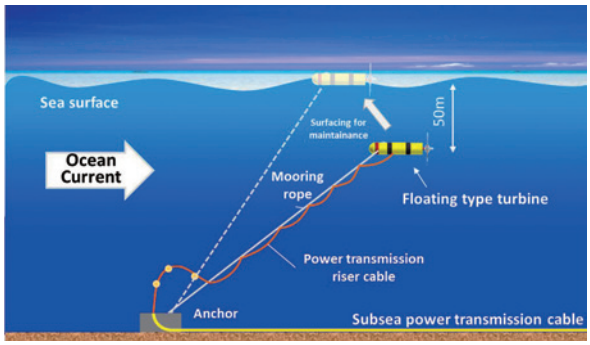
Marine currents must have the following characteristics in order to realize power generation from them: few daily or seasonal fluctuations in the speed and direction of the flow; a large current about 100km wide off the East China Sea and the Pacific Ocean, and; a flow near the sea surface in a sea area with a depth of several hundred meters.[*3] In order to generate power from such an ocean current, the underwater floating ocean current power generation system has the following characteristics:

(1) The goal is to achieve the capacity factor of 60% or higher, which is extremely high for renewable energy, due to being able to continuously use energy from stable ocean currents for a long time. This stable power supply can also be expected to be a base load power source.

(2) The floating body with turbine is moored to the bottom of the sea with a mooring line, and floating in the sea by the marine current as if it were a kite (Fig. 3). It can easily be installed in deep water by extending the mooring line, so it is possible to set a wide range of installable sea areas and to deploy large-scale power generation farms with a large number of power generators.

In addition, because they are all underwater, they can be

■Fig. 3:Conceptual diagram of an underwater floating ocean current power generation system



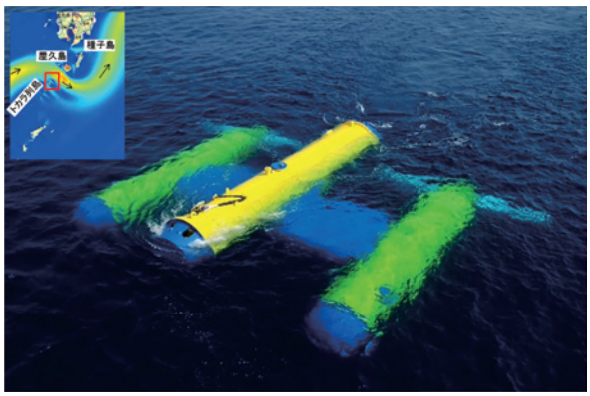
operated at a stable depth without being affected by waves, and they will not interfere with ship navigation. Furthermore, since it is possible to use simple mooring, the ease of installation also contributes to cost reduction.

(3) The rotational torque accompanying turbine rotation can be canceled by connecting two counter-rotating turbines, thus maintaining a stable position in the sea and enabling efficient power generation.

(4) Maintenance and repair are easy because the turbine can be sent to the ocean surface as needed by adjusting the direction and buoyancy of the turbine.

Taking advantage of these characteristics, it is assumed that an actual underwater floating ocean current power generation system would have a power output of 2MW (1,000kW x 2) per unit. A large-scale ocean current power generation farm with a large number of them would aim to achieve a power generation cost of ¥20/kWh or less, which is the target set for NEDO projects, and to realize a power generation system comparable to other power generation methods in terms of power generation costs.

■Fig. 4:External view of the 100kW "Kairyu" demonstration prototype and the demonstration test area



Offshore Operational Tests

Using the results of essential element technology development that began in 2011, a power generation demonstration experiment of an underwater floating ocean current power generation system was conducted in the actual Kuroshio current region from July to August 2017.

For this demonstration test, an actual demonstration prototype with a turbine diameter of approximately 1/3 scale (Fig. 4. Named "Kairyu" after soliciting names from local elementary and junior high school students) was developed and built at IHI Yokohama Engineering Center, using the same mechanism, structure, and materials as the actual machines of the future.

This "Kairyu" floats in the water with an overall length and width of approximately 20m and a weight of approximately 330 tons. It is composed of three watertight and pressure-resistant vessels (pods) that contain various machinery. At the rear ends of the left and right pods, there is a horizontal axis turbine equipped with a controllable blade pitch angle mechanism, with a rotor diameter of 11 meters. Together, the left and right pods can generate a maximum of 100kW in a 3-knot current. The central pod is equipped with a mechanism for adjusting buoyancy, power transmission equipment, and so forth. During power generation in the sea, the depth and position of the machine, power generation performance, and emergency response are controlled autonomously in response to the changing external environment by the built-in control device. In an advance trial run during which the unit was towed, it was confirmed that it can generate a maximum output of 100kW, as planned, and that it could stably float through autonomous control.

The next verification test in the Kuroshio area was conducted in the coastal area north of Kuchinoshima, Toshima Village, Tokara Islands, Kagoshima Prefecture, which has been approved as a marine energy demonstration field by the National Ocean Policy Secretariat, Cabinet Office. A power generation test was carried out by mooring "Kairyu" in the marine area where the Kuroshio current flows, about 5km offshore from Kuchinoshima, with a seafloor depth of approximately 100m. There was a current of 2 knots maximum during this test period, and power generation of approximately 30kW was achieved as a result of this demonstration test. Valuable data about the actual Kuroshio current area's characteristics was also obtained, such as the float stability of floating objects, and installation and operational work in the actual marine area. This is the world's first power generation using a 100kW class ocean current generator that is installed in an actual ocean current area.

Towards Practical Use

Underwater floating ocean current power generation systems are a new power generation technology that can shoulder the role of a base load power source through

1) Marine current energy and high efficiency underwater turbine power generators that bring high capacity factor, and

2) Low-cost float mooring methods, regardless of the sea area.

In the future, we aim to commercialize the ocean current power generation system in the 2020s by carrying out detailed investigations and research on the Kuroshio current as a renewable energy source, and long-term operation trials are planned to be implemented from 2019 to 2020. ■

● This paper is based on the results of a NEDO project, the "Marine Energy Technology Research and Development / Marine Energy Power Generation Technology Demonstration Study."

*1 New Energy and Industrial Technology Development Organization (NEDO): "NEDO Renewable Energy Technology White Paper -- Towards a New Energy Society" (2010)

*2 New Energy and Industrial Technology Development Organization (NEDO): Results report for "Research and Development of Natural Energy Technologies such as Wind Power / Research and Development of Offshore Wind Power Generation Technology, etc. / Operations Related to Understanding Marine Energy's Potential" (2011)

*3 In addition to ocean current power generation, tidal current power generation is a method of power generation that utilizes underwater currents. Tidal currents associated with tidal fluctuations are characterized by large fluctuations in the speed and direction of the flow during the day.

Efforts towards the Creation of an Oyster Farming Pipe Utilizing Biodegradable Plastics

[KEYWORDS] Hiroshima Bay / aquaculture materials / outflow prevention

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(Ocean Newsletter No. 447, 20 March 2019)

Oyster farming utilizes several plastic materials including oyster pipes (20cm-long polyethylene tubes to provide spaces for farmed oysters) and Styrofoam floats of oyster rafts. The number of oyster pipes used in Hiroshima Bay are estimated to be more than 200million, and some of them are lost due to ship collisions. Introduction of biodegradable materials used for oyster pipes could reduce the environmental problems associated with the lost and drifted pipes. To identify the strength of biodegradable oyster pipes, strength tests have been conducted since 2018, in addition to exiting studies to reduce pollutions caused by broken styrofoam floats.

Can Oyster Farming Pipes be Prevented from Outflowing?

The problem of oyster farming materials and drifting waste in Hiroshima Bay has been around for more than 20 years, and the Styrofoam floats (hereinafter referred to as "floats") and oyster pipes (hereinafter referred to as "pipes") have been alternately attracting attention over the past several years. In 2017, the Umi & Nagisa Foundation conducted a demonstration test in which float pellets were turned into fuel at four locations nationwide, and achieved a certain level of success, at the end of 15 years development. Next, an experiment using oyster pipes made of biodegradable plastic was conducted in Hiroshima. This has been a long-standing challenge, even before marine plastics became a social problem.

Plastic pipes for oyster farming are used when hanging scallop shells to which the seedlings will be attached, to secure a certain amount of space between them. The existing polyethylene (hereinafter referred to as PE) pipes are 20cm long, have a 1.5cm outside diameter, approx. a 1.0cm inside diameter, and cost only a few yen per pipe, but they are important materials and are kept for reuse, and not allowed to outflow. Pipe outflows have become both an economic and an environmental problem for oyster farmers. Currently, more than 200 million pipes are used in Hiroshima Bay, with 17,000 pipes per floating raft for oyster farming. Even if a tenth of a few percent of using pipes are outflowing, it means that 100,000 pipes will be released. This is a considerable amount if you have accumulated the outflow pipe, but the cause of outflows is not just the aquaculture work, and it seems impossible to completely prevent outflows by the efforts of fishermen alone. For example, over the past three years, there have been, average per year, 40 oyster farming floating rafts collide with the ship and are broken. If all the pipes became disengaged during these accidents, then the outflow from these accidents would be 680,000 pipes/year. Fishermen must work on outflow prevention and improvements, but because of this background, we decided to conduct a field experiment with biodegradable plastic pipes that would decompose faster than PE pipes.


Fragmented oyster pipes and white Styrofoam floats drifted down

Initiatives in Hiroshima Prefecture

More than 15 years ago, the Western District Hiroshima Prefectural Fisheries Promotion Council established a program for purchasing pipes that have been released and drifted out of the prefecture, but purchases are subject to conditions, such as the shape of the pipes, and local municipalities where the beach with drifted pipes is located may dispose of them. In addition, officers in charge at Hiroshima Fisheries Cooperative and the the Fisheries Division of Hiroshima Prefectural Government were aware of the problems and visited the float processing demonstration test conducted by the Foundation in FY2017, but it did not lead to a proper disposing project.

However, on May 14, 2018, a representative of Yamaguchi Prefecture visited the Hiroshima Prefectural Office and requested, in writing, "Thorough outflow prevention and recovery of plastic pipes used in oyster farming". In response, Hiroshima Prefecture sent an administrative guidance about outflow prevention to the head of the fishery cooperative that handles oyster farming in the prefecture. At the Governor's regular press conference, reporters asked questions about marine litter countermeasures, in particular about outflows of oyster farming materials and the request

lodged by Yamaguchi Prefecture.

When oyster farmers from Hiroshima Prefecture collected drifting pipes and other litter in Suo-Oshima Town and other places in Yamaguchi Prefecture on September 7, apparently some of them were surprised by the large number of pipes. It shows that there is not precise information of the issue amongst oyster farmers. On the other hand, there is also an initiative for float processing in which the Hiroshima Fisheries Cooperative acts as a contact point, and we expect that this will lead to an improvement in fishermen's awareness and efforts to solve the pipe outflow problem.

Challenges for Trial Production, Experimentation, and Introduction of Biodegradable Plastic Pipes

Two types of experiments were planned, using a total of three types of prototype pipes (20cm long PBS and 2 types of PLA)*1, and using the existing PE pipes for comparison. In Experiment (1), hanging the pipes down on an aquaculture cage, the percentage of good reusable pipes was measured by selecting not-reusable pipes that had cracks or were bent, assuming actual work such as moving rafts. As for biodegradable plastic pipes, unused prototype pipes and pipes that had deteriorated after being boiled in seawater for several hours were used and installed in the same rack for comparison. They were installed at the fisheries cooperative on October 25, 2018, and would be collected in January and May, 2019. For experiment (2), pipes will be installed at depths of 0m (surface level), 1m, and 5m, and then their weight and surface deterioration will be observed. The Hiroshima Prefectural Fisheries Division and Ocean Technologies Center of Hiroshima prefectural Technology Research Institute will begin a seawater immersion test on November 2, and will measure weight changes after 1, 3, and 6 months to investigate durability and degradability.

When compared to the ready-made PE, the PLA prototype seems to be very hard and strong, but it is vulnerable to cracking. The PBS prototype is flexible and seems to be the closest to the ready-made PE. In January 2019, we observed the status after three months of immersion. Just like in actual harvesting, scallop shells were dropped on the ship and the pipes were collected separately. According to the fishermen who cooperated in the experiment, they felt that more pipes had cracked than the PE pipes that they use on a daily basis, and they were worried that the pipes would break when put into a cleaning machine for reuse. There are still lots of tasks in this work.

It may be better to consider introduction to "blister pipe (mame-kuda)" first. For collecting oyster seedlings, a short pipe, cut to about 1 cm in length and known as a " blister pipe (mame-kuda)" is used. Blister pipes were the most commonly collected piece of the marine litter. Blister pipes are less likely to break due to resistance to running water, and are therefore easier to introduce into actual faming than longer pipes.

Hanging ropes with biodegradable plastic pipes

"Blister pipes" are used in between scallops

Also, as a matter of concern for their introduction, there is a specific gravity issue that is difficult to notice when used on land. Most biodegradable plastics sink, so more floats will be attached to the rafts if biodegradable plastic is used and the burden on fishermen will increase. In the case of outflows, PE pipes can be collected by rafts and work boats, but biodegradable plastic will become seabed waste and will be difficult to collect. It is said that used PVC pipes and PE pipes are still on the seabed. There is no material that is good to leave in nature, not just biodegradable plastic.

Sustainable Aquaculture

The non-use of plastic, such as straws and plastic bags that are provided directly to customers, will lead to improving corporate images, while measures for floats and pipes,

which are items not to be provided to customers, tend to be delayed, as they are unlikely to lead to increased product prices. For this reason, the Public Awareness of Hiroshima Prefecture residents are important, but at the same time, it is necessary that distributors show concern when fishermen take countermeasures against outflows and to see whether fishermen are properly managing their fishing gear. In addition, certification for eco-labels, etc., shall also require added items to be checked off regarding proper treatment and disposal of fishing gear.

Some ear-pleasing information has been reported on the problem of marine plastics, but there is no quick remedy for the marine litter problem. The best way is to keep up steady, uninterrupted efforts. This probably wouldn't have been so exciting if the Ocean Plastics Charter had been signed.

It is important not to focus on the G20 declaration to be held in Osaka in June 2019, but to focus on the subsequent government and industry efforts. ■

*1 PBS (polybutylene succinate) and PLA (polylactic acid) are both a type of biodegradable plastic.

Protecting Palau's Oceans through Disposal of Explosive Remnants of War (ERW)

[KEYWORDS] unexploded munitions disposal / conservation of ocean areas / international contributions

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In Palau, the non-governmental organization Japan Mine Action Service (JMAS) has been working to dispose of explosive remnants of war (ERW) since 2012. For example, the outsides of many depth charges (weapons for anti-submarine warfare) remaining on the Japanese cargo vessel known as Helmet Wreck have rotted in the 70 years since the war, releasing the poisonous picric acid. As this acid has negative impacts on the water condition in the gulf, JMAS took efforts to prevent this up until 2015. Currently, the organization deals with monitoring and disposing ERW found on sunken ships and in shallow waters and in securing safety in the oceans.

Japan Mine Action Service (JMAS)

Japan Mine Action Service (JMAS) is a designated non-profit organization (NPO) that has been certified by the Tokyo Metropolitan Government, and is sometimes referred to as an NGO because of its activities. Japan Ground Self Defense Force retirees set up the organization in 2002 and immediately started the Cambodia unexploded bomb disposal program. After that, the organization has worked in Afghanistan, Angola, and Pakistan. At present, the organization is involved in a comprehensive machinery project related to landmine and unexploded bomb disposal in Cambodia's Kampong Thom Province, a regional development promotion project that includes landmine and unexploded shell disposal in Banteay Meanchey Province, a "Safe Village Construction" comprehensive community development project in Battambang Province, a cluster munitions processing mechanization project in Laos's Xiangkhouang Province, a project to deal with unexploded munitions in Palau, and the Oil Leakage Countermeasures Project for World War II Wrecks in Truk Lagoon Marine Area, Federated States of Micronesia" (Chuuk State).

With the exception of the "Safe Village Construction" project in Cambodia, the organization is funded as part of Japan's Official Development Assistance (ODA) and is expected to contribute to the Sustainable Development Goals (SDGs), a global standard set by the United Nations.

Explosive Remnants of War

A basic bomb mechanism operates through the combination of an explosive charge, which is the center of the explosive power, and a fuse that ignites it. Normally, when the bomb is not used, the explosive charge and the fuse are separated to prevent the bomb from exploding unexpectedly, which allows the bomb to be stored safely.

What are commonly referred to as unexploded ordinance are either unexploded or abandoned ordinance. Unexploded Ordinance (UXO) are bombs that did not explode even though a fuse was attached to the explosive charge for use in combat. Abandoned Explosive Ordnance (AXO) are

Investigating depth charges in shallow water.

munitions that have been abandoned or left unattended because of withdrawal or disarmament, etc. In many cases AXOs had not been used and, usually, a fuse was not attached.

UXO and AXO are collectively defined as Explosive Remnants of War (ERW), but both ERW and UXO are used in the same way as terms for unexploded munitions.

Unexploded Munitions in Palau

After World War I, Palau became a Japanese mandate from a German colony, the Nan'yo Cho (Territorial Government of the South Seas) and its Palau Branch were established, and Palau became the core island of the South Pacific Islands. Palau became an important base for the Japanese Navy when World War II began, and was therefore subject to attack by the U.S. military. On March 30 and 31, 1944, aircraft launched from U.S. Navy aircraft carriers attacked ships and ground facilities, dropping mines in Palau's harbor and surrounding waterways. This was the so-called Palau Air Raid. As a result, every ship berthed on that day was sunk while at anchor.

JMAS Palau is currently dealing with unexploded bombs and shells used by the U.S. military, as well as abandoned bombs left in the sea, which were at the time mounted on Japanese ships that sank. In the three years from 2012 to

Protecting Palau's Oceans through Disposal of Explosive Remnants of War (ERW)

2015, JMAS dealt with the depth charges loaded on a ship known as the Helmet Wreck, which sank in water that is 30m deep and 1km off the coast of Malakal Port, Palau's only commercial port. Helmet Wreck is a tentative name and was a transport ship used by the Japanese military, but the ship's real name is unknown. A depth charge is a bomb that attacks submarines; it is dropped from a ship into the water and when reaching a set depth, the fuse is activated and it explodes.

The depth charges were disposed of because 70 years after the war, the depth charge containers in the water had corroded and cracked. Picric acid, which is a toxic explosive charge, was leaking from the inside and having an adverse effect on the environment. In 2013 the Palau government asked the Geneva International Centre for Humanitarian Demining (GICHD) in Switzerland to conduct an environmental survey. As a result of the survey, two depth charges, which had fuses attached and were leaking picric acid, were removed from the Helmet Wreck.

Permicron Guard (trade name), which hardens in water to form a harmless plastic, was used to prevent leakage of picric acid. Permicron Guard is used for reinforcement and rust prevention in harbors, river facilities, etc., and the components do not contain toxic substances and do not dissolve in water. Leakage of picric acid is prevented by smearing Permicron Guard on cracks in the depth charge containers.

In 2014, 105 depth charges were treated to prevent picric acid leakage, and the pH value of the seawater in the ship improved from 6.80 to 8.07, which is the average value for the ocean area, and seawater transparency increased. In addition, signs of fish life have increased and the ecosystem is also recovering. Two depth charges with fuses were destroyed on land in 2015. Thereafter, periodic monitoring is conducted to check for environmental abnormalities and new picric acid leaks, and to take measures to prevent leaks.

Raising a depth charge using a balloon.

Using Google Earth to record depth charges.

Slight leakage of picric acid continues, but it has been suppressed to such an extent that there is almost no major impact on the environment.

From 2016, JMAS surveyed 36 shipwrecks and unexploded munitions over approximately 700,000m2 of ocean in depths of less than 10m in Malakal Bay and the Rock Islands Southern Lagoon World Heritage site. Of the 36 recorded shipwrecks, 15 have been confirmed, 5 had unexploded munitions, and many depth charges, etc., were discovered, even in shallow waters.

The Palau government is trying to establish a database of unexploded munitions that records their location, type, number, etc., on a map, using it as an index to ensure safety. Initially it was registered in the Palau government's map system, but now it uses Google Earth, which is simpler and more generalized. The figure on the right shows shallow water depth charges recorded in Google Earth: red marks indicate depth charges scheduled to be disposed of, white circles have already been disposed of, and numbers identify each depth charge. The situation of this unexploded ordinance is clear at a glance, and JMAS intends to dispose of all depth charges in the area during the year.

In Palau, the Lagoon Monument legal provision requires the obtaining of approval from the President when working on underwater ruins. Therefore, depth charge disposal is also carried out with the President's permission. From next year, JMAS intends to dispose of an estimated 165 depth charges that are left in the Helmet Wreck. Unlike the work in shallow water, the water at Helmet Wreck reaches 30m depth, which makes it more difficult, but we want to make every effort to ensure that Palau is as safe as possible. ■

● NPO Japan Mine Action Service (JMAS) https://jmas-ngo.jp/

IPCC Special Report on the Ocean and Cryosphere in a Changing Climate

Headline Statements of the Summary for Policymakers

Section A. OBSERVED CHANGES AND IMPACTS

Observed Physical Changes

A1. Over the last decades, global warming has led to widespread shrinking of the cryosphere, with mass loss from ice sheets and glaciers (very high confidence), reductions in snow cover (high confidence) and Arctic sea ice extent and thickness (very high confidence), and increased permafrost temperature (very high confidence).

A2. It is virtually certain that the global ocean has warmed unabated since 1970 and has taken up more than 90% of the excess heat in the climate system (high confidence). Since 1993, the rate of ocean warming has more than doubled (likely). Marine heatwaves have very likely doubled in frequency since 1982 and are increasing in intensity (very high confidence). By absorbing more CO_2, the ocean has undergone increasing surface acidification (virtually certain). A loss of oxygen has occurred from the surface to 1000m (medium confidence).

A3. Global mean sea level (GMSL) is rising, with acceleration in recent decades due to increasing rates of ice loss from the Greenland and Antarctic ice sheets (very high confidence), as well as continued glacier mass loss and ocean thermal expansion. Increases in tropical cyclone winds and rainfall, and increases in extreme waves, combined with relative sea level rise, exacerbate extreme sea level events and coastal hazards (high confidence).

Observed Impacts on Ecosystems

A4. Cryosphere and associated hydrological changes have impacted terrestrial and freshwater species and ecosystems in high mountain and polar regions, through the appearance of land previously covered by ice, changes in snow cover, and thawing permafrost. These changes have contributed to changing the seasonal activities, abundance and distribution of ecologically, culturally, and economically important plant and animal species, ecological disturbances, and ecosystem functioning. (high confidence)

A5. Since about 1950 many marine species across various groups have undergone shifts in geographical range and seasonal activities in response to ocean warming, sea ice change and biogeochemical changes, such as oxygen loss, to their habitats (high confidence). This has resulted in shifts in species composition, abundance and biomass production of ecosystems, from the equator to the poles. Altered interactions between species have caused cascading impacts on ecosystem structure and functioning (medium confidence). In some marine ecosystems, species are impacted by both the effects of fishing and climate changes (medium confidence).

A6. Coastal ecosystems are affected by ocean warming, including intensified marine heatwaves, acidification, loss of oxygen, salinity intrusion and sea level rise, in combination with adverse effects from human activities on ocean and land (high confidence). Impacts are already observed on habitat area and biodiversity, as well as ecosystem functioning and services (high confidence).

Observed Impacts on People and Ecosystem Services

A7. Since the mid-20th century, the shrinking cryosphere in the Arctic and high-mountain areas has led to predominantly negative impacts on food security, water resources, water quality, livelihoods, health and wellbeing, infrastructure, transportation, tourism and recreation, as well as culture of human societies, particularly for Indigenous peoples (high confidence). Costs and benefits have been unequally distributed across populations and regions. Adaptation efforts have benefited from the inclusion of Indigenous knowledge and local knowledge (high confidence).

A8. Changes in the ocean have impacted marine ecosystems and ecosystem services with regionally diverse

outcomes, challenging their governance (high confidence). Both positive and negative impacts result for food security through fisheries (mediumconfidence), local cultures and livelihoods (medium confidence), and tourism and recreation (medium confidence). The impacts on ecosystem services have negative consequences for health and well-being (medium confidence), and for Indigenous peoples and local communities dependent on fisheries (high confidence).

A9. Coastal communities are exposed to multiple climate-related hazards, including tropical cyclones, extreme sea levels and flooding, marine heatwaves, sea ice loss, and permafrost thaw (high confidence). A diversity of responses has been implemented worldwide, mostly after extreme events, but also some in anticipation of future sea level rise, e.g., in the case of large infrastructure.

Section B. PROJECTED CHANGES AND RISKS

Projected Physical Changes

B1. Global-scale glacier mass loss, permafrost thaw, and decline in snow cover and Arctic sea ice extent are projected to continue in the near-term (2031–2050) due to surface air temperature increases (high confidence), with unavoidable consequences for river runoff, and local hazards (high confidence). The Greenland and Antarctic Ice Sheets are projected to lose mass at an increasing rate throughout the 21st century and beyond (high confidence). The rates and magnitudes of these cryospheric changes are projected to increase further in the second half of the 21st century in a high greenhouse gas emissions scenario (high confidence). Strong reductions in greenhouse gas emissions in the coming decades are projected to reduce further changes after 2050 (high confidence).

B2. Over the 21st century, the ocean is projected to transition to unprecedented conditions with increased temperatures (virtually certain), greater upper ocean stratification (very likely), further acidification (virtually certain), oxygen decline (medium confidence) and altered net primary production (low confidence). Marine heatwaves (very high confidence) and extreme El Niño and La Nina events (medium confidence) are projected to become more frequent. The Atlantic Meridional Overturning Circulation (AMOC) is projected to weaken (very likely). The rates and magnitudes of these changes will be smaller under scenarios with low greenhouse gas emissions (very likely).

B3. Sea level continues to rise at an increasing rate. Extreme sea level events that are historically rare (once per century in the recent past) are projected to occur frequently (once per year or more often at many locations) by 2050 in all RCP scenarios, especially in tropical regions (high confidence). The increasing frequency of high water levels can have severe impacts in many locations depending on exposure (high confidence). Sea level rise is projected to continue beyond 2100 in all RCP scenarios. For a high emissions scenario (RCP8.5), projections of global sea level rise by 2100 are larger than in AR5 due to a larger contribution from the Antarctic ice sheet (medium confidence). In coming centuries under RCP 8.5, sea-level rise is projected to exceed rates of several centimeters per year resulting in multi-metre rise (medium confidence), while for RCP2.6 sea level rise is projected to be limited to around 1m in 2300 (low confidence). Extreme sea levels and coastal hazards will be exacerbated by projected increases in tropical cyclone intensity and precipitation (high confidence). Projected changes in waves and tides vary locally in whether they simplify or ameliorate these hazards (medium confidence).

Projected Risks for Ecosystems

B4. Future land cryosphere changes will continue to alter terrestrial and freshwater ecosystems in high-mountain and polar regions with major shifts in species distributions resulting in changes in ecosystem structure and functioning, and eventual loss of globally unique biodiversity (medium confidence). Wildfire is projected to increase significantly for the rest of this century across most tundra and boreal regions, and also some mountain regions (medium confidence).

B5. A decrease in global biomass of marine animal communities, their production, and fisheries catch potential, and a shift in species composition are projected over the 21st century in ocean ecosystems from the surface to the deep seafloor under all emission scenarios (medium confidence). The rate and magnitude

of decline are projected to be highest in the tropics (high confidence), whereas impacts remain diverse in polar regions (medium confidence) and increase for high emission scenarios. Ocean acidification (medium confidence), oxygen loss (medium confidence) and reduced sea ice extent (medium confidence) as well as non-climatic human activities (medium confidence) have the potential to exacerbate these warming-induced ecosystem impacts.

B6. Risks of severe impacts on biodiversity, structure and function of coastal ecosystems are projected to be higher for elevated temperatures under high compared to low emissions scenarios in the 21st century and beyond. Projected ecosystem responses include losses of species habitat and diversity, and degradation of ecosystem functions. The capacity of organisms and ecosystems to adjust and adapt is higher at lower emissions scenarios (high confidence). For sensitive ecosystems such as seagrass meadows and kelp forests, high risks are projected if global warming exceeds 2℃ above pre-industrial temperature, combined with other climate-related hazards (high confidence). Warm- water corals are at high risk already and are projected to transition to very high risk even if global warming is limited to 1.5℃ (very high confidence).

Projected Risks for People and Ecosystem Services

B7. Future cryosphere changes on land are projected to affect water resources and their uses, such as hydropower (high confidence) and irrigated agriculture in and downstream of high-mountain areas (medium confidence), as well as livelihoods in the Arctic (medium confidence). Changes in floods, avalanches, landslides, and ground destabilization, are projected to increase risk for infrastructure, cultural, tourism, and recreational assets (medium confidence).

B8. Future shifts in fish distribution and decreases in their abundance and fisheries catch potential due to climate change are projected to affect income, livelihoods, and food security of marine resource-dependent communities (medium confidence). Long-term loss and degradation of marine ecosystems compromises the ocean's role in cultural, recreational, and intrinsic values important for human identity and wellbeing (medium confidence).

B9. Increased mean and extreme sea level, alongside ocean warming and acidification, are projected to exacerbate risks for human communities in low-lying coastal areas (high confidence). In Arctic human communities without rapid land uplift, and in urban atoll islands, risks are projected to be moderate to high even under a low emissions scenario (RCP2.6) (medium confidence), including reaching adaptation limits (high confidence). Under a high emissions scenario (RCP8.5), delta regions and resource rich coastal cities are projected to experience moderate to high risk levels after 2050 under current adaptation (medium confidence). Ambitious adaptation including transformative governance is expected to reduce risk (high confidence), but with context-specific benefits.

Section C. IMPLEMENTING RESPONSES TO OCEAN AND CRYOSPHERE CHANGE

Challenges

C1. Impacts of climate-related changes in the ocean and cryosphere increasingly challenge current governance efforts to develop and implement adaptation responses from local to global scales, and in some cases pushing them to their limits. People with the highest exposure and vulnerability are often those with lowest capacity to respond (high confidence).

Strengthening Response Options

C2. The far-reaching services and options provided by ocean and cryosphere-related ecosystems can be supported by protection, restoration, precautionary ecosystem-based management of renewable resource use, and the reduction of pollution and other stressors (high confidence). Integrated water management (medium confidence) and ecosystem-based adaptation (high confidence) approaches lower climate risks locally and provide multiple societal benefits. However, ecological, financial, institutional and governance constraints for such actions exist (high confidence), and in many contexts ecosystem-based adaptation will

only be effective under the lowest levels of warming (high confidence).

C3. Coastal communities face challenging choices in crafting context-specific and integrated responses to sea level rise that balance costs, benefits and trade-offs of available options and that can be adjusted over time (high confidence). All types of options, including protection, accommodation, ecosystem-based adaptation, coastal advance and retreat, wherever possible, can play important roles in such integrated responses (high confidence).

Enabling Conditions

C4. Enabling climate resilience and sustainable development depends critically on urgent and ambitious emissions reductions coupled with coordinated sustained and increasingly ambitious adaptation actions (very high confidence). Key enablers for implementing effective responses to climate-related changes in the ocean and cryosphere include intensifying cooperation and coordination among governing authorities across spatial scales and planning horizons. Education and climate literacy, monitoring and forecasting use of all available knowledge sources, sharing of data, information and knowledge, finance, addressing social vulnerability and equity, and institutional support are also essential. Such investments enable capacity-building, social learning, and participation in context-specific adaptation, as well as the negotiation of trade-offs and realisation of co-benefits in reducing short-term risks and building long-term resilience and sustainability. (high confidence) This report reflects the state of science for ocean and cryosphere for low levels of global warming (1.5℃), as also assessed in earlier IPCC and IPBES reports.

G20 Osaka Leaders' Declaration (excerpt)

PREAMBLE

1. We, the Leaders of the G20, met in Osaka, Japan on 28-29 June 2019 to make united efforts to address major global economic challenges. We will work together to foster global economic growth, while harnessing the power of technological innovation, in particular digitalization, and its application for the benefit of all.
2. Building on work done by previous presidencies, we will strive to create a virtuous cycle of growth by addressing inequalities and realize a society where all individuals can make use of their full potential. We are resolved to build a society capable of seizing opportunities, and tackling economic, social and environmental challenges, presented today and in the future, including those of demographic change.
3. We will further lead efforts to foster development and address other global challenges to pave the way toward an inclusive and sustainable world, as envisioned in the 2030 Agenda for Sustainable Development.

Global Environmental Issues and Challenges

34. Noting the important work of the International Panel on Climate Change (IPCC) and Intergovernmental Science-policy Platform on Biodiversity and Ecosystem Sources (IPBES), and in the light of recent extreme weather events and disasters, we recognize the urgent need for addressing complex and pressing global issues and challenges, including climate change, resource efficiency, air, land, fresh water and marine pollution, including marine plastic litter, biodiversity loss, sustainable consumption and production, urban environmental quality and other environmental issues, and for promoting and leading energy transitions, with the best available science, while promoting sustainable growth. A paradigm shift is needed where the virtuous cycle of environment and growth is accelerated through innovations, and with business communities playing an important role, in synergy with the public sector. To this end we stress the importance of accelerating the virtuous cycle and leading transformations to a resilient, inclusive, and sustainable future. We emphasize the importance of taking concrete and practical actions and collecting international best practices and wisdom from around the world, mobilizing public and private finance, technology and investment and improving business environments.

Climate Change

35. To this end, we strive to foster inclusive finance for sustainable development, including public and private financing mobilization and alignment between them, as well as innovation in a wide range of areas for low emissions and resilient development. Climate actions at all levels with broad participation, including by nonstate actors, will be the key to realizing such a paradigm shift. In further enhancing this effort, as appropriate to each country's circumstances, we will look into a wide range of clean technologies and approaches, including smart cities, ecosystem and community based approaches, nature based solutions and traditional and indigenous knowledge. We need to enhance efforts to support actions and cooperation in adaptation and disaster risk reduction, in particular, for the most vulnerable communities, and to elaborate further and foster coherence between mitigation action, adaptation measures, environmental protection, and resilient infrastructure. We note the successful adoption of the implementation guidelines for the Paris Agreement and the completion of the stocktaking of the Talanoa Dialogue at the United Nations Framework Convention on Climate Change Conference of Parties (UNFCCC COP) 24 and the outcomes of the meeting of G20 energy and environment ministers in Karuizawa, subsequent to the successful G20 Buenos Aires Summit. We are determined to make best use of this momentum, and thus look forward to a successful Climate Action Summit of the UN Secretary-General and concrete outcomes at UNFCCC COP 25 in Santiago, Chile. Signatories to the Paris Agreement who confirmed at Buenos Aires its irreversibility and are determined to implement it, reaffirm their commitment to its full implementation, reflecting common but differentiated responsibilities and respective capabilities, in the light of different national circumstances. By 2020 we aim to communicate, update or maintain our NDCs, taking into account that further global efforts are needed. We emphasize the importance of providing financial resources to assist developing countries with respect to both mitigation and adaptation in accordance with the Paris Agreement.

36. The United States reiterates its decision to withdraw from the Paris Agreement because it disadvantages American workers and taxpayers. The U.S. reaffirms its strong commitment to promoting economic growth, energy security and access, and environmental protection. The U.S.'s balanced approach to energy and environment allows for the delivery of affordable, reliable, and secure energy to all its citizens while utilizing all energy sources and technologies, including clean and advanced fossil fuels and technologies, renewables, and civil nuclear power, while also reducing emissions and promoting economic growth. The United States is a world leader in reducing emissions. U.S. energy-related CO_2 emissions fell by 14% between 2005 and 2017 even as its economy grew by 19.4% largely due to the development and deployment of innovative energy technologies. The United States remains committed to the development and deployment of advanced technologies to continue to reduce emissions and provide for a cleaner environment.

Energy

37. We acknowledge the importance of energy transitions that realize the "3E＋S" (Energy Security, Economic Efficiency, and Environment ＋ Safety) in order to transform our energy systems into affordable, reliable, sustainable and low GHG emissions systems as soon as possible, recognizing that there are different possible national paths to achieve this goal. Recalling the G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth Communique, we acknowledge the role of all energy sources and technologies in the energy mix and different possible national paths to achieve cleaner energy systems. We also recognize opportunities offered by further development of innovative, clean and efficient technologies for energy transitions, including hydrogen as well as, depending on national circumstances, the Carbon Capture, Utilization and Storage (CCUS) taking note of work on "Carbon Recycling" and "Emissions to Value". We acknowledge the G20 Japanese Presidency's initiative called Research and Development 20 for clean energy technologies ("RD20"). In light of recent events highlighting concern about safe flow of energy, we acknowledge the importance of global energy security as one of the guiding principles for the transformation of energy systems, including resilience, safety and development of infrastructure and undisrupted flow of energy from various sources, suppliers, and routes. We recognize the value of international cooperation on a wide range of energy-related issues including energy access, affordability and energy efficiency, and energy storage. We reaffirm our joint commitment on medium term rationalization and phasing-out of Inefficient Fossil Fuel Subsidies that encourage wasteful consumption, while providing targeted support for the poorest.

Environment

38. We recognize that improving resource efficiency through policies and approaches, such as circular economy, sustainable materials management, the 3Rs (reduce, reuse, recycle) and waste to value, contributes to the SDGs, as well as to addressing a wide range of environmental challenges, enhancing competitiveness and economic growth, managing resources sustainably, and creating jobs. We encourage work with the private sector towards innovation in the cooling sector. We will also work with stakeholders in order to increase the demand for recycled products. We look forward to the development of a roadmap of the G20 Resource Efficiency Dialogue under the Japanese Presidency.

39. We reiterate that measures to address marine litter, especially marine plastic litter and microplastics, need to be taken nationally and internationally by all countries in partnership with relevant stakeholders. In this regard, we are determined to swiftly take appropriate national actions for the prevention and significant reduction of discharges of plastic litter and microplastics to the oceans. Furthermore, looking ahead beyond those initiatives and existing actions by each member, we share, and call on other members of the international community to also share, as a common global vision, the "Osaka Blue Ocean Vision" that we aim to reduce additional pollution by marine plastic litter to zero by 2050 through a comprehensive life-cycle approach that includes reducing the discharge of mismanaged plastic litter by improved waste management and innovative solutions while recognizing the important role of plastics for society. We also endorse the G20 Implementation Framework for Actions on Marine Plastic Litter.

40. As illegal, unreported, and unregulated (IUU) fishing remains in many parts of the world a serious threat to the sustainability of the ocean, we recognize the importance of addressing IUU fishing for ensuring the sustainable use of marine resources and conserving the marine environment including biodiversity, and reaffirm our commitment to end IUU fishing.

Displacement and Migration

41. We note the 2019 Annual International Migration and Displacement Trends and Policies Report to the G 20 prepared by the OECD in cooperation with ILO, International Organization for Migration (IOM) and United Nations High Commissioner for Refugees (UNHCR). We will continue the dialogue on the various dimensions of these issues in the G20.

42. Large movements of refugees are a global concern with humanitarian, political, social and economic consequences. We emphasize the importance of shared actions to address the root causes of displacement and to respond to growing humanitarian needs.

43. We thank Japan for its Presidency and for hosting a successful Osaka Summit and its contribution to the G20 process, and we look forward to meeting again in Saudi Arabia in 2020, in Italy in 2021 and in India in 2022.

ANNEX

Ministerial Declarations and Communiqués

1. G20 Agriculture Ministers' Declaration 2019 (11–12 May)
2. G20 Ministerial Statement on Trade and Digital Economy (8–9 June)
3. Communiqué G20 Finance Ministers & Central Banks Governors Meeting (8–9 June)
4. Communiqué G20 Ministerial Meeting on Energy Transitions and Global Environment for Sustainable Growth (15–16 June)

G20 Working Groups and Other Documents

1. G20 Principles for Quality Infrastructure Investment
2. Programme of Work to Develop a Consensus Solution to the Tax Challenges Arising from the Digitalization of the Economy
3. G20 Fukuoka Policy Priorities on Aging and Financial Inclusion
4. Proposed Global Partnership for Financial Inclusion (GPFI) Work Program
5. G20 Shared Understanding on the Importance of UHC Financing in Developing Countries
6. G20 Compendium of Good Practices for Promoting Integrity and Transparency in Infrastructure Development
7. G20 High Level Principles for Effective Protection of Whistleblowers
8. G20 AI Principles
9. Women at Work in G20 countries: Progress and policy action
10. G20 Initiative on Human Capital Investment for Sustainable Development
11. Osaka Update on the G20 Action Plan on the 2030 Agenda for Sustainable Development
12. Guiding Principles for the Development of Science, Technology, and Innovation for SDGs Roadmaps
13. Osaka Comprehensive Accountability Report on G20 Development Commitments
14. G20 Implementation Framework for Actions on Marine Plastic Litter
15. G20 Action Agenda on Adaption and Resilient Infrastructure
16. G20 Karuizawa Innovation Action Plan on Energy Transitions and Global Environment for Sustainable Growth

G20 Implementation Framework for Actions on Marine Plastic Litter PREAMBLE

We, the G20 members, recognize the increasing urgency to tackle the issue of marine litter, especially marine plastic litter and microplastics, on a global scale, further building on existing efforts. In this regard, we acknowledge the United Nations Environment Assembly (UNEA) resolutions 4/7 on Marine plastic litter and microplastics and 4/10 on Addressing single-use plastic products pollution, and note the decision at the 14th meeting of the Conference of the Parties to the Basel Convention to include plastic waste under the convention.

As the "G20 Action Plan on Marine Litter" adopted at the G20 Hamburg Summit in 2017 laid the foundation for the G20 members to address marine litter, this "G20 Implementation Framework for Actions on Marine Plastics Litter" is to facilitate further concrete actions on marine litter, especially marine plastic litter and microplastics, in line with the G20 Action Plan on Marine Litter, while taking into account our own appropriate policies, approaches and national circumstances, on a voluntary basis. This framework is expected to complement the work of the UNEP.

I. Facilitation of Effective Implementation of the Action Plan

We will facilitate effective implementation of the G20 Action Plan on Marine Litter through encouraging voluntary actions by the G20 members in accordance with national policies, approaches and circumstances, and their information sharing and continued updating as follows:

1. Implementation of actions

- Facilitate the implementation of the G20 members' actions in line with the G20 Action Plan on Marine Litter, based on respective national policies, approaches and circumstances, and in collaboration with Regional Seas Conventions and other relavant organizations and instruments.
- Promote a comprehensive life-cycle approach to urgently and effectively prevent and reduce plastic litter discharge to the oceans, in particular from land-based sources, through measures, inter alia, environmentally sound waste management, environmentally sound clean-up of marine plastic litter, deployment of innovative solutions, and international cooperation to enhance national capacities, as well as prevention and reduction of plastic waste generation and littering, promotion of sustainable consumption and production, including but not limited to promoting resource efficiency, circular economy, sustainable materials management, waste to value approach, and measures to address sea-based sources.

2. Information sharing and continued updating

- Share and update information on relevant policies, plans, and measures taken/to be taken in line with the G20 Action Plan on Marine Litter on a voluntary basis and promote policies and measures by peer learning from best practices, utilizing opportunities to co-organize with relevant meetings, inter alia, the G20 Resource Efficiency Dialogue and the multi-stakeholder platform to be established under the UNEP, which will be decided by G20 presidencies.
- The information to be shared may include effective measures to prevent and reduce plastic litter discharge to the oceans and their achievements and challenges1 where applicable and available. - Utilize the opportunity of the G20 Resource Efficiency Dialogue during the Japanese Presidency for the first information sharing, and make a portal site available with the support of the Government of Japan for efficient information sharing and updating, and possible outreach.

II. Collaborative Actions and Outreach of Implementation of the Action Plan

In addition to Section I, we will engage in collaborative actions among the G20 members and outreach activities beyond the G20, cooperating with and supported by relevant international and regional organizations and initiatives, while maximizing synergies and avoiding duplication of work, particularly with the work of the UNEP, as follows:

1. Promotion of international cooperation

- 1 Relevant indicators, data or other numerical information can be also included at the discretion of each G20 member, for example: the amount of wastes generated, reused, collected, recycled, and

properly disposed of ; the amount of marine litter cleaned up ; the scale of use of innovative technologies and materials including R&D investment ; the scale and/or effect of assistance for countries that need technical capacity development including the increased amount of wastes properly disposed of (encouraged to indicate the proportion/elements of plastic waste and/or microplastics, if available)

- Engage in international and regional cooperation and share best practices through relevant instruments, initiatives and programs. Emphasis should be placed on regional cooperation in collaboration with relevant Regional Seas Programs, Regional Fisheries Management Organizations and other regional initiatives, as appropriate.
- Promote cooperation among the G20 members and with other partners to empower governments, communities, and the private sector to advance measures mentioned in Section I. 1 including through technical assistance for those who need technical capacity development. - Invite relevant international organizations to develop policy tools/options such as best practice guidance for capacity development and infrastructure investment through, inter-alia, public-private partnership to remove barriers to private financing, in cooperation with the G20 members.

2. Promotion of innovative solutions

- Enhance collaboration internationally to advance innovative solutions such as for product design, resource efficient and circular approaches, waste management practice and technologies, waste water treatment technologies, environmentally sound products, taking into account their contribution to marine pollution and full life-cycle environmental impact, in cooperation with existing international fora and initiatives, including but not limited to the World Circular Economy Forum, the Platform for Accelerating the Circular Economy, the G20 Resource Efficiency Dialogue, and the G7 Innovation Challenge to Address Marine Plastic Litter. Encourage relevant actors to take a life-cycle approach in the development and market penetration of innovative solutions to reduce the negative environmental, economic and social impacts.
- Encourage voluntary activities by the private sector internationally on the advancement of innovative solutions including environmentally sound product design, resourceefficient business models, and value retention practices. Explore ways to support and further facilitate such activities, including through holding relevant workshops in collaboration with business communities.

3. Sharing scientific information and knowledge

- Encourage the ongoing work of GESAMP (Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection) to strengthen scientific foundations and build scientific capacity including by promoting and piloting harmonized/comparable monitoring and analytical methodologies for measuring and monitoring marine litter, especially marine plastic litter and microplastics and their impact.
- Encourage the development of global-scale monitoring of marine litter, especially marine plastic litter and microplastics, using harmonized methodologies in cooperation with Regional Seas Conventions and Programmes, the IOC-UNESCO, the UNEP and other relevant organizations and initiatives.
- Encourage scientific communities and relevant experts to explore ways to identify and estimate the sources, pathways and fate of plastic waste leakage toward the development of global land and sea-based source inventories, including by holding relevant workshops, and contribute to the scientific and technological work of the UNEP, while noting that single-use plastics and fishing gears are reported to constitute significant sources.
- Encourage international coordination on scientific research, including socio-economic research and research on microplastics including nanoplastics, and the sharing of scientific knowledge such as the impacts of plastic pollution on human health, marine biodiversity and ecosystems.

4. Multi-stakeholder involvement and awareness raising

- Collaborate and cooperate with, and empower non-G20 countries, local governments, the private sector, civil society organizations, NGOs, and academia to work in a multisector manner and invite them to take actions in line with this framework, including in collaboration with partnerships or networks focused on global marine litter issues.
- Raise awareness globally on the importance of, among others, urgent and effective actions at all levels to prevent and reduce plastic litter discharge to the oceans, as well as sustainable consumption and production, including but not limited to promoting resource efficiency, circular economy, sustainable materials management, and waste to value, by utilizing opportunities such as the “World Environmental Day,” the “World Oceans Day,” and related national awareness days.

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