

Transcript of Natural Science Lecture on "Transforming our society facing the changing sea - Microplastics in the ocean -" organised by *Maison franco-japonaise* and Japanese-French Oceanographic Society of Japan on 23 October 2021

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Abstract: Japanese-French Oceanographic Society of Japan had planned to hold the 18th Japanese-French Oceanography Symposium in 2020 to celebrate its 60th anniversary. However, this was postponed due to the COVID-19 pandemic. In 2021 a web-based symposium was available, and the 18th Japanese-French Oceanography Symposium was held between 19–23 October 2021. In order to disseminate the results obtained by the exchanges between French and Japanese researchers working on oceanography and fisheries science at this symposium to the public, *Maison franco-japonaise* and Japanese-French Oceanographic Society of Japan organised a public symposium on the theme of "Transforming our society facing the changing sea - Microplastics in the ocean -" with the co-organiser the *Société franco-japonaise des Techniques Industrielles* (SFJTI) as the Natural Science Lecture Series of *Maison franco-japonaise* on 23 October 2021. This paper outlines the reasons for choosing this theme for the lecture, the basic knowledge of the microplastics issue and the summary of each presentation. Presenters were Dr François Galgani of Ifremer, Dr Katsunori Fujikura of JASMTEC, Dr Sylvain Agostini University of Tsukuba, Ms Cristina Barreau of Surfrider Foundation Europe, two high school students and Teacher Mr Takashi Inoue of Sanyo Gakuen Juniro and Senior High School and Professor Tadahisa Iwata of SFJTI/the University of Tokyo.

Keywords : *social transformation, microplastics, 60th anniversary of Japanese-French Oceanographic Society of Japan, Decade of Ocean Science*

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1. The 60th anniversary symposium of the Japanese-French Oceanographic Society

The Japanese-French Oceanographic Society was founded in April 1960. In 1984, a sister society on the French side was established, the Japanese-French Oceanographic Society France, at the instigation of Hubert-Jean Ceccaldi, Professor at *Ecole pratique des hautes Etudes* and then French President of the *Maison franco-*

japonaise. Since 1984, the two Japanese-French Oceanographic Societies have organised Japanese-French Oceanography Symposium, in principle, at intervals of one to three years, alternating between Japan and France. The 18th Japanese-French Oceanography Symposium was planned to be held in Tokyo in 2020, the 60th anniversary of the founding of the Japanese-French Oceanographic Society of Japan. However, it was postponed due to the COVID-19 pandemic, and the symposium was held from 18 to 23 October 2021 using the web, with the support of the *Maison franco-japonaise*, the French Research Institute on Japan at *Maison franco-japonaise (L'Institut français de Recherche sur le Japon à la Maison franco-japonaise)*, Japanese-French Oceanographic Society of France, Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), Japan, Science and Technology Department, Embassy of France in Japan, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), The Japanese Society of Fisheries Science, The Japanese Society of Fisheries Oceanography, The Oceanographic Society of Japan, Japanese National Committee for the UN Decade of Ocean Science for Sustainable Development and the *Fondation Sasakawa franco-japonaise*.

The symposium organising committee discussed the theme of the 18th Japanese-French Oceanography Symposium. The symposium organising committee then turned its attention to the declaration of the 72nd UN General Assembly in 2017 on the UN Decade of Ocean Science for Sustainable Development (2021–2030) ("the Decade of Ocean Sciences") in its comprehensive resolution on the ocean (Fig. 1). This Decade of Ocean Science states that a special international focus will be placed on achieving the Sustainable Development Goals, in particular SDG 14, and other ocean-related goals

for the decade 2021–2030. The UN Decade of Ocean Science has seven goals, or "seven oceans", as societal outcomes. One of these is a "clean ocean" in which pollution sources are identified, reduced, and eliminated (Fig. 1 below).

Today's oceans are facing changes in the marine environment due to global warming, plastics from land-based sources entering the oceans through rivers and small plastic fragments entering the marine food chain, and anthropogenic impacts such as land reclamation, pollution and eutrophication of the oceans. In order to realise and keep a marine environment of sustainable, rich and clean oceans, human society must change its ways. Therefore, the theme of the 18th Japanese-French Oceanography Symposium was set as "Oceanography for future we want: transformation of our society in the changing sea" and the symposium was positioned as part of the United Nations Decade of Ocean Science, which will begin in 2021. An application was submitted to the Japanese National Committee of the UN Decade of Marine Science for the 18th Japanese-French Oceanography Symposium as an activity of the UN Decade of Ocean Science, which was officially approved.

The symposium consisted of a web-based poster session from 18–21 October 2022 and a core-time discussion between presenters, a web-based mini-symposium with participants on 21 October, with four research presentations each by Japanese and French researchers on the web on 19 October 2022 and the commemorated symposium "60 years of Japanese-French cooperation in oceanography" organised by the Japanese-French Oceanographic Societies of Japan and France, the *Maison franco-japonaise* and the French Institute for Research on Japan at the *Maison franco-japonaise* on 20 October 2022. In order to disseminate the results of the 18th



Fig. 1 Logo for the UN Decade of Ocean Science (top: source <https://www.oceandecade.org/ja/>) and the seven societal goals (bottom left) and ten challenges (bottom right) (see below: https://www.spf.org/opri/newsletter/500_1.html?latest=1)

Japanese-French Oceanography Symposium to the public on the final day on 23 October 2021, the organising committee consulted with Professor Atsushi Miura, Chairperson of the Scientific and Cultural Committee of the *Maison franco-japonaise*, Professor Sunao Sawada, Vice Chairperson of the same committee, and other people. As a result, it was decided that on 23 October 2022, as part of the Natural Science Lecture Series organised by the *Maison franco-japonaise*, the *Maison franco-japonaise* and the Japanese-French Oceanographic Society of Japan presented the results of the academic

exchanges at the Japanese-French Oceanography Symposium to the public.

2. SDG 14 and marine microplastics

Each SDG has several targets: target 14.1 of SDG 14 is "By 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution." (Fig. 2). In addition, a large proportion of marine litter is plastic. Target 14.1, mentioned above, has global indicators, which raise (a) indicators of coastal eutrophication and (b) the density of plastic litter,

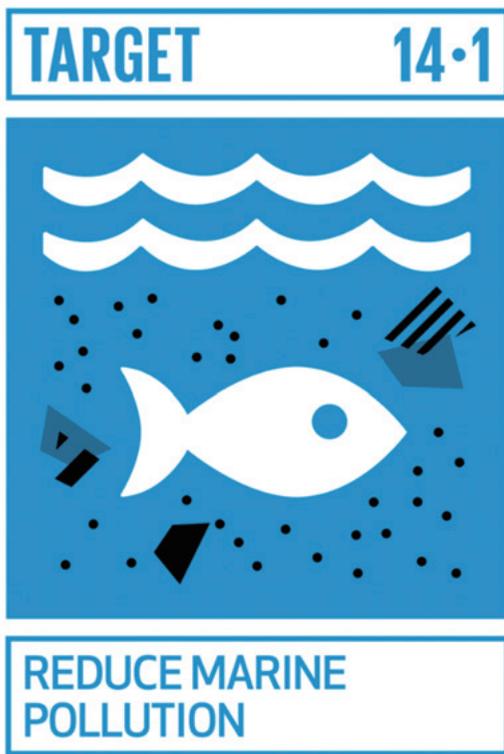


Fig. 2 English logo for Target 14.1 of SDG 14 (source: <https://www.future-creation-support.com/2017/05/29/sdgs-goal14/>)

making marine plastics an important topic (<https://unstats.un.org/sdgs/metadata/files/Metadata-14-01-01.pdf> accessed on 10 February 2022). Plastic is a general term for natural and synthetic resins among organic polymeric materials, which are mainly made from petroleum, show viscous fluidity when heated and can be moulded into a predetermined shape. They are not decomposed by micro-organisms, are stable in air and water, do not decompose or dissolve, and are lightweight. This makes them very convenient for human life. Since the 1970s, the mass consumption of plastics on land has rapidly increased and much of the plastics used has reached the sea. However, most of the plastics



Fig. 3 Microplastics (Source: <https://www.wbsj.org/activity/conservation/law/plastic-pollution/article/2021-05-06/>)

that reach the sea does not return from the sea to land.

Plastics are broken down into smaller pieces by ultraviolet radiation, heat and waves, but it is not easily decomposed by micro-organisms. Therefore, they do not enter the material cycle of bio-elements such as carbon, phosphorus, nitrogen and other elements that make up the bodies of living organisms and remains in the ocean in the form of microplastics. Microplastics are defined as plastics with a diameter of 5 mm or less (Fig. 3). Furthermore, when microplastics are further fragmented, they become nanoplastics ($< 1 \mu\text{m}$). Although it has become clear that nanoplastics are diffusing into the atmosphere as well as the oceans and that their extremely small nature allows them to pass through cell membranes and enter living tissues and organs, little is known about their danger to humans. This is mainly due to the fact that they

are too small to be easily measured.

Various chemical substances are originally added to plastics when they are manufactured and processed, such as dyeing agents, flame retardants for fire prevention, plasticisers for softening and UV absorbers to give them the properties required for their intended use. These chemicals are referred to as "additives". Additives, together with their degradation products they produce, contain many substances that are harmful to the human body. For example, bisphenol A (BPA), which is used as a raw material for polycarbonate, and phthalic acid additives used as plasticisers have endocrine-disrupting effects (also called environmental hormones) that can cause cancer and impair reproductive functions even at low concentrations and are harmful persistent organic pollutants (POPs). Polybrominated diphenyl ethers (PBDEs), brominated flame retardants used as flame retardants, are also well known as one of the POPs and are thyroid disruptors and neurotoxic. The degree to which additives leach in the ocean depends on the additive's molecular weight and instability, environmental conditions such as pH and temperature, and the permeability of the plastic polymer. If the additive is highly hydrophobic, it will stay in the plastic without leaching much and move with the plastic. As plastics are highly hydrophobic, they attract various types of lipophilic and persistent organic pollutants in seawater and adsorb them onto the plastic. For example, POPs, which are toxic and harmful chemicals such as DDT and PCBs, are accumulated in the animal's body as lipoidal materials once eaten by animals. In other words, although the plastics themselves may be discharged from animal bodies, the chemical components adsorbed on them are absorbed and accumulated in the bodies of animals that eat the plastics. Furthermore, POPs are thought to be

concentrated and accumulated in fish and shellfish through the food chain and taken up by the human body that eats them (Fig. 4). At moment, there may be little to concern, but if plastic pollution progresses further, it is feared that it will have a negative impact on marine ecosystems and human health. We are currently faced with oceans that are becoming increasingly polluted with microplastics, and we need to change the way our society works to overcome this problem.

The Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), an independent group of scientific experts advising the UN system on the scientific aspects of marine environmental protection, has developed a new programme on microplastics with a review aimed at comprehensively mapping existing knowledge, aligning it according to guidelines and identifying the extent to which research has not been carried out on marine microplastics and chemical components related to the microplastics. A workshop organized by United Nations Educational, Scientific and Cultural Organization-Intergovernmental Oceanographic Commission (IOC) in Paris in June 2010 brought together experts from industry, academia, NGOs and policymakers to examine plastic particles as a persistent, bioaccumulative and toxic transport vector in the ocean. In 2012, GESAMP created Working Group 40 (WG40), a working group to study 'Sources, dynamics and impacts of plastics and microplastics in the marine environment'. Dr François Galgani, Director of the Corsica branch of the French Research Institute for Exploitation of the Sea (Ifremer), a member of the Japanese-French Oceanographic Society of France, has been working on this issue from the beginning and is the co-chair for microplastics of the third phase of WG40, which began in 2018. Another major

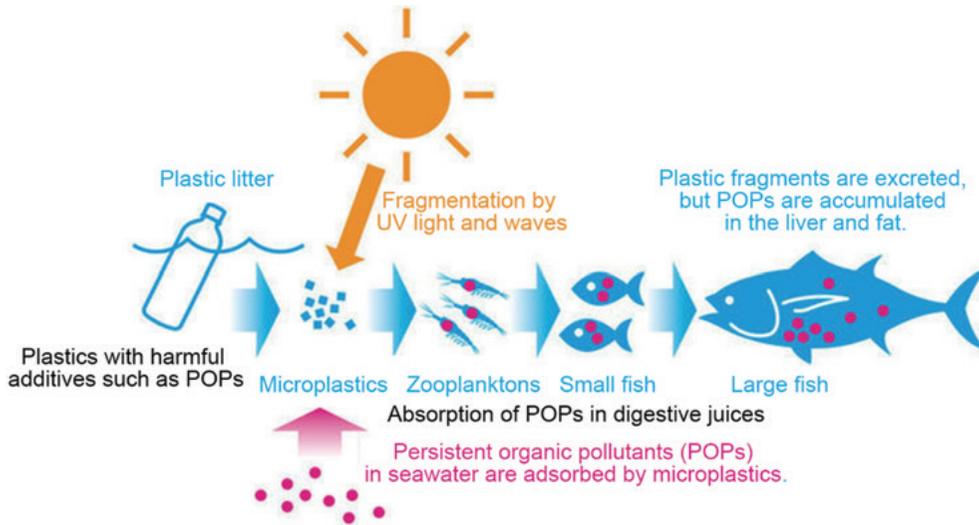


Fig. 4 Plastics with harmful additives become microplastics and absorb harmful persistent organic pollutants (POPs) in the sea. Zooplanktons mistake microplastics for food, eat them to take up the POPs. Zooplanktons are eaten by small fish. Larger fish eat the small fish that have accumulated POPs to accumulate higher concentrations of POPs (Figure from the Ocean Sweep Association: <https://www.atpress.ne.jp/news/277287>, partly modified).

motivation for organising this symposium was the fact that several core members of the Japanese-French Oceanographic Society conduct research on marine microplastics and are key researchers in this field in Japan.

Countries have national borders, and oceans have exclusive economic zones and territorial waters. However, as air and sea water move across national borders, the problem of marine plastics in seawater or floating on the sea surface cannot be dealt with by one country alone but must be solved through cooperation between countries that share a common destiny. Therefore, in consultation with Professor Tatsuya Maruyama, a member of the Scientific and Cultural Committee of the *Maison franco-japonaise*, and Professor Mitsuru Yamazaki, an associate member of the same committee, we decided to invite people who are researching microplastics in Japan and France to give pre-

sentations and discuss the issue of microplastics in the ocean together with the symposium participants. The theme of this Japanese-French Science Lecture was decided as "Transforming our society facing the changing sea - Microplastics in the ocean -" organised by the *Maison franco-japonaise* and the Japanese-French Oceanographic Society of Japan and co-organised by the Japanese-French Society of Industrial Techniques.

3. Structure of the symposium

The presentation (Table 1) featured a keynote address by Dr François Galgani of Ifremer, one of the first researchers in the world to address this issue. For the content, see Dr Galgani's article in this issue. The pictures of plastic waste accumulating on the beautiful Mediterranean seabed were shocking. Next, Dr Katsunori Fujikura of the Japan Agency for Marine-Earth

Table 1 Programme of the Japanese-French Science Lecture on "Transforming our society facing the changing sea - Microplastics in the ocean -" on 23 October 2021.

(14 : 45–15 : 00)	Zoom connection test	Secretariat
15 : 00–15 : 05	Introduction	President Professor Teruhisa Komatsu (SFJO Japan)
15 : 05–15 : 35	Oceans of plastics	Dr François Galgani (Ifremer Bastia)
15 : 35–16 : 05	Approaching of the missing plastics	Dr Katsunori Fujikura (JAMSETC)
16 : 05–16 : 35	Tara Jambio Mission Microplastics: science, education, art and sharing	Dr Sylvain Agostini (Shimoda Marine Research Centre, University of Tsukuba)
16 : 35–17 : 05	The fight against microplastic pollution of the ocean: from citizen action to the development of standards	Mme Cristina Barreau (Surfrider Foundation Europe)
17 : 05–17 : 35	Towards a solution to the marine litter problem in the Seto Inland Sea: Practical steps to make the problem a "Personal matter"	Mr Takashi Inoue, teacher (adviser) and two students (Sanyo Gakuen Junior & Senior High School Geography and History Club)
17 : 35–18 : 05	Development of plastics that degrade in the ocean and future prospects	President Professor Tadahisa Iwata (Japanese-French Society of Industrial Techniques/the University of Tokyo)
18 : 05–18 : 35	General discussion	Moderator Professor Mitsuru Yamazaki (Academic and Cultural Projects Committee, <i>Maison franco-japonaise</i>)
18 : 35–18 : 40	Closing remarks	President Professor Teruhisa Komatsu (SFJO Japan)

Science and Technology (JAMSTEC), who is working to find out the whereabouts of plastics in the sea, explained the current situation. The samples analysed included microplastic samples collected by Mr Kojiro Shiraiishi, a Japanese yachtsman who participated in the Vendée Globe, a solo, port-free, round-the-world yacht race from 8 November 2020, in a location that is not normally open to observation. Assistant Professor Sylvain Agostini of Shimoda Marine Research Centre, University of Tsukuba, is a leader of the project of the Japanese Association of Marine Biology (JAMBIO), a network of Japanese coastal experimental stations belonging to universities supported by the Tara Ocean Foundation surveying the distribution of microplastics around the stations and raises awareness of the public. He presented the surveys on

microplastics and awareness-raising activities for the public through artistic activities and public participation events. One unique activity is through the art, in which students at Tokyo University of the Arts also participated. Ms Cristina Barreau of Surfrider Foundation Europe working to raise awareness of the plastics problem and change environmental policy in Europe and France presented how important public participation and political commitment is to solve the problem of marine plastics. She gave examples of concrete activities and results in Europe. Symposium participants recognised that environmental activities in Japan also need to be committed to the policy-making process. A presentation was given by two second-year high school students from the Geography and History Club of Sanyo Gakuen Junior and Senior High

School and their advisor, Teacher Mr Takashi Inoue, on the efforts of the club to study plastic waste collected by trawl nets and washed up on island beaches in the Seto Inland Sea, and to raise public awareness of the need to keep plastic out of the environment. Unique initiatives included efforts to show the relationship between the lives of people living in the town and plastics collected from the sea at a product display in a shopping centre so that people who are not interested in environmental issues can understand the relationship, and activities to find out where plastic waste can be found in the town. Finally, Professor Tadahisa Iwata, President of *Société franco-japonaise des Techniques industrielles* (SFJTI: the Japanese-French Society of Industrial Techniques), who is researching bioplastics that degrade in the sea at the University of Tokyo, introduced the current status of his research and future prospects, focusing on his own research results. There was also an interesting report on how biodegradable plastics actually change in the deep sea. Based on these reports, a lively discussion was held on how we can overcome the microplastic problem and survive if we change our society, in a general debate chaired by Professor Mitsuru Yamazaki, a member of the Scientific and Cultural Projects Committee. One notable outcome was the large number of high school students and their teachers who attended the event as a result of an appeal to many high schools by Professor Mitsuru Yamazaki. These are the people who will be responsible for the SDG issues in the future, or the teachers who will educate such students, and it can be said that this symposium led to the development of the core members of the next generation who will achieve the SDGs.

4. Epilogue

A student from the Sanyo Gakuen Senior High School Geography and History Club, who attended the symposium, suggested that they would like to exchange their experiences on activities concerning plastics with high school students in France who are working on the marine plastic issue. Members of the Japanese-French Oceanographic Society of France searched for a high school in France that was engaged in such activities, and found that students at *Paul Bousquet - Lycée de la mer* (Paul Bousquet Marine High School) in Sète on Étang de Thau, a brackish lake in the Mediterranean Sea, were working to solve the marine plastic problem. The Japanese-French Oceanographic Societies of Japan and France are currently building bridges with the supervisory teachers of the two high schools. If the exchange between the two schools progresses, the two Japanese-French Oceanographic Societies of France and Japan are considering that two high school students present the results of the exchange at the 19th Japanese-French Oceanography Symposium scheduled for 23-27 October 2023 in Caen, Normandy. It is a great achievement that this symposium has paved the way for the next generation of Japanese-French exchanges towards the implementation of SDG 14. In the future, the Japanese-French Oceanographic Society of Japan hopes to continue to work together with the *Maison franco-japonaise* towards the implementation of the SDGs.

Acknowledgements

We were not able to bring everyone together at the *Maison franco-japonaise* in Tokyo for this symposium as everyone had wanted. However, about 100 participants from France and Japan were connected via the web. This symposium could not have been possible without the

cooperation and support of many parties, especially the *Maison franco-japonaise*. I would like to express my deepest gratitude to the members of the Scientific and Cultural Committee of the *Maison franco-japonaise* for their efforts in making this symposium possible, in particular to Professor Atsushi Miura, Chair, Professor Sunao Sawada, Vice Chair, Professor Tatsuya Maruyama, Professor Mitsuru Yamazaki and Ms Eriko Takeda and Ms Nami Aosawa in charge of projects at the Secretariat. I would also like to thank the simultaneous interpreters and Ms Tomoko Honda of the Secretariat of the Japanese-French Oceanographic Society of Japan for their great help in organising the symposium smoothly. I would like to thank them here. We also acknowledge to the Japanese-French Society of Industrial Techniques for co-hosting the symposium, and Dr Kazufumi Takayanagi, Professor Yuji Tanaka, Professor Yasuyuki Koike and Ms Tomoko Honda, Secretary of the Japanese-French Society of Oceanography of Japan, for their comments on the manuscript. Finally, I sincerely thank to the supports of Japanese-French Oceanographic Society of France, Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT), Japan, Science and Technology Department, Embassy of France in Japan, Japan Agency for Marine-Earth Science and Technology (JAMSTEC), The Japanese Society of Fisheries Science, The Japanese Society of Fisheries Oceanography, The Oceanographic Society of Japan, Japanese National Committee for the UN Decade of Ocean Science for Sustainable Development and the *Fondation Sasakawa franco-Japonaise*. Without the supports, the symposium was not able to be realised.

Appendix

The followings are the abstracts of Natural Science Lecture on "Transforming our society facing the changing sea - Microplastics in the ocean -" organised by *Maison franco-japonaise* and Japanese-French Oceanographic Society of Japan on 23 October 2021 are listed below. Appendix 1 and 2 are abstracts in French and Japanese, respectively.

