Urgent Proposal on the Discharge of ALPS Treated Water: An Analysis Based on Scenario Planning

Fukushima Daiichi Nuclear Power Plant crammed with tanks containing treated water [(C) Maxar Technologies, Inc.] (November 2020)

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Introduction

As a think tank in maritime country Japan, the Sasakawa Peace Foundation (SPF) set up the Ocean Policy Research Institute (OPRI) to contribute to the solution of various issues concerning the ocean and propose feasible policies to serve as reference for policymakers in the international community. It also set up the Security Studies Program, which engages in research activities and make policy proposals derived therefrom to contribute to peace and stability in Japan, the Asian region around Japan, and the world. With the aim of exploring ways for Japan—an advanced country in the civilian use of atomic energy and the only atomic-bombed country in a war—to advance the cause of nuclear disarmament and nonproliferation in the world, one of the activities of this program that started in 2018 is the study of atomic energy and nuclear nonproliferation.

The accident at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi Nuclear Power Plant in 2011 produced an enormous amount of water contaminated by radioactive substances, and the Japanese government has decided to discharge into the ocean "treated water" with most radioactive substances removed. There are a multitude of issues related to the discharge that need to be examined, including the marine environment in areas near the nuclear plant, impact on fisheries products and ways to deal with damages caused by harmful rumors, relations with other maritime countries such as the Pacific island states, ways to deal with the "information warfare" waged by China to discredit Japan in the international community, and how to maintain Japan's credibility in the international community.

At the SPF, in light of its awareness of this situation and the emphasis on the concept of comprehensive maritime security in the Fourth Basic Plan on Ocean Policy approved by the Cabinet last April, the OPRI, which specializes in maritime issues, and the researchers of the Security Studies Program engaged in research on atomic energy and nuclear nonproliferation held joint discussions to share knowledge and experience the two entities possess in order to offer solutions on the ALPS treated water issue as a think tank.

The discharge of treated water is a long process that will take at least 30 years to complete. The Japanese government needs a long-term strategy rather than mere transient measures to cope with arising situations. For this reason, the scenario planning method was employed in an effort to find solutions to the multiple

problems. Discussions were held with experts on what preparations Japan needs to make and how to deal with information disclosure in the event of troubles. The result of the deliberations is hereby compiled as a policy proposal.

In the scenarios outlined below, while ALPS treated water and the civilian use of atomic energy are mentioned, the SPF does not take any specific position on the discharge of treated water into the ocean and the use of atomic energy.

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Discharge of ALPS Treated Water from the Fukushima Daiichi Nuclear Power Plant into the Ocean
— From a Regional Issue to an Issue with National Credibility at Stake —

The accident at the TEPCO Fukushima Daiichi Nuclear Power Plant (hereinafter, Fukushima Daiichi Nuclear Plant accident) that occurred in 2011 has had widespread ramifications. In particular, there have been grave concerns about the proliferation of radioactive substances. The leakage of such substances on land and in the sea has caused damages to agricultural, forestry, and fisheries products from Fukushima and the nearby prefectures due to harmful rumors. The reputation of Japan's nuclear technology as an advanced country in the civilian use of atomic energy has been compromised, and after the accident, a decision was made to decommission 24 nuclear reactors, including the six at the Fukushima Daiichi Nuclear Plant and Reactors 1 and 2 at the Kansai Electric Power Company's Mihama Nuclear Plant.[1] There has been a regression in the use of nuclear energy, which used to make up 30% of Japan's electric power supply before the accident.

The accident has not ended completely. Massive amounts of water need to be circulated to cool off the melted nuclear fuel and contact with the nuclear fuel contaminates the water with radioactive substances. Most radioactive substances are removed from the contaminated water, which becomes "treated water," with a specialized facility called ALPS (Advanced Liquid Processing System) and is stored in tanks in the grounds of the Fukushima Daiichi Nuclear Plant. The accumulated amount of "treated water" has already exceeded 1.3 million tons, currently stored in 1,073 tanks. The nuclear plant's grounds are running out of space, so the final disposal of the "treated water" is an urgent issue. However, this "treated water" still contains one radioactive substance that ALPS is unable to remove, tritium, which is known to affect the human body—such as reduce blood cell components—if consumed in large quantities.

The Ministry of Economy, Trade, and Industry (METI) in charge of the discharge of treated water has attempted to prove the "safety" of the discharge into the ocean with scientific evidence, and the Ministry of Foreign Affairs (MOFA) has duly communicated the results globally. However, such efforts have been insufficient to give "peace of mind" to the Japanese people and foreign countries.

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[1] Federation of Electric Power Companies of Japan, "Measures for the Decommissioning of Nuclear Power Plants," [https://www.fepc.or.jp/nuclear/haishisochi/index.html] (in Japanese).

The question of how to turn proof of safety into psychological "peace of mind" is a challenge for evidence-based policymaking.

The Japanese government has decided to dilute the "treated water" to a level that does not affect the environment and the human body and discharge this into the ocean from summer 2023 as the final solution to the "treated water" problem. While the comprehensive report submitted by the International Atomic Energy Agency (IAEA) to Prime Minister Fumio Kishida in July concluded that this is not expected to affect the human body and the environment, unsavory rumors are expected to impact fisheries products once the discharge begins, and China and other neighboring countries and the Pacific island states are expected to react strongly. If troubles occur in relation to the discharge, the Japanese government's credibility may suffer both domestically and internationally.

On the other hand, the discharge of "treated water" containing tritium into the ocean is not an issue unique to the Fukushima Daiichi Nuclear Plant or the accident there. This is being undertaken routinely by many nuclear facilities in the world. If throughout the long process of discharge, which will take more than 30 years, no trouble occurs or Japan is able to minimize the impact by responding promptly when troubles do occur, this may enhance the reputation of Japan's agricultural, forestry, and fisheries products, its management skills of nuclear facilities, and Japan itself. Will the treated water discharge produce more positive or negative effects? It will be difficult to make any predictions for the future as a simple extension of the present situation since the impact will be multifaceted, ranging from domestic issues for Fukushima and its neighboring prefectures to international issues also involving the IAEA.

With the above in mind, a group of researchers from OPRI and the Security Studies Program employed the "scenario planning" method to examine solutions on how Japan should handle the discharge of treated water.

Scenario planning involves making predictions on various scenarios for the future, based on which the validity of the direction, methodology, and policies currently adopted is reexamined, and attempts are made to introduce new methodology and policies. It is believed to be useful when the future is unpredictable. It is said that oil major Shell established this method. To be more precise, this company is known to have included the scenario of unrest in the Middle East causing crude oil prices to surge in its management strategy in the

early 1970s and was thus relatively unscathed from the impact of the Fourth Middle East War in 1973 and the subsequent Oil Shock.[2]

The discharge of ALPS treated water into the ocean is also an issue where the future is difficult to predict simply as an extension of the current discourse. Therefore, based on a discussion of what are the most important domestic and international factors determining the future and what is the appropriate scope and timeframe, we put forward four scenarios on "Japan's reputation as a nation as of 2025 and what will happen 10 years after" and suggested what policies Japan should adopt for each scenario. Lastly, policies that Japan needs to adopt regardless of which scenario comes to pass were considered and compiled as a policy proposal. Furthermore, while the scenarios for the future will also be affected by variables other than those related to how the treated water discharge is handled, the scenarios presented here focus heavily on factors that will be affected by how this process is handled.

【Outline of Envisioned Scenarios】

Scenario 1: No trouble in discharge; Japan wins total victory in "information warfare"
Scenario 2: Minor troubles in discharge; advantage gained in "information warfare"
Scenario 3: Widespread impact; harmful rumors affect entire East Japan; economic recession
Scenario 4: Japan's decline; increasing impact from deterioration of international credibility

[2] From the study meeting with the Japanese Institute of Middle Eastern Economies of the Institute of Energy Economics, Japan on May 22, 2020.

Diagram 1: Scenarios Related to ALPS Treated Water Discharge from 2025

【Proposal】

Proposal "The government should make concerted efforts to build a system capable of dealing with domestic and international issues relating to the discharge of ALPS treated water into the ocean."

- From scientific "safety" to psychological "peace of mind"
- Reconfirmation of the importance of risk communication
- Set up an "Office on ALPS Treated Water Discharge" in the National Security Agency (NSA) under the Cabinet Secretariat

1. Scenarios and Policies Japan Should Adopt

This section outlines four scenarios on the impact on Japan of the discharge of ALPS treated water in terms of troubles in the discharge, such as the detection of radioactive substances above the standard values, the "information warfare" waged by China and others, and so forth. Policies Japan should adopt in each scenario will then be discussed.

Scenario 1: No trouble in the discharge; Japan wins total victory in "information warfare"

The discharge of ALPS treated water into the ocean at TEPCO's Fukushima Daiichi Nuclear Power Plant (hereinafter, Fukushima Daiichi Nuclear Plant) started in summer 2023 goes smoothly. No previously feared mechanical trouble and no radioactive substances above the standard values are detected. METI, in charge of the discharge of treated water, MOFA, in charge of international messaging, and the Ministry of Agriculture, Forestry, and Fisheries (MAFF) (Fisheries Agency), responsible for the quality of fisheries products, join hands to create an "Office on ALPS Treated Water Discharge" under the NSA. Japan deepens cooperation with the IAEA to make utmost efforts to win international understanding on the discharge of treated water. It discloses data on nuclear substances contained in the discharged water and inspection results of fisheries products in a timely manner, giving thorough explanations to other countries, particularly its neighbors. As a result, in addition to the U.S. and the EU, South Korea and the Pacific island states show understanding to Japan's discharge of treated water, and Korea and Taiwan gradually lift import restrictions on fisheries products from Fukushima and the nearby prefectures.[3] On the other hand, China's claim that "the discharge of treated water from Fukushima will pollute international waters" loses credibility. Japan ultimately wins in the "information warfare" waged by China since the Fukushima Daiichi Nuclear

[3] According to Ministry of Agriculture, Forestry, and Fisheries, "Changes in Restrictions by Foreign Countries and Territories," South Korea bans the import of all fisheries products from all five Tohoku prefectures, except Yamagata, and three prefectures of northern Kanto. China bans the import of all foodstuffs, including fisheries products, from 10 prefectures in the Tohoku, Kanto, and Koshin regions, including Fukushima, Miyagi, Ibaraki, and Tochigi. Taiwan, which had imposed an import ban on products from Fukushima, Ibaraki, Tochigi, Gunma, and Chiba lifted the ban partially after it applied for membership in the Trans-Pacific Partnership (TPP) in 2021, allowing exports if inspection reports on radioactive substances and certificates of origin are submitted. See MAFF website. [https://www.maff.go.jp/j/export/e_shoumei/shoumei.html] (in Japanese)

Plant accident.

The smooth discharge of treated water results in positive effects in many areas, contributing not only to the fisheries industry and regional development, but also to the revival of Japan's industrial competitiveness and even the enhancement of its overall international reputation.

In the fisheries industry, confidence in the safety of fisheries products from Fukushima, such as greenling and spotted halibut, is restored, leading to a revival of the "Joban Mono (meaning produce of Ibaraki and eastern Fukushima)" brand. At the same time, the per capita consumption of fisheries products by the Japanese people rebounds. Per capita consumption which peaked in Fiscal 2001 at 40.2 kilograms has dropped by almost half in Fiscal 2021 to (approximately) 23.2 kilograms, bottoming out in Fiscal 2023 but begins to rise in Fiscal 2024. Per capita spending peaked in 2015 at 46,500 yen before declining continuously to 41,400 yen in 2019,[4] but this rises above the 50,000 yen level from 2025. Outside Japan, the "Japanese food boom" brought about by health consciousness and waning concerns about radioactive contamination results in greater interest in Japanese fisheries products. Exports of fisheries products recorded in 2022 amounted to 387.3 billion yen, representing a 28.5% increase over the previous year. China, the number one importer of Japanese food products, including agricultural products, and number two importer Hongkong accounted for 36.4% of exports.[5] Although China and Hongkong ban the import of fisheries and agricultural products from East Japan in reaction to the treated water discharge, Japan is able to increase its exports every year, reaching 1 trillion yen in 2025, by developing new markets in Southeast Asia and elsewhere. This boom in the fisheries industry changes young people's attitude toward employment. The number of workers in this industry dropped to some 124,000 in 2021, the lowest recorded in history,[6] levelling off after that. In 2025, the number of fisheries workers increases for the first time since 2000. Furthermore, the "marine industry,"[7] which brings together the fisheries industry, tourism, the

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[4] Fisheries Agency, *White Paper on Fisheries, FY2022*, p. 41. See (1) Japanese People's Per Capita Consumption of Fisheries Products in Appendix 2.

[5] Ministry of Agriculture, Forestry, and Fisheries press release on "Exports of Agricultural, Forestry, and Fishery Products and Food in 2022." See (2) Exports of Fisheries Products in Appendix 2.

[6] Fisheries Agency, *White Paper on Fisheries, FY2022*, p.78. See (3) Number of Fishing Industry Workers in Appendix 2.

[7] "Offshore Wind Power Generation: From the Standpoint of 'Marine Industry'," *Ocean Newsletter,* No. 550, July 5, 2023. [https://www.spf.org/opri/newsletter/550_1.html?latest=1]

restaurant business, and so forth in an effort to fully utilize all sea-related regional resources, flourishes. Businesses that capitalize on the regional characteristics of marine products by emphasizing local fish species and cuisine unique to each area, including the Pacific, the Sea of Japan, the Seto Inland Sea, and the Okhotsk Sea.

The vitality of the fisheries industry also has a positive effect on tourism. The number of foreign visitors recovers to the pre-Covid level (31.88 million in 2019[8]) and continues to increase steadily. This number reaches 50 million in 2025, when the Osaka Expo is held. Visitors to the Expo itself reach 40 million, way above the projected number (28.2 million), establishing its reputation in the international community as the "most successful Expo in the 21st Century." The increase of fisheries workers leads to revitalization of local initiatives in fishing villages, and various ideas for blue tourism are devised and implemented as part of the "marine industry." In particular, interest in Japanese food and fisheries products gives a major boost to blue tourism among foreign tourists coming to Japan. Blue tourism, which used to be a minor program subsidized by the Tourism Agency and other offices, becomes a major component of the tourism industry from 2025, generating revenues of 1 trillion yen nationwide in this fiscal year.

The successful discharge of the ALPS treated water triggers a change in the people's perception of the use of atomic energy. Operations at the Kashiwazaki-Kariwa Nuclear Power Plant in Niigata Prefecture and other nuclear plants in the country resume, accounting for 15-20% of electric power supply in the country, thus contributing to the realization of a carbon neutral society. With this, Japan is able to partially absorb the rise in the cost of fossil fuels caused by Russia's military invasion of Ukraine. Japan succeeds in keeping electricity charges at the lowest level among developed countries. Consumer confidence, which has been dampened by rising commodity prices, is restored, and stable power supply and affordable electricity have a positive effect on industry. The Taiwan Semiconductor Manufacturing Co. (TSMC), the world's top semiconductor contract manufacturing company which has announced the construction of its production plant in Kumamoto Prefecture, highly rates Japan's stable power supply and high-quality labor force, announcing official plans to build a second

[8] Tourism Agency, "Number of Inbound and Outbound Travelers." [https://www.mlit.go.jp/kankocho/siryou/toukei/in_out.html] See (4) Number of Foreign Visitors in Appendix 2.

plant in Kumamoto. Other semiconductor makers and foreign companies also accelerate the location of their plants and research bases in Japan. Hokkaido and Tohoku in particular, where vast tracts of land are available, succeed in inviting Japanese and foreign companies to build facilities there with the resumption of operations at the Tomari and Onagawa Nuclear Power Plants.

The (No. 1) TSMC plant in Kumamoto plans to produce large logic semiconductors, that are in great demand for use in smartphones and cars, at a scale equivalent to 55,000 12-inch wafers per month. It has announced that the plant will have a total floor area of around 21.3 hectares and will hire a total of 1,700 workers. The size of the work force and the production scale is estimated to have an economic ripple effect of over 4 trillion yen in 10 years from the start of operation (scheduled for 2024).[9] The opening of advanced technology-related production plants and research bases by Japanese and foreign companies will not only generate revenues through their production activities, but will also produce economic ripple effects to the tune of 10 trillion yen in the next 10 years through job creation in the regions, corporate participation in regional development, and so forth. Stable supply of affordable electric power will have a positive effect on industry as a whole.

As discussed above, Japan will enhance its credibility in the international community if the discharge of ALPS treated water goes smoothly. This will not only revive the fisheries industry and tourism but will also have a positive effect on the economic society. The economic ripple effects in the 10 years from 2025 will exceed 15 trillion yen.

＜Policies Japan Should Adopt under this Scenario＞

- Although the discharge of ALPS treated water comes with risks, successful handling will present a great opportunity for Japan. It should first afford the people with “safety” and “peace of mind” inside the country and create an environment that will prevent the waging of “information warfare” from overseas.

- Not only METI, which is responsible for the discharge, but also MOFA and

[9] Yuhei Aotani, “On-Site Experience of the Enormous Size of TSMC Kumamoto Plant that Will Generate Over 4 Trillion Yen Economic Ripple Effects,” Nikkei XTECH, May 9, 2023. [https://xtech.nikkei.com/atcl/nxt/column/18/00138/050801278/] (in Japanese)

MAFF should work together to win the international community's trust. This will create a virtuous cycle for tourism, industry, and the economic society through the elimination of concerns about fisheries products. Toward this end, the national government should put in place a system for dealing with this problem as a united national effort, such as by setting an "Office on ALPS Treated Water Discharge" in the NSA, to undertake thorough information disclosure on the ALPS treated water and message on Japan's merits.

Scenario 2: Minor troubles in the discharge; advantage gained in "information warfare"

After the start of the discharge of ALPS treated water from the Fukushima Daiichi Nuclear Plant in summer 2023, although there are temporary suspensions of operation due to mechanical troubles and occasional detection of some radioactive substances above the standard values in the discharged water, the impact is kept at a minimum with timely provision of information—based on lessons learned on information disclosure and risk communication from the Fukushima Daiichi Nuclear Plant accident—and thorough explanations given to other countries. In cooperation with the IAEA, the national government makes concerted efforts led by the "Office on ALPS Treated Water Discharge" in the NSA to execute the discharge.

Thanks to such efforts, the U.S. and the EU, as well as South Korea and the Pacific island states show understanding of the treated water discharge. While import restrictions on fisheries products from Fukushima continue, those on fisheries products from the neighboring prefectures are lifted gradually, with faith being restored on oysters from Minamisanriku, anglerfish from Ibaraki, blue-skinned fish from Katsuura, and other fisheries products from prefectures near Fukushima. Even though China wages a campaign claiming, "the discharge of treated water from Fukushima pollutes international waters," this is supported by only a handful of other countries.

The fact that the impact of troubles from the discharge and harmful rumors remains minimal has a positive effect in many areas.

In the fisheries industry, there is a revival in the consumption of fisheries products. Per capita fisheries products consumption among the Japanese people, which peaked in Fiscal 2001 at 40.2 kilograms, has since continued to decline. By Fiscal 2021, this figure has dropped by almost half to (an estimated) 23.2 kilograms.[10] A reversal starts in Fiscal 2025. While per capita spending by the Japanese people peaked in 2015 at 46,500 yen and has since been diminishing, dropping to 41,400 yen in 2019, a slight increase each year starts in 2025.

With waning concerns about radioactive pollution, the rise in appreciation of "Japanese food" resumes. Thanks also to growing interest in seafood as healthy

[10] See Footnote 4.

food, export of fisheries products continues to increase from 387.3 billion yen in 2022.[11] China has been the number one importer and Hongkong the number two importer of Japanese food products, including agricultural products, accounting for 36.4% of all exports. Although China and Hongkong have banned the import of fisheries and agricultural products from East Japan in reaction to the treated water discharge, Japan succeeds in opening up new markets in Southeast Asia and elsewhere. The vitality of the fisheries industry also changes young people's attitude toward employment. While the number of workers in the fishing industry has dropped to a record low of 124,000 in 2021,[12] levelling out after that, a reversal begins from 2025. There is an increase in younger workers, and the industry achieves a rejuvenation. In light of this, active efforts are undertaken in various areas across the country to boost the "marine industry" bringing together the fisheries industry, tourism, restaurant business, and so forth to fully utilize all sea-related regional resources.

The number of foreign visitors coming to Japan recovers to the pre-Covid level (31.88 million in 2019[13]). This level is maintained thanks partly to the Osaka Expo. In the tourism industry, there is great interest in blue tourism, which is part of the "marine industry," and an increasing number of foreign tourists participate in blue tourism due to the high profile of Japanese food and fisheries products. While there has been no significant increase in visitors to Fukushima due to the import bans imposed by various countries, the government subsidizes blue tourism in Fukushima and implements policies to prevent Fukushima from lagging behind the nationwide boom. After 2025, blue tourism establishes its position as a component of the tourism industry, generating revenues at the 300-billion-yen level nationwide. Activities targeting foreign tourists, such as experiencing drag net fishing, are offered.

The fact that there have only been minor glitches in the ALPS treated water discharge helps develop a certain extent of understanding of the use of atomic energy, even though concerns and fear of severe accidents remain. Operations at the Kashiwazaki-Kariwa Nuclear Power Plant in Niigata Prefecture and other nuclear plants in the country gradually resume, accounting for 10-15% of electric power supply in the country, thus contributing to the realization of a carbon neutral society and playing a role in supplementing the unstable power supply

[11] See Footnote 5.
[12] See Footnote 6.
[13] See Footnote 8.

due to the increasing use of renewable energies. Rising power cost finally comes to an end, and Japan becomes able to set relatively competitive electricity charges compared to other developed countries. With the gradual recovery of consumer confidence, foreign companies begin to consider locating production plants and research bases in Japan, particularly for advanced semiconductors. For example, the decision by TSMC, the world's top semiconductor contract manufacturing company, to build its production plant in Kumamoto. TMSC's Kumamoto plant is expected to generate an economic ripple effect of over 4 trillion yen in 10 years,[14] such as by creating jobs in the regions.

Keeping troubles in the discharge of ALPS treated water into the ocean at a minimum serves to enhance Japan's credibility in the international community and has a positive effect on the economy and society. The economic ripple effects in the 10 years from 2025 will reach 7.5 trillion yen.

＜Policies Japan Should Adopt under this Scenario＞

- It is unthinkable that the long process of discharging ALPS treated water into the ocean can remain trouble-free. At the very least, Japan needs to keep the impact at the minimum by making all necessary preparations to deal with troubles swiftly based on the recognition that troubles will occur. It must bear in mind that this will help win the international community's trust and have a positive effect on the economic society.

- The government should also implement policies to ensure that Fukushima will not be the only prefecture left behind by the nationwide revival of the fisheries industry, tourism, and industry, such as by utilizing reserve funds to deal with damages caused by harmful rumors.

[14] See Footnote 11.

Scenario 3: Widespread impact; harmful rumors affect entire East Japan; economic recession

The discharge of ALPS treated water from the Fukushima Daiichi Nuclear Plant, which started in summer 2023, is marred by multiple troubles, such as suspension of operations due to mechanical troubles and certain radioactive substances in the treated water exceeding the standard values. Lessons learned on information disclosure and risk communication after the Fukushima Daiichi Nuclear Plant accident have not been applied and provision of information to the Japanese people and the world is often delayed and reactive, giving rise to suspicions both at home and abroad that there is an attempt to "downplay the harmful effect and risks of the ALPS treated water."

Taking advantage of this situation, China wages an "information warfare" to blast Japan's inadequate management of its nuclear facilities and pollution of the ocean, calling on the neighboring countries and the Pacific island states to form a united front. Japan's relations with South Korea, which has begun to improve in 2023, deteriorate, and its import ban on fisheries products from Fukushima and the nearby prefectures is extended to cover the entire East Japan. Taiwan and the Pacific island states introduce new import restrictions, causing a serious setback in the exports of oysters from Minamisanriku, scallops from Hakodate, and other products that have been increasing so far. The Pacific island states even demand compensation from the Japanese government for marine pollution and damages to their tourism industry caused by unsavory rumors. The U.S. and the EU, which have been supportive of the discharge in the beginning, toughen their position, demanding that Japan discontinue the discharge of treated water and investigate the causes of the troubles. This issue is also taken up at the IAEA Board of Governors.

Troubles in the treated water discharge gives rise to harmful rumors both in Japan and internationally, resulting in negative effects in many areas.

With regard to the fisheries industry, consumers become averse to consuming fisheries products. The Japanese people's per capita consumption of fisheries products, which peaked in Fiscal 2001 at 40.2 kilograms, dropped to (an estimated) 23.2 kilograms in Fiscal 2021.[15] This goes below 20 kilograms in 2025 and the downward trend continues. While interest in "Japanese food" remains

[15] See Footnote 4.

strong overseas, the reputation of Japanese fisheries and food products suffers significantly due to concerns about radioactive contamination. Meanwhile, China and South Korea make inroads into the Japanese cuisine market, causing serious difficulties for Japanese companies. Due to tougher import restrictions by these two countries and others, exports of Japanese fisheries products have begun to decline after peaking out in 2022 at 387.3 billion yen,[16] dropping by 40% to around 220 billion yen in 2025. The adverse situation in the fisheries industry alienates young people. The number of workers, which was at a record low of 124,000 in 2021,[17] continues its unchecked slide, going below 100,000 in 2025. With young people shying away from the fishing industry, fishing ports, especially in Fukushima and the nearby prefectures, close down one after the other, resulting in the inevitable degeneration of the "marine industry."

The number of foreign visitors continues to fall below the pre-Covid level. (31.88 million in 2019[18]) The Osaka Expo in 2025 fails to occasion a recovery of inbound consumption, and the number of foreign tourists each year remains at the 20 million level. In the tourism industry, although blue tourism subsidized by the Tourism Agency and prefectural governments has managed to continue, more and more fishing villages abandon blue tourism each year.

Multiple troubles in the ALPS treated water discharge aggravate the people's distrust of the use of atomic energy. TEPCO's Kashiwazaki-Kariwa Nuclear Power Plant in Niigata Prefecture and nuclear facilities nationwide fail to obtain the local governments' consent to resume operation, rendering them idle. Nuclear power accounts for only 5% of power source, while the penetration of renewable energies remains slow, resulting in continuing rise in the cost of electricity. During summer and winter, when the use of air conditioners is at its peak, the people are asked to conserve energy repeatedly, approaching a situation threatening power outage. Japan is known for its high electricity cost and unstable power supply compared to other developed countries.

As a result, already low consumer confidence recedes further, and investment activities stagnate. Although TSMC, the world's top semiconductor contract manufacturer, opens its first production plant in Kumamoto and starts manufacturing, it announces the suspension of its previous plan to build a second

[16] See Footnote 5.
[17] See Footnote 6.
[18] See Footnote 8.

plant. While there used to be many foreign companies, particularly semiconductor makers, considering locating their production plants and research bases in Japan due to the tense Taiwan situation, they are now shifting to South Korea or Indonesia. TSMC's first production plant in Kumamoto is estimated to generate over 4 trillion yen in economic ripple effects in 10 years through job creation in the localities, revenues from production, corporate contribution to regional development, and so forth.[19] Foreign companies' investment in Japan has been expected to generate enormous economic ripple effects, but this fails to materialize.

As seen in the above, troubles in the discharge of ALPS treated water into the ocean will lead to the loss of Japan's credibility in the international community. This also has negative effects on the economy and society, causing various entities to steer clear of Japan.

＜Policies Japan Should Adopt under this Scenario＞

- Failure to deal appropriately with troubles in the long process of ALPS treated water discharge will have a negative effect not only on the fisheries industry, but also on the economic society as a whole. All the anticipated troubles must be identified and have response policies in place in advance.

- With regard to information disclosure after troubles occur, lessons must be learned from the failure in messaging and risk communication after the Fukushima Daiichi Nuclear Plant accident. Policies should be put in place to enable timely and appropriate explanation, such as by forming a public relations team consisting of communication experts in the government.

[19] See footnote 11.

Scenario 4: Japan's decline; increasing impact from deterioration of international credibility

The discharge of ALPS treated water from the Fukushima Daiichi Nuclear Plant, which started in summer 2023, is marred by multiple troubles, such as suspension of operations due to mechanical troubles and certain radioactive substances in the treated water exceeding the standard values. Radioactive substances exceeding the safety standard are also found in flatfish caught in waters off Fukushima. The Japanese government's credibility in terms of its ability to manage nuclear facilities is destroyed. China's "information warfare" accelerates the vilification of Japan's image as a country. Not only South Korea and the Pacific island states but also the U.S. and EU strengthen import restrictions on Japanese foodstuff, including fisheries products. The Pacific island states even demand compensation from the Japanese government for marine pollution due to the discharge and reputational damages to their tourism industry. The IAEA, which has shown understanding of the discharge of treated water into the ocean, is now also concerned about this situation, asking Japan to suspend the discharge and conduct a thorough investigation into the causes. The discharge is discontinued for an extended period.

These troubles in the discharge not only give rise to damages caused by harmful rumors both at home and abroad, but also have a serious impact on the Japanese society as a whole.

In terms of the fisheries industry, the Japanese people's per capita consumption of fisheries products, which peaked in Fiscal 2001 at 40.2 kilograms, dropped to (an estimated) 23.2 kilograms in Fiscal 2021.[20] The downward trend becomes unstoppable, going below 20 kilograms in 2025 and declining further thereafter. Concerns about the safety of Japanese products go beyond fisheries products and affect a wide range of food products. As a result, food imports increase, and food self-sufficiency rate plunges further from 38% (in terms of calories) in Fiscal 2021,[21] going below 30% in 2025.

While interest in "Japanese food" remains strong overseas, the reputation of

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[20] See footnote 4.

[21] Ministry of Agriculture, Forestry, and Fisheries, "Japan's Food Self-Sufficiency Ratio." [https://www.maff.go.jp/j/zyukyu/zikyu_ritu/012.html]

Japanese fisheries and food products suffers significantly due to concerns about radioactive contamination. Meanwhile, China and South Korea make inroads into the Japanese cuisine market, inflicting serious damages on Japan's fisheries industry, agriculture, and food processors. This is clearly reflected in statistics. Exports of Japanese fisheries products have begun to decline after peaking out in 2022 at 387.3 billion yen,[22] dropping by 75% to less than 100 billion yen in 2025. The severe situation of the fisheries industry further alienates young people. The number of workers in the fisheries industry, which was at a record low of 124,000 in 2021,[23] continues to decline, dropping by half to 60,000 in 2025. With young people shying away from the fishing industry, fishing ports not only in Fukushima and nearby prefectures but across the country close down one after the other.

The number of foreign visitors continues to fall significantly below the pre-Covid level (31.88 million in 2019[24]) The Osaka Expo in 2025 fails to spur a recovery of inbound consumption. Only 8 million people visit the Expo, less than one-third of the projected 28.2 million. This Expo comes to be known as the "worst Expo in the 21st Century" in the international community. As a result, the annual number of foreign visitors to Japan remains around the 10 million level. In the tourism industry, although blue tourism subsidized by the Tourism Agency and prefectural governments has managed to continue, more and more fishing villages abandon blue tourism each year. By 2030, both the central government ministries and the local governments decide to discontinue subsidies for blue tourism, further damaging Japan's international image.

Due to the multiple troubles in the ALPS treated water discharge, the people's distrust of the use of atomic energy is at its worst. TEPCO's Kashiwazaki-Kariwa Nuclear Power Plant in Niigata Prefecture and other nuclear facilities nationwide fail to obtain the local governments' consent to resume operation, rendering them idle. Furthermore, there is an outcry from local residents at the sites where nuclear plants of the Kansai and Kyushu Electric Power Companies have resumed operations, demanding the suspension of their operation, ultimately forcing them to stop operating. With the nuclear plants unable to contribute to the power supply and little progress in the penetration of renewable energies, cost of electricity continues to rise. During summer and winter, when

[22] See Footnote 5.
[23] See Footnote 6.
[24] See Footnote 8.

the demand for power is at the highest for air conditioning, people are frequently asked to conserve energy. Widespread power outage occurs frequently. Japan is often referred to domestically and internationally as a country with high electricity cost and unstable power supply, and its position as a "developed country" is often questioned.

As a result, the already low consumer confidence deteriorates further and investment activities stagnate, bringing about serious deflation.

Although TSMC, the world's top semiconductor contract manufacturer, builds its first production plant in Kumamoto, it reduces the scale of production, and a previous plan to build a second plant is cancelled. While there used to be many foreign companies, particularly semiconductor makers, considering locating their production plants and research bases in Japan due to the tense Taiwan situation, South Korea and Indonesia replace Japan as their choices. The global trend of shunning Japan accelerates. TSMC's first production plant in Kumamoto is estimated to generate over 4 trillion yen in economic ripple effects in 10 years through job creation for the local people, product revenues, corporate contribution to regional development, and so forth.[25] However, due to the downsizing of production scale, economic ripple effects are reduced by half, and a long-term decline in foreign investments in Japan comes about.

Due to troubles in the ALPS treated water discharge, the Japanese government loses its credibility in the international community. Trust in the technologies of Japan, a country which has long been considered a technology powerhouse, is also lost. Aggravated by the failure of the 2025 Osaka Expo, the global trend of abandoning Japan becomes increasingly serious. The economic loss Japan incurs in 2025, including lost opportunity revenues, amounts to 5 trillion yen, triggering the process of Japan's decline.

＜Policies Japan Should Adopt under this Scenario＞

- Troubles relating to the discharge of ALPS treated water into the ocean must not be taken lightly. Scenario 4 is not simply a product of imagination. This must be understood as a matter of the credibility of Japanese technology and Japan as a country. The government must take the responsibility to avoid making the fatal mistake of radioactive

[25] See Footnote 11.

substances above the standard value being found in fisheries products from Fukushima and the nearby prefectures.

2. Proposal

It is clear that whichever of the four scenarios actually comes to pass, the impact of the discharge of ALPS treated water will not be limited to Fukushima and the nearby prefectures or the fisheries industry. It goes without saying that the safety of the discharge technology must be ensured and all conceivable troubles, including minor ones, must be identified and preparations should be made to enable appropriate information disclosure and explanation of response measures in a timely manner. The lessons learned from the communication botch after the Fukushima Daiichi Nuclear Plant accident, where the government took time to grasp the situation and mistakes or expressions that gave rise to misunderstanding of the provided information compromised Japan's credibility, must be borne in mind.

With this understanding, OPRI and the Security Studies Program would like to make the following proposal.

Proposal: "The government should make concerted efforts to build a system capable of dealing with domestic and international issues relating to the discharge of ALPS treated water into the ocean."

- **From scientific "safety" to psychological "peace of mind"**
- **Reconfirmation of the importance of risk communication**
- **Set up an "Office on ALPS Treated Water Discharge" in the NSA under the Cabinet Secretariat**

The reason why the disposal of ALPS treated water has given rise to strong reaction both at home and abroad and become an issue that may impact Japan's credibility as a country is that TEPCO, operator of the Fukushima Daiichi Nuclear Plant, has lost the capability to deal with this issue, while the government ministries' failure to collaborate has resulted in confusing messaging and prevented timely response. As seen in the scenarios, the ALPS treated water discharge is expected to impact multiple areas, so the government needs to build a system to ensure that the discharge proceeds without a hitch.

First, METI, which is directly responsible for the ALPS treated water discharge, should make utmost efforts to ensure safety. METI has so far strived to prove the "safety" of the treated water discharge through scientific verification. The

occurrence of tritium is in no way a problem unique to the Fukushima Daiichi Nuclear Plant or the accident there. This happens at all nuclear facilities in the world, and many countries in the world release treated water into the ocean. The half-life of tritium is 12.33 years, which is the length of time for one-half of its radioactive isotopes to decay, a relatively short one among radioactive nuclides. Radiation from tritium has weak penetrating power, so even when ingested into the human body, it very rarely affects health by internal exposure to radiation. Its properties are similar to hydrogen, and it is readily assimilated by water, so it does not accumulate in the body and is discharged immediately. Therefore, METI has judged that when diluted below the standard value, discharge of treated water into the ocean can win general understanding. Statistically, the total amount of tritium in the over 1.3 million tons of treated water stored in tanks at present is only less than 20 grams.[26] METI has repeatedly stated on its website that the total amount of radioactive substances to be released in a year is at a very low level, compared to China and other countries.[27]

However, scientific proof of "safety" and messaging and communication based on this has not necessarily led to "peace of mind" in Japan and internationally. In Japan, fisheries industry workers in Fukushima and the neighboring prefectures have been voicing their concerns about the reputational damages that the treated water discharge has caused, while China has been waging a persistent "information campaign" taking advantage of the gap between "safety" and "peace of mind." This shows that the Japanese government and TEPCO, the messaging parties, have yet to win trust.[28]

It is widely recognized in many fields, including psychology, economics, and political science, that "trust," an essential basis for successful communication and mutual understanding between the originator and recipient of information, plays a critical role in social relations, including political and economic activities.[29]

It is necessary to understand that there are two types of "trust"[30] when considering the relation between science and technology and society.

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[26] Denki Shimbun, "Basic Q&A on Tritium," [https://www.denkishimbun.com/tritium_qa/a6.html] (in Japanese)
[27] See (2) in Appendix 1.
[28] See (1) in Appendix 1.
[29] Toshio Yamagishi, Hisashi Komiyama, "Significance and the Structure of Trust -- Theoretical and Empirical Research on Trust and Commitment Relations," INSS Journal 2, 1995, p. 1
[30] Ibid., p. 4.

First, trust as expectation on the other party's capability. The people will have trust if they believe that the national government and the nuclear plant operator are capable of operating the discharge equipment safely and managing risks. Second is trust as expectation on the other party's intent. In the treated water discharge, if the national government and the plant operator are motivated by public interest and make studious efforts to share information on the risks at hand, then there will be greater trust among the people. On the other hand, if there is doubt that they might be concealing unfavorable information, then there will be no trust.

Therefore, the messaging methodology needs to be reviewed. It would have been desirable to form a third-party body consisting of local fishermen and experts on radiation to monitor sea waters regularly and release relevant information. It will not be difficult for a genuine third-party body to win "trust." If this is not possible, it is necessary to create an environment conducive to cooperation with an IAEA task force made up of experts from different countries[31] to undertake monitoring and verification after the start of discharge. Verification of the discharge and information disclosure by IAEA as a neutral party will win "trust" necessary for both domestic and international communication, thus mitigating concerns about the discharge and the occurrence of damages caused by harmful rumors.

MOFA plays an important role as the channel of negotiations with the IAEA. It

[31] The IAEA set up a "task force" consisting of experts from 11 countries, including China, in April 2021, which began work to verify the safety of ALPS treated water. On July 4, 2023, IAEA Director General Rafael Grossi submitted a comprehensive report to Prime Minister Fumio Kishida, concluding that "the discharge of ALPS treated water into the ocean meets international safety standards." Grossi has indicated that monitoring by the task force will continue even after the start of the discharge.

must strive to explain Japan's position to South Korea and the Pacific island states—which China is wooing to form a united front—to win their understanding and maintain the cooperative relationship with the IAEA.

The fisheries industry was seriously affected by the nuclear plant accident in 2011. Subsequently, various inspections were conducted after fish was caught before they were distributed in the market, and the industry as a whole made tremendous efforts to disclose the results swiftly in order to restore trust in society. Twelve years after the accident, such efforts are paying off gradually. Concerns about fisheries products are subsiding in Japan. The treated water discharge is regarded as another round of challenge for the fisheries industry. Based on past experience, efforts to restore trust in society are necessary at an early stage. Despite trends in the number of fishing industry workers and consumption of fisheries products are showing decline of the fisheries industry and there are mounting concerns that the discharge of ALPS treated water into the ocean may further exacerbate the situation of the fisheries industry, initiatives taken by the Fisheries Agency to mitigate reputational damage and revive the fishing industry are seen by the consumers as insufficient. From the standpoint of regional development through the "marine industry" and expansion of the consumption of fisheries products, the agency needs to be more actively involved with the issue of ALPS treated water discharge. As stated earlier, scientific proof of the "safety" of the ALPS treated water by the IAEA and other third parties does not necessarily mean "peace of mind" on the part of the consumers. It is necessary for the Fisheries Agency, fishing ports, fisheries product processors, brokers responsible for opening up new markets, and the major retailers to work together to give consumers "peace of mind." In a case study of how consumer confidence improved after an incident in which oysters from Hokkaido caused a norovirus epidemic, it was found that ensuring transparency of safety management procedures in the shipment process and holding regular tasting sessions led to the consumers' "peace of mind" and improved consumer confidence.[32] At the time of the Fukushima Daiichi Nuclear Plant accident in March 2011, although consumers avoided fisheries products from Fukushima and the nearby prefectures for a while after a substantial amount of water containing low-level radioactive waste was discharged into the ocean, consumption recovered with thorough inspection of radioactive substances

[32] Atsumi Furuya, et al, Graduate School of Fisheries Sciences, Hokkaido University, "Analysis of Economic Impacts of Damage Caused by a Rumor – Case Study of Oysters in Hokkaido." [https://www.jstage.jst.go.jp/article/srs/38/3/38_3_761/_pdf/-char/ja] (in Japanese with English abstract)

in the shipment process. Actual statistics show that while the per capita fisheries product consumption in 2010 was 34.0 kilograms, this was 32.1 kilograms in 2011, showing no significant change.[33] Referring to such cases and facts, efforts to nip in the bud damages from harmful rumors are essential through ensuring transparency in the fishing and shipment processes, disclosing data on fisheries products inspections, and appropriate communication of quality control policies.

Since this proposal focuses on the start of the discharge of ALPS treated water into the ocean, there is little discussion on the use of atomic energy. However, as seen in the scenarios, it must be remembered that the smooth handling of the discharge will affect the stability of power supply and electricity charges, as well as Japan's industry as a whole. According to the "Fiscal 2022 Opinion Poll on Nuclear Energy" conducted by the Japan Atomic Energy Relations Organization (JAERO), only 25.1% of the respondents answered "yes" to the question, "Is it possible to ensure safety in nuclear power generation in the future?"[34] The people's doubts about the use of atomic energy have remained deep-rooted even 12 years after the Fukushima accident. If troubles occur frequently in the discharge of the ALPS treated water, it is obvious that the people will lose faith completely in the use of atomic energy.

From the above, since it is conceivable that the ALPS treated water discharge will impact multiple areas and considering METI, MOFA, and the Fisheries Agency will have to come up with responses in different areas, it is not easy for the government to work together to build a system to deal with the related issues. On the other hand, discord between government ministries, each sending out different messages, and lack of information sharing may lead to greater domestic and international distrust of the treated water discharge. For this reason, we ask that a system be put in place to facilitate constant information sharing and discussion among relevant agencies and the implementation of appropriate policies, such as by creating an "Office on ALPS Treated Water Discharge" under the NSA in the Cabinet Secretariat. It is also important not to repeat the communication missteps that have led to the people's distrust of the decommissioning of nuclear plants, the discharge of ALPS treated water into the ocean, and the use of atomic energy. The government must recruit communication experts to build a system with no vulnerabilities that can be

[33] See Footnote 4.
[34] Japan Atomic Energy Relations Organization, "Fiscal 2022 Opinion Poll on Atomic Energy." [https://www.jaero.or.jp/data/01jigyou/pdf/tyousakenkyu2022/results_2022.pdf] (in Japanese)

taken advantage of to wage an “information warfare.”

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13. Japan Atomic Energy Relations Organization, "Fiscal 2022 Opinion Poll on Nuclear Energy." [https://www.jaero.or.jp/data/01jigyou/pdf/tyousakenkyu2022/results_2022.pdf] (in Japanese)

Appendices

【Appendix 1】

Fact Sheets Relating to Discharge of ALPS Treated Water into the Ocean

(1) Chronology Regarding ALPS Treated Water

Date	Actions	Purpose, Result
April 4-10, 2011	TEPCO discharges low-level radiation contaminated groundwater into the ocean.	To make space for water storage to ensure that high-level radiation contaminated water does not leak into the ocean, the discharge of low-level contaminiated water into the ocean becomes inevitable. Due to failure to promote public awareness in advance, this is criticized by both the local residents and the neighboring countries.
From March 2013	Advanced Liquid Processing System (ALPS) starts operation to filter contaminated water.	While ALPS is supposed to remove all radioactive substances except tritium, there have been cases of residual substances.
May 13, 2013	Fukushima Prefectural Federation of Fisheries Co-operative Associations opposes TEPCO's proposal to pump groundwater and discharge this into the ocean to build underground pipeline.	Based on the opinion that "TEPCO alone cannot win the fisheries cooperatives' trust and the national government should explain its policy," METI starts to hold joint briefings for the local communities with TEPCO.
September 8, 2013	(Then) Prime Minister Shinzo Abe declares in his speech at the General Meeting of the International Olympic Committee, where Japan is making its bid to host the Tokyo Olympic Games, that "the situation is under control." with regard to the contaminated waste.	Aimed at clearing up the international community's concerns about ocean pollution.
November 2016	METI sets up "Subcomittee on ALPS and the Handling of Treated Water."	Discussion of solutions for disposal of contaminated water from a third-party perspective.
November 2017	TEPCO builds frozen soil wall under building housing the nuclear reactors.	This is aimed at preventing groundwater from entering the nuclear reactor buildings and the resulting increase in contaminated water, but its effectiveness is found to be limited.
September 2018	TEPCO announces that despite its previous claim that "ALPS can remove all radioactive substances other than tritium," there are certain substances ALPS cannot remove that exceed the standard value.	TEPCO's approach to information disclosure is criticized because it only published data on its website in the beginning.
August 2019	TEPCO announces its estimate that "the grounds of Fukushima Daiichi Nuclear Plant will be filled to the brim with storage tanks for treated water by summer 2022."	Final disposal of ALPS treated water becomes an urgent issue.
February 2020	The subcommittee releases its report.	A conclusion is reached that discharge into the ocean is the most feasible solution.
July 2023	IAEA submits comprehensive report on ALPS treated water to Prime Minister Fumio Kishida.	The report concludes that "the discharge of ALPS treated water into the ocean meets international safety standards."

(Source) Created by author based on the Tokyo Electric Power Company website and other sources.

(2) Total amount of tritium discharged from nuclear power plants in various countries

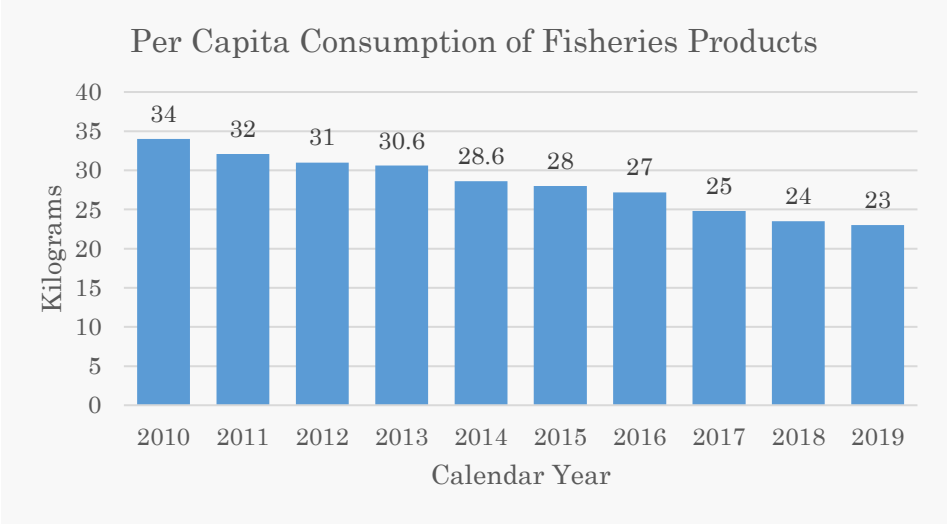
Country	Facility	Amount	Year
Japan	**Fukushima Daiichi Nuclear Plant**	**22 trillion becquerels**	From 2023
South Korea	Wolseong Nuclear Plant	23 trillion becquerels	2016
China	Taishan No. 3 Nuclear Plant	143 trillion becquerels	2020
U.S.	Callaway Nuclear Plant	42 trillion becquerels	2002
Canada	Darlington Nuclear Plant	241 trillion becquerels	2015
France	La Hague Nuclear Fuel Reprocessing Facility	13,700 trillion becquerels	2015

(Source) Created by author based on Federation of Electric Power Companies of Japan website and other sources.

【Appendix 2】

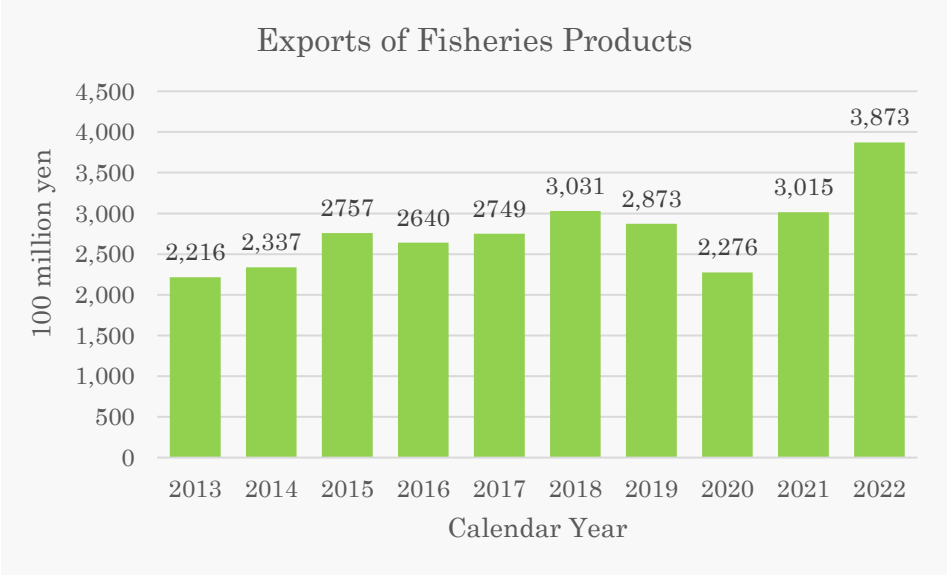
Statistics on Fisheries Products, Tourism

(1) Japanese people's per capita consumption of fisheries products



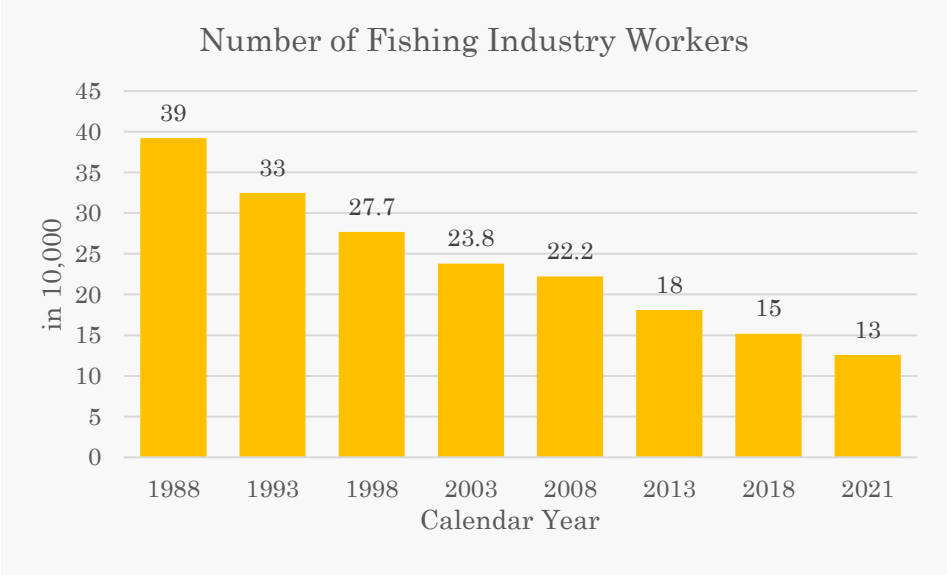
(Source) Created by author based on the Fisheries Agency's "White Paper on Fisheries, FY 2022."

(2) Exports of Fisheries Products



(Source) Created by author based on Ministry of Agriculture, Forestry, and Fisheries, "Annual Exports" (in Japanese) and other sources.

(3) Number of fishing industry workers



(Source) Created by author based on Fisheries Agency's " White Paper on Fisheries, FY2022" and other sources.

(4) Number of Foreign Visitors

(Source) Created by author based on Tourism Agency, "Number of Inbound and Outbound Travelers" and other sources.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