

Progress Status of Discussions Regarding Marine Organism Rearing Test Fukushima Daiichi Nuclear Power Station

February 24, 2022

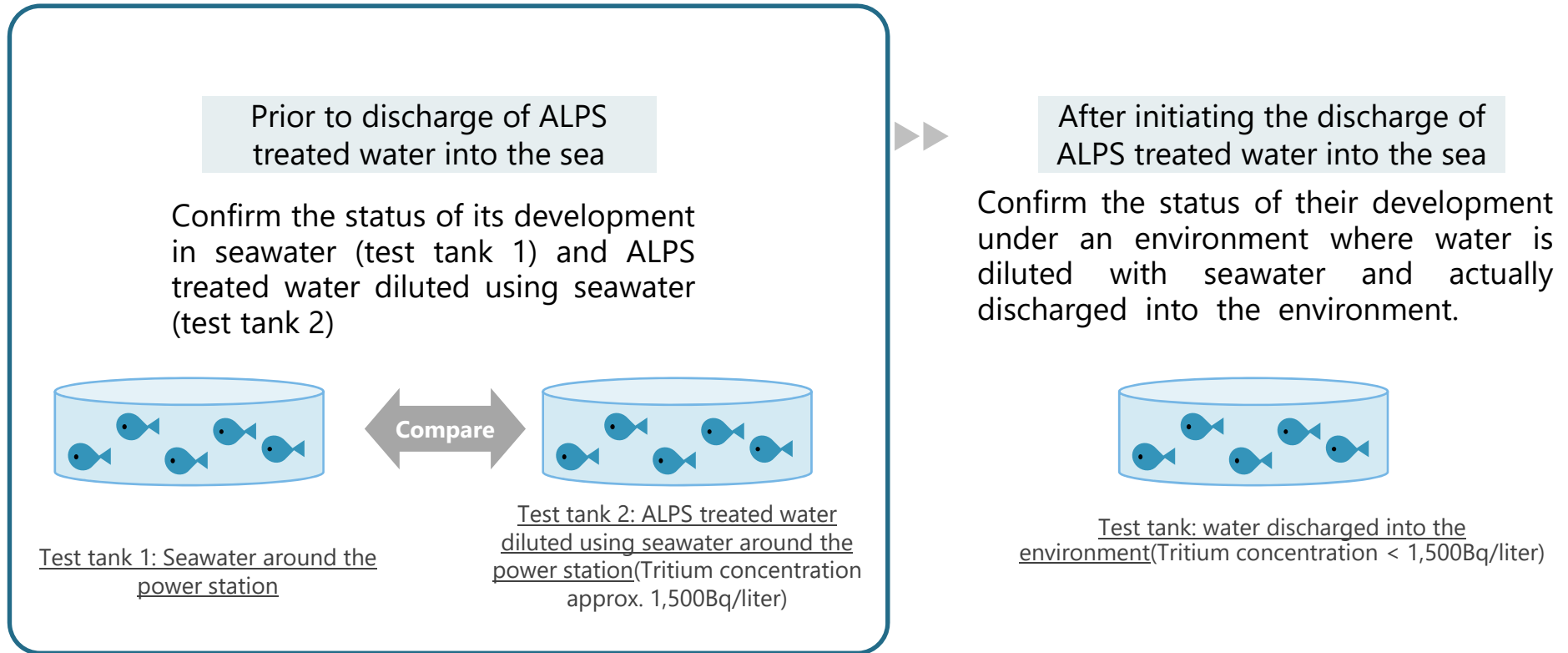


TEPCO Holdings, Inc.

1. Rearing test of Marine Organisms

- We decided to conduct marine organism rearing tests based on the following feedback we received from many people when explaining the safety of tritium, our policy in discharging ALPS treated water into the sea, and the equipment to the local community and parties concerned.
 - I want you to show that the environment is not affected by actually rearing fish, rather than using jargon and numbers to explain it away
 - I'd find it easier to understand if you could demonstrate safety in an easy-to-understand manner by rearing fish in treated water for example
- In response to the feedback, to alleviate people's concerns and to cultivate peace of mind, we will rear marine organisms in tanks of ALPS treated water diluted with seawater and compare them with organisms reared in normal seawater and report the results carefully in an easy-to-understand manner.
- Based on the results of many studies domestic and abroad on the behavior of tritium, data for this test will first be gathered for 6 months to show that tritium is not concentrated in the living bodies and that the concentration of tritium in live bodies do not exceed that of the rearing environment as demonstrated in past tests results.
- The status and progress in rearing tests shall be disclosed when necessary.

【Reference】 Plan for the marine organisms rearing test



Topic covered today

2. Status of discussions regarding marine organisms rearing test

<Progress to this point and future plans>

- Discussions on the trial environment, selection of organism species, and verification items in rearing have been held with opinions from experts and people of the fisheries industry.
- **The details of the marine organisms rearing tests will be finalized and tests will start in seawater and in ALPS treated water diluted with seawater around September 2022. The growth of the organisms in their respective environments will be compared against each other. The tritium concentrations within the living bodies will be analyzed and assessed.**
- Before the start of the rearing tests, **we will start trial rearing marine organisms during March in normal seawater found around the station with the expert and technical support of experts outside of the company to gain rearing knowhow and confirm equipment design.**
- **Starting around July, marine organisms will be reared in conditions similar to the tests to get them used to the environment.**

<Rearing tests overview>

[Scale] Fish: around 600 flounder (young fish)

Shellfish: around 600 abalone (young shellfish)

[Trial environment] Two closed circulation system rearing tank series filled with seawater around the power station and two filled with ALPS treated water diluted with seawater will be installed in the controlled area on station premises to rear organisms that will be compared against each other.

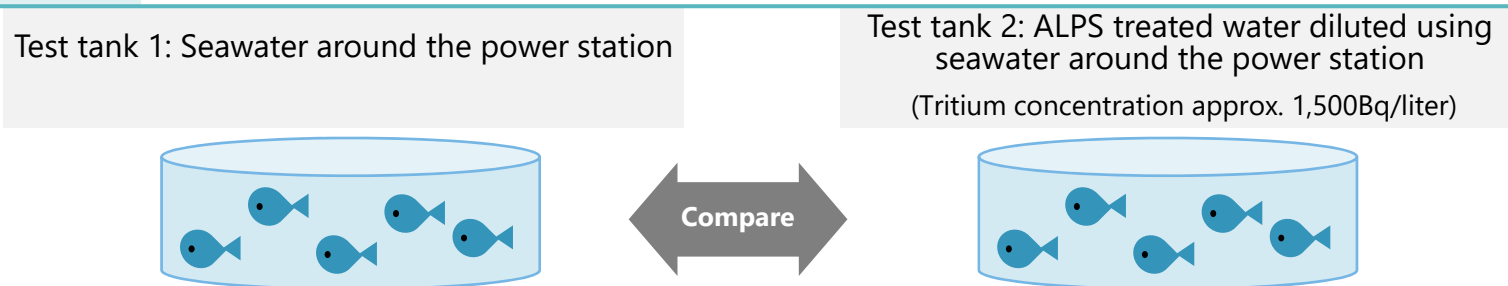
[Information disclosure] From the stage of trial rearing, the status of rearing shall be disclosed in a highly transparent and proactive manner. Once rearing practice starts, a marine organism rearing diary will be posted periodically on the company website and on Twitter

- Once rearing test starts, the rearing will be posted online using cameras and analysis results will be periodically disclosed.

3. Overview of rearing test prior to discharge of ALPS treated water into the sea

- Rearing tests on marine organisms in seawater and ALPS treated water diluted using seawater will be conducted and the growth of the organisms in their respective environments will be compared against each other. The tritium concentrations within the living bodies will be analyzed and assessed.

Trial subjects	<ul style="list-style-type: none"> • Organisms to be reared as of now are as follows. <ul style="list-style-type: none"> ➢ Fish: around 600 flounder (young fish) ➢ Shellfish: around 600 abalone (young shellfish)
Rearing tests start date	<ul style="list-style-type: none"> • Around September 2022 <ul style="list-style-type: none"> ➢ The flounder to be reared will be spawned and hatched around March 2022, and will become young fish that will grow stably in the summer. As such, the rearing tests start date is set around September after the young fish are carried onto premises and get used to the environment.
Trial environment	<ul style="list-style-type: none"> • Fish reared in seawater around the power station [rearing tank 1] and ALPS treated water diluted with seawater around the power station [rearing tank 2] will be compared. • 4 closed circulation system rearing tank series will be installed in the controlled area on station (near the front gate). <ul style="list-style-type: none"> ➢ There will be 2 seawater tank series and 2 tank series filled with ALPS treated water diluted with seawater ➢ Rearing conditions in rearing tank 1 and rearing tank 2 will be identical



【Reference】 Selecting rearing subjects

- Flounders and abalone were chosen as marine organisms to be reared based on the advice of experts, considering criteria such as the amount of accumulated knowledge on how to rear them and organism that naturally can be caught in the sea off Fukushima Prefecture.
- We will consider increasing the types of marine organisms to be reared on a separate date with input from experts.

【Advice from experts】

- The marine organisms to be reared should be organisms that are easy to rear. There should be an established body of knowledge and knowhow for how to rear them and should be caught in the sea off Fukushima Prefecture.
- Specifically, I recommend flounder and red seabream for fish and abalone for shellfish.

【Current rearing subjects※1】

Fish : Flounder※2

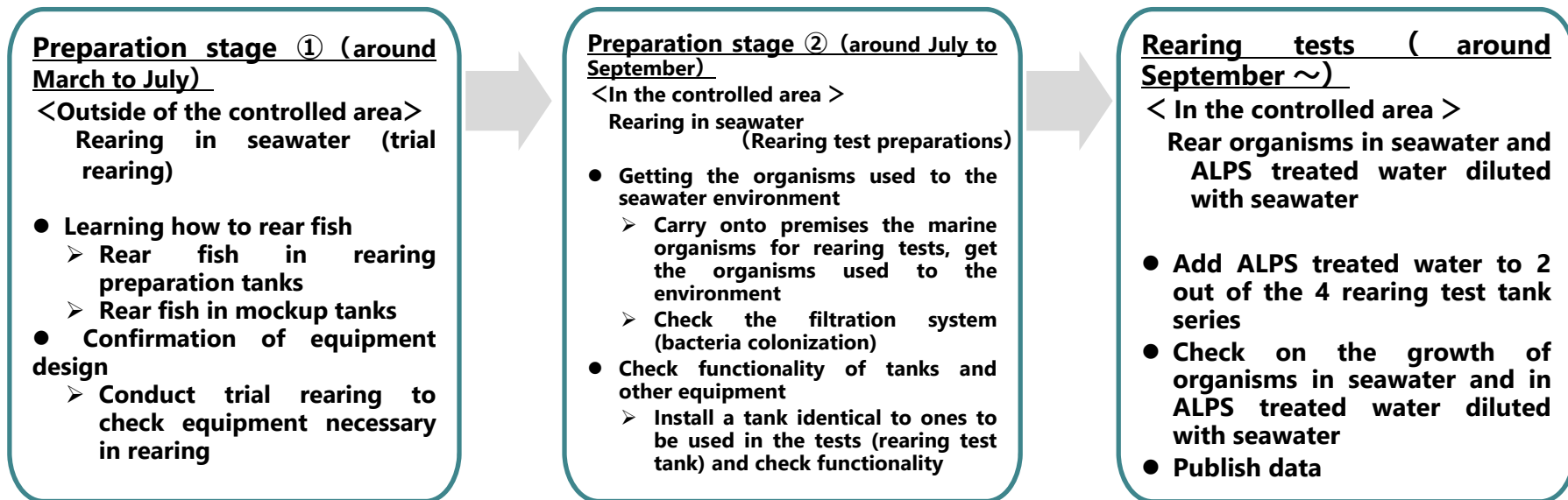
Shellfish : Abalone

※1 : Further discussions and trials will be conducted for seaweed as experts have pointed out that seaweed is difficult to determine if alive or dead and is difficult to grow in tanks. Subjects of seaweed rearing tests will be determined by May 2022.

※2 : Flounders were chosen here from the two types of fish that were recommended by experts because they are found in the sea off Fukushima Prefecture.

4. Preparations for rearing test

- Flounder rearing technologies are well established. Preparations for the start of rearing tests are underway under the guidance of experts.
- To ensure rearing tests come smoothly, the time until the start of rearing tests around September 2022 is positioned as the “preparation stage.”



Preparation stage① [Rearing practice]: 100 flounders, separate from those to be used in the rearing tests, will be reared to learn how to rear flounder and to grow bacteria necessary in maintaining water quality (the bacteria once grown, will be moved to a feeding test tank)

Preparation stage ② [Rearing test preparations]: The functionality of the rearing test tank and the surrounding equipment will be confirmed. Afterward, marine organisms for the rearing tests will be carried in and let go in the rearing test tanks (4 tank series) to get them used to the seawater environment, to check them for any diseases and to confirm bacteria colonization.

Rearing tests: The rearing tests will start once ALPS treated water is added to 2 out of the 4 rearing test tank series.

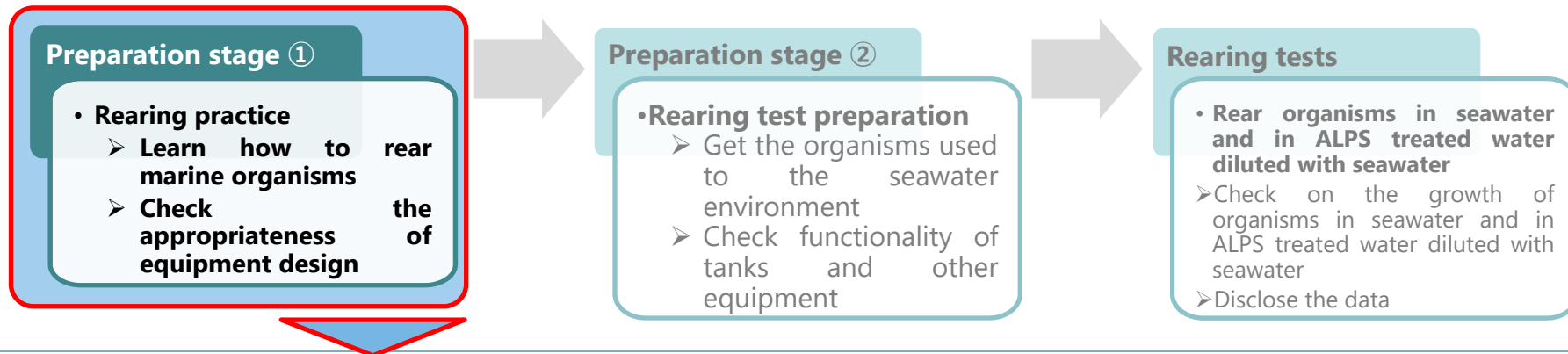
【Reference】 Details of rearing preparation to rearing test



Stage	Rearing details	Goals (deliverables)	Location
<p>Preparation stage① [Rearing practice] (around March to July)</p>	<ul style="list-style-type: none"> ● Equipment: 1 tank series(normal seawater) ● Rear:100 flounder (Hatched in 2021) 20 abalone <p>Details of seaweed to be reared are being discussed</p>	<ul style="list-style-type: none"> ● Learn how to rear marine organisms ● Finalize detailed design of rearing test tanks ● Prepare filtration systems (grow bacteria) ● Exact requirements necessary for rearing equipment other than tanks ● Create rearing and operating procedures 	<p>On station premises</p> <ul style="list-style-type: none"> - Outside of the controlled area - - Near the partner company office buildings -
<p>Preparation stage② [Rearing test preparations] (around July to September)</p>	<ul style="list-style-type: none"> ● Equipment: 4 tank series (normal seawater) ● Rearing: 600 flounder (hatched 2022) 600 abalone 《150 abalone ×4 groups》 <p>Details of seaweed to be reared are being discussed</p>	<ul style="list-style-type: none"> ● Carry in flounder and abalone, get them used to the environment ● Check for disease ● Check the filtration system (bacteria colonization) ● Check the functionality of rearing tanks, power systems, and air conditioning and ventilation systems ● Check operating procedures at this scale ● Check emergency response procedures ● Check expert cooperation structure 	<p>On station premises</p> <ul style="list-style-type: none"> - Inside the controlled area - - Near the front gate -
<p>Rearing tests (around September -)</p>	<ul style="list-style-type: none"> ● Equipment: 4 tank series <ul style="list-style-type: none"> • 2 normal seawater tank series • 2 tank series of ALPS treated water diluted with seawater ● Rearing: 600 flounder 600 abalone 《150 abalone ×4 groups》 <p>Details of seaweed to be reared are being discussed Flounder from Preparation stage ② will be used in the tests</p>	<ul style="list-style-type: none"> ● Disclose growth of fish in an easy-to-understand manner ● Disclose data on radiation 	<p>On station premises</p> <ul style="list-style-type: none"> - Inside the controlled area - - Near the front gate -

【Reference】 Overview of Preparation stage ①

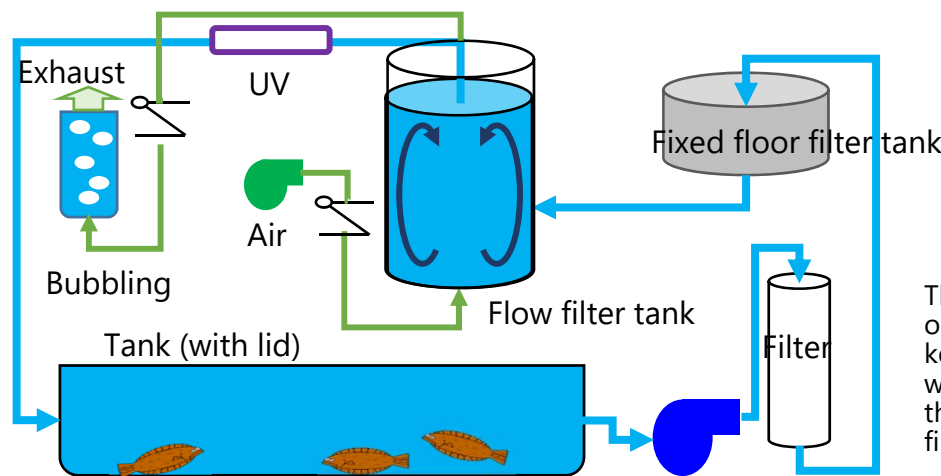
- In Preparation stage ①, flounder and abalone (100 flounder and 20 abalone) will be reared in seawater surrounding the Fukushima Daiichi Nuclear Power Station on station premises (outside of the controlled area.)
- The goal is to finalize detailed design of rearing test tanks and to learning how to rear marine organisms.



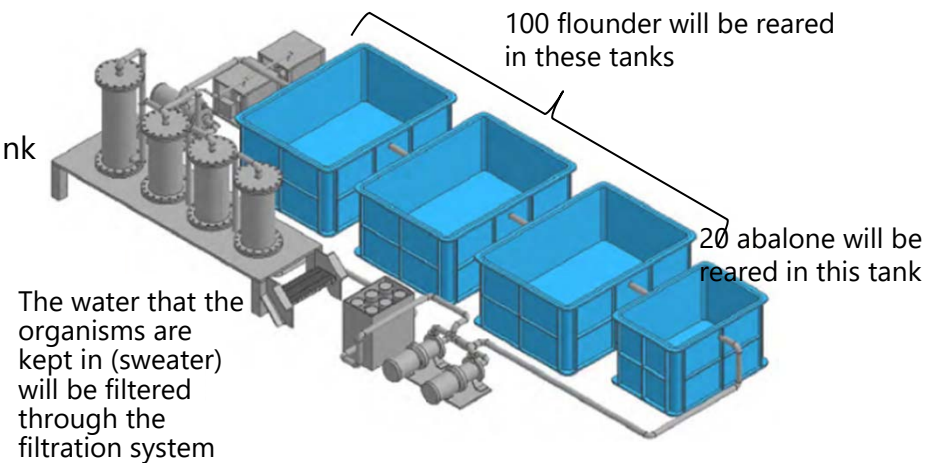
Test stage	Details	Goals (deliverables)	Location	
Rearing practice Learn how to rear tests in preparation for the rearing tests	Rearing preparation tank	<ul style="list-style-type: none"> • Equipment: 1 rearing tank series (Normal seawater) • Rearing: 100 Flounder 	<ul style="list-style-type: none"> • Learn how to rear marine organisms 	On station premises - Outside of the controlled area - - Near the contractor buildings -
	Mockup tank	<ul style="list-style-type: none"> • Equipment: 1 rearing tank series (Normal seawater) • Rearing: Flounder, abalone, seaweed (TBD) Flounder will be transported from the rearing preparation tank. 20 abalone 	<ul style="list-style-type: none"> • Learn how to rear marine organisms • Finalize detailed design of rearing test tanks • Exact requirements necessary for rearing equipment other than tanks • Create rearing and operating procedures 	On station premises - Outside of the controlled area - - Near the west gate -

【Reference】 Design of mockup tanks (Preparation stage ①) **TEPCO**

- Rearing organisms on land using closed-loop circulation tanks
 - The water that the organisms are kept in (seawater) will be filtered through the filtration system and recycled
- Objectives of mockup tank design
 - Can rear marine organisms for a long time in a healthy state
 - Expected equipment problems can be dealt with appropriately
 - Can be maintained and expanded easily



Mockup tank system
(equivalent to one rearing test tank series)



Mockup tank system
(equivalent to one rearing test tank series)

Large plastic tank (box-shaped)

Large tank
Size :2.0m×1.1m×0.80m (outer size) Capacity : 1,200L
Small tank
Size:1.3m×0.9m×0.7m(outer size) Capacity: 500L

5. Information disclosure policy for the rearing test

- The status of trial rearing and rearing tests shall be disclosed in a highly transparent and proactive manner

The status of trial rearing



Status of rearing tests



Occurrence of abnormality



Conclusion of Rearing tests

- Once rearing in rearing preparation tanks start, the state of the marine organisms will be shared on the company website and on Twitter (starting around March)
- The following will be disclosed once the rearing test starts
 - Purpose and overview of the rearing tests, fundamental information on organic contamination of tritium
 - Constant: The online publication of the rearing tanks using monitoring camera
 - Periodic: Rearing environment (water quality, temperature, etc.), rearing condition (changes in the number of organisms), analysis results (comparison of tritium concentrations in living bodies and tritium concentration in seawater, etc.)
- Details and cause of abnormality
- Summary of the rearing tests

6. Schedule



Test stage	Location	FY2021		FY2022				FY2023	
		3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q
Preparation stage① (Rearing practice)	On station premises - Outside of the controlled area - - Near the contractor buildings -	Learn how to rear marine organisms in the rearing preparation tank		Learn how to rear marine organisms and grow bacteria in the mockup tank					
Preparation stage② (Rearing test preparation)	On station premises - Inside the controlled area - - Near the front gate -	Hatch and grow founder for the rearing tests 【Hatching】		【Carrying onto premises】 Check rearing tests equipment functionality, start getting the flounder used to the seawater environment, check for diseases, check on bacteria colonization					
Rearing tests				Rearing tests				Disclose data obtained in rearing tests	

The schedule is subject to change based on progress made

【Reference】 Nuclides subject to analysis in the rearing test

- The radioactive materials concentration of the diluted ALPS treated water and the marine organisms will be measured once rearing test starts according to the sea area monitoring section of the Comprehensive Monitoring Plan currently being developed. Results will be published every month.
 - The appropriateness of locations, frequency and methods (measured nuclides, lower limit of measurement, minimum limit of detection, and items subject to measurement) are being discussed in the Ministry of the Environment's Expert Committee on Sea Area Monitoring for ALPS Treated Water.
- A concrete analysis plan for the rearing tests will be disclosed when the Comprehensive Monitoring Plan is finalized.
- The plan will be revised as needed based on the results of assessments on the impact that the discharging ALPS treated water into the sea may have on people and the environment, and the opinions from parties concerned.

【Reference】 Developing an implementation structure for the marine organisms rearing test

- Multiple external research organizations are reviewing our plans and the basic design of our equipment.
- We are coordinating with experts from outside of the company to gain their technical expertise in determining if the fish are diseased, and to secure objectivity in tritium analysis.
- Persons experienced in rearing flounder have been secured to check on the fish daily, and the manage the tanks and the water quality. Technicians who are experienced in handling and analyzing radioactive materials have also been secured.

Implementati on structure	Type of work	Examples
Roles of external experts	Technical support	<ul style="list-style-type: none">• Provide advice regarding the rearing tests generally• Evaluate when abnormalities occur (determination of whether it is a disease that occurs even under normal aquafarming conditions)• Analyze tritium in organisms (analyze as a third party and compare results with TEPCO analysis results)