

# Fukushima Daiichi Nuclear Power Station

## Progress in preparations for the marine organisms rearing test

<Reference Material>  
September 12, 2022  
TEPCO Holdings  
Fukushima Daiichi D&D Engineering Company

- In order to alleviate people's concerns and to cultivate peace of mind, we will rear marine organism in tanks of seawater containing ALPS treated water and compare them with organism 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.
- We had started practicing rearing flounder in seawater found around the station in March to learn how to rear marine organisms and to verify equipment design, and have accumulated know-how in breeding. Having also experienced parasites-related deaths and deaths due to the difference of salinity in salt baths※ to eliminate parasites, we have started rearing practice in the mockup tanks in July with improvements, such as reviewing tank design considering the elimination and reduction of parasites and bathing the flounder in salt baths to get rid of the parasites when they first come into the facility.

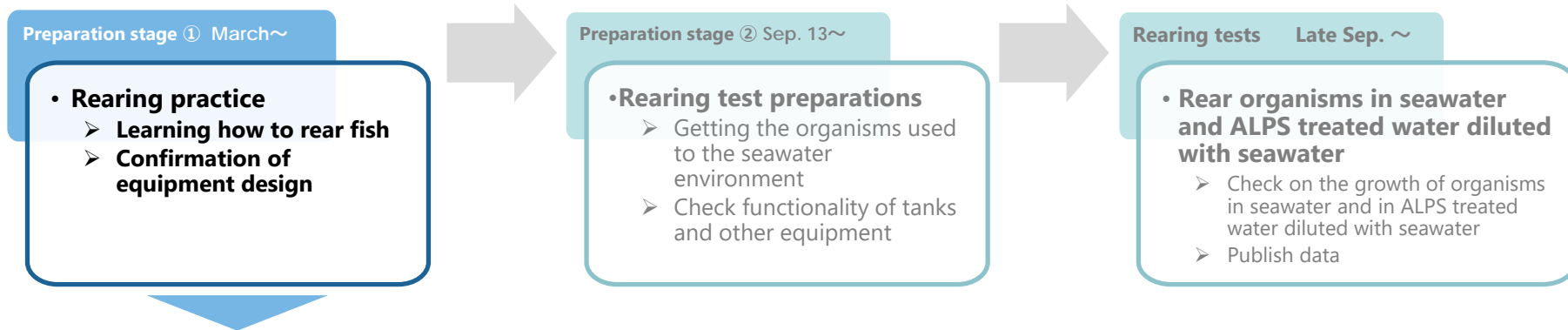
※Salt bath: A way to eliminate parasites in fish by using the difference in salinity in seawater and osmotic pressure in the parasite's body.

<Announced as of July 21, 2022>

- During rearing practice conducted since July with mockup tanks, we made improvements to review tank design considering the elimination and reduction of parasites and to get rid of the parasites, and confirmed that the improvements are effective.
- In light of this progress we will be moving on to the next phase of rearing test preparation (hereinafter referred to as, "Preparation stage ② (rearing test preparation)") tomorrow, September 13.
- During "Preparation stage ② (rearing test preparation)" tanks for rearing test of the same design as the mockups and ancillary equipment will be newly installed in the controlled areas on station premises and new marine organisms (flounder) to be used for the rearing test will be put into the tanks. Seawater from around the power station will be used in the tanks to allow the marine organisms to acclimate.
- We plan to begin rearing tests at the end of September but we also believe it will be effective to conduct rearing tests using concentrations of tritium that will actually be discharged into the sea. Therefore, we plan to conduct additional rearing tests using water from around the tunnel outlet which will have a concentration of tritium of around 30Bq/L.

# 1. Overview of the rearing practice (Preparation stage ①)

- During Preparation stage① (Rearing practice), rearing practice tanks and mockup tanks on station premises (outside of the controlled area) were used to rear flounder, abalone, and sea lettuce using seawater from around the power station in order to acquire rearing know-how and perform detailed examinations of the design of rearing test tanks.
- During rearing practice with mockup tanks we made improvements to review tank design considering the elimination and reduction of parasites and to get rid of the parasites, and confirmed that the improvements are effective. (Refer to the chart below)



| Test stage  | Details   | Deliverables   | Period           | Location   |
|---|---|--|------------------|--|
| Rearing preparation tank  | <ul style="list-style-type: none"> <li>● Equipment: 1 rearing tank series (Normal seawater)</li> <li>● Target : Flounder<br/>140 flounder</li> </ul>  | <ul style="list-style-type: none"> <li>• Learn how to rear marine organisms</li> </ul>   | March ~ July     | On station premises<br>- Outside of the controlled area -<br>- Near the contractor buildings - |
| Rearing practice<br>Learn how to rear marine organisms for Rearing test | <ul style="list-style-type: none"> <li>● Equipment: 1 rearing tank series (Normal seawater)</li> <li>● Target : Flounder, abalone, seaweed (sea lettuce)<br/>Flounder will be transported from the rearing preparation tank (approx. 80), approx. 30 abalone, around 2 kg of seaweed</li> </ul> | <ul style="list-style-type: none"> <li>• Learn how to rear marine organisms</li> <li>• Finalize detailed design of rearing test tanks</li> <li>• Exact requirements necessary for rearing equipment other than tanks</li> <li>• Create rearing and operating procedures</li> </ul> | July ~ September | On station premises<br>- Outside of the controlled area -<br>- Near the west gate -            |

## 【Reference】 Leveraging the know-how and experience gained in rearing practice

- During rearing practice, we enlisted the assistance of experts from outside the company to train employees how to rear flounder while also managing water tank/water quality and checking the development of flounder and abalone, etc. on a daily basis.

### Opinions received from external experts

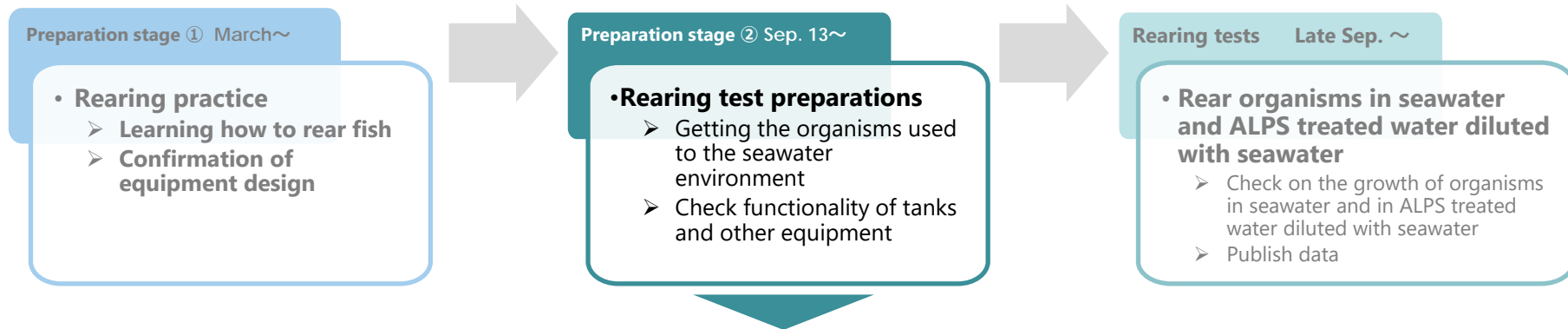
- It's impossible to completely eliminate parasites, but the equipment, methods, and parasite countermeasures employed during current rearing training are not inferior, so you should continue to do just what you're doing. However, since we anticipate that the period of rearing will be very long, an issue to address is how to maintain this level of management into the future.
  - You're performing the basics for marine organisms rearing and there are no problems. If you aim to rear for a longer period of time you will have to be further innovative in regards to methods for maintaining dissolved oxygen, and the flow in water tanks and filtration tanks.
- Based on our experience gained in use of the rearing practice tanks, we made improvements to review tank design considering the elimination and reduction of parasites and to get rid of the parasites (bathing the flounder in salt baths) when they first come into the facility.

### Primary parasite countermeasures

- [ Measures to prevent parasites from getting in ]  
Salt baths are implemented before new fish are put in the tanks in order to prevent parasites from getting into the mockup tanks
  - [ Measures to prevent parasites from spreading ]  
UV sterilizers have been installed in each tank to eliminate parasites (including eggs) before they can spread to other water tanks
  - [ Measures for detecting parasites ]  
Random inspections of flounder are conducted (in order to find parasites early), in addition to searches for the eggs of parasites in rearing practice tanks, and additional countermeasures are deliberated as necessary
- Based on the knowledge gained from the mockup tank we have revised operating methods to enable us to maintain suitable water quality for the rearing of abalone, such as stipulating conditions for filter materials and flow speed.
  - Further improvements will be made during the rearing test preparation phase as we move towards actual rearing tests.

## 2. Commencement of rearing test preparation (Preparation stage ②)

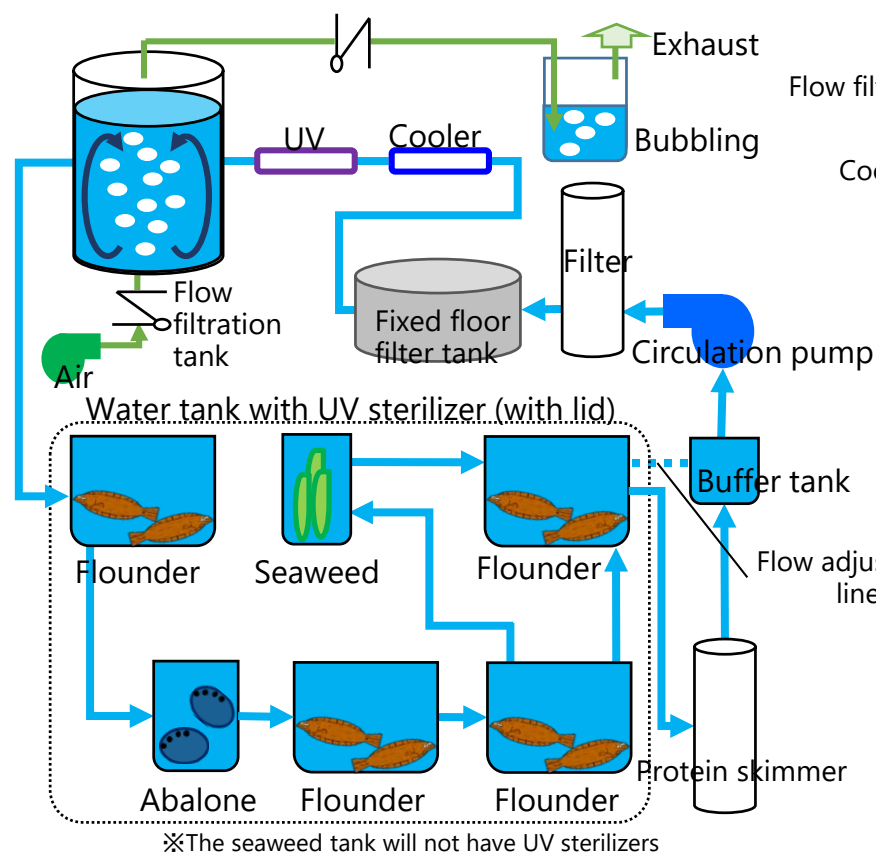
- In light of the progress made during Preparation stage ① (Rearing practice), such as acquiring rearing know-how and examining the design of rearing equipment, we will be moving on to the next phase, Preparation stage ② (Rearing test preparation), tomorrow (September 13).
- During “Preparation stage ② (rearing test preparation)” tanks for rearing test of the same design as the mockups and ancillary equipment will be newly installed in the controlled areas on station premises and new marine organisms (flounder) to be used for the rearing test will be put into the tanks. Seawater from around the power station will be used in the tanks to allow the marine organisms to acclimate.



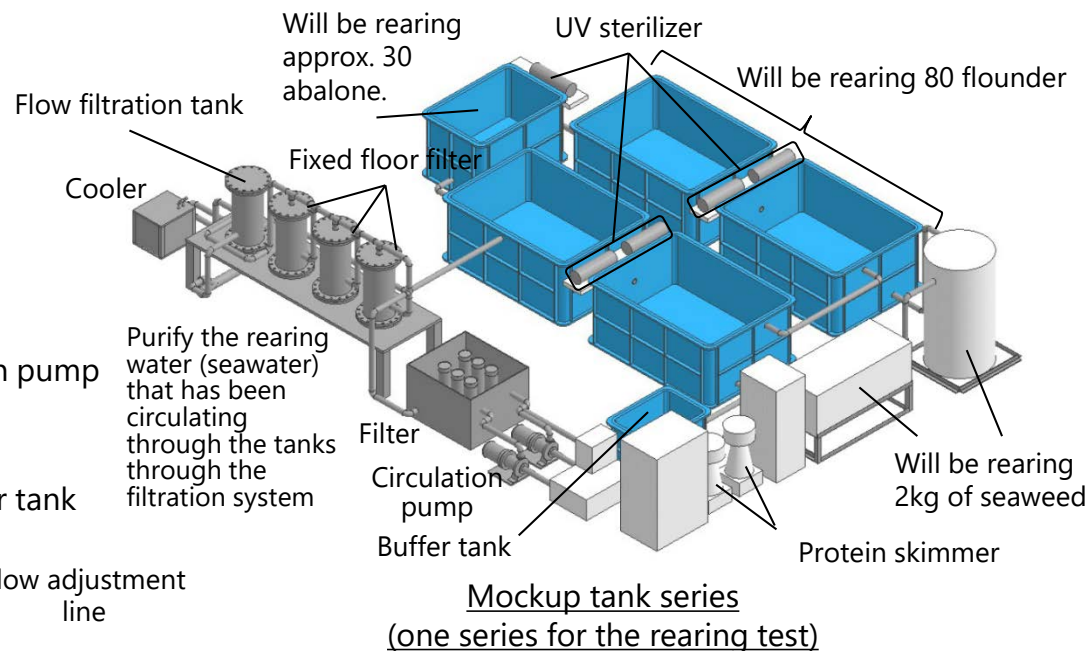
| Stage   | Details   | Primary Goals  | Location  |
|---|---|--|---|
| <b>Preparation stage ②</b><br>[Rearing test preparations] | <ul style="list-style-type: none"> <li>● Equipment: 5 rearing tank series (Normal seawater)</li> <li>● Target: Approx. 750 flounder <small>(Born in 2022)</small><br/>               《150 flounder × 5 series》</li> </ul> | <ul style="list-style-type: none"> <li>● Examine rearing test tank functions</li> <li>● Examine filtration systems (bacteria adherence)</li> <li>● Bring in flounder and allow them to acclimate</li> <li>● Check for diseased flounder</li> <li>● Examine procedures for using actual test equipment</li> </ul> | On station premises<br>- Inside of the controlled area -<br>- Near the front gate - |

### 3. Detailed design of rearing test tanks

- There have been no large issues during rearing practice using mockup tanks, which began in July, so the rearing test tanks will be designed just like the current mockup tanks.



**Mockup tank series**  
(one series for the rearing test)



#### Large plastic tank

Tank for flounder: Size 1.7m×1.2m×0.7m(Outer size), capacity : 1,000L  
 Tank for abalone: Size 1.1m×0.8m×0.6m(Outer size), capacity : 400L  
 Tank for seaweed:  
 Box (placed horizontally): Size 1.2m×0.6m×0.6m(Outer size), capacity : 200L  
 Round (placed vertically): Size (diameter) 0.5m×1.5m(Outer size), capacity : 200L

※The actual size and capacity of the tank may be different

# 4. Schedule

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

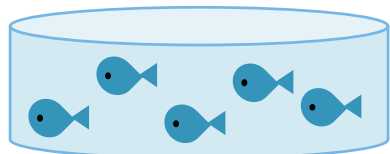
The schedule is subject to change based on progress made

# 【Reference】 Overview of rearing test prior to discharge of ALPS treated water into the sea

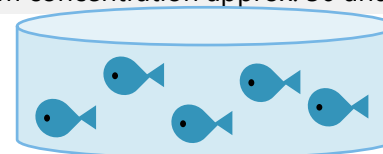
- Rearing tests on marine organisms in seawater and ALPS treated water diluted using seawater will be conducted and the growth of the organisms in their respective environments will be compared against each other. The tritium concentrations within the living bodies will be analyzed and assessed.
- We believe it will be effective to conduct rearing tests using concentrations of tritium that will actually be discharged into the sea for achieving the goals of the rearing test. Therefore, we plan to conduct additional rearing tests using water from around the tunnel outlet which will have a concentration of tritium of around 30Bq/L.

|                          |  |
|--------------------------|--|
| Trial subjects           | <ul style="list-style-type: none"><li>• Organisms to be reared as of now are as follows.<ul style="list-style-type: none"><li>➢ Fish: around 750 flounder (young fish) (Number including additional rearing tests)</li><li>➢ Shellfish: around 750 abalone (young shellfish)</li><li>➢ Seaweed: sea lettuce, gulfweed (around several kg)</li></ul></li></ul>  |
| Rearing tests start date | <ul style="list-style-type: none"><li>• Late September, 2022 (plan)<ul style="list-style-type: none"><li>➢ 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 late September after the young fish are carried onto premises and get used to the environment.</li></ul></li></ul>  |
| Trial environment        | <ul style="list-style-type: none"><li>• Fish reared in seawater around the power station [Rearing tank 1 (2 series)] and ALPS treated water diluted with seawater around the power station [Rearing tank 2 (3 series)] will be compared.</li><li>• 5 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"><li>➢ There will be 2 seawater tank series and 3 tank series filled with ALPS treated water diluted with seawater</li><li>✓ Approx. 30Bq/L × 1 series (additional rearing tests), Approx. 1,500Bq/L × 2 series</li><li>➢ Rearing conditions in rearing tank 1 and rearing tank 2 will be identical except for the water</li></ul></li></ul> |

Test tank 1: Seawater around the power station  
(Tritium concentration approx. 1Bq/L)

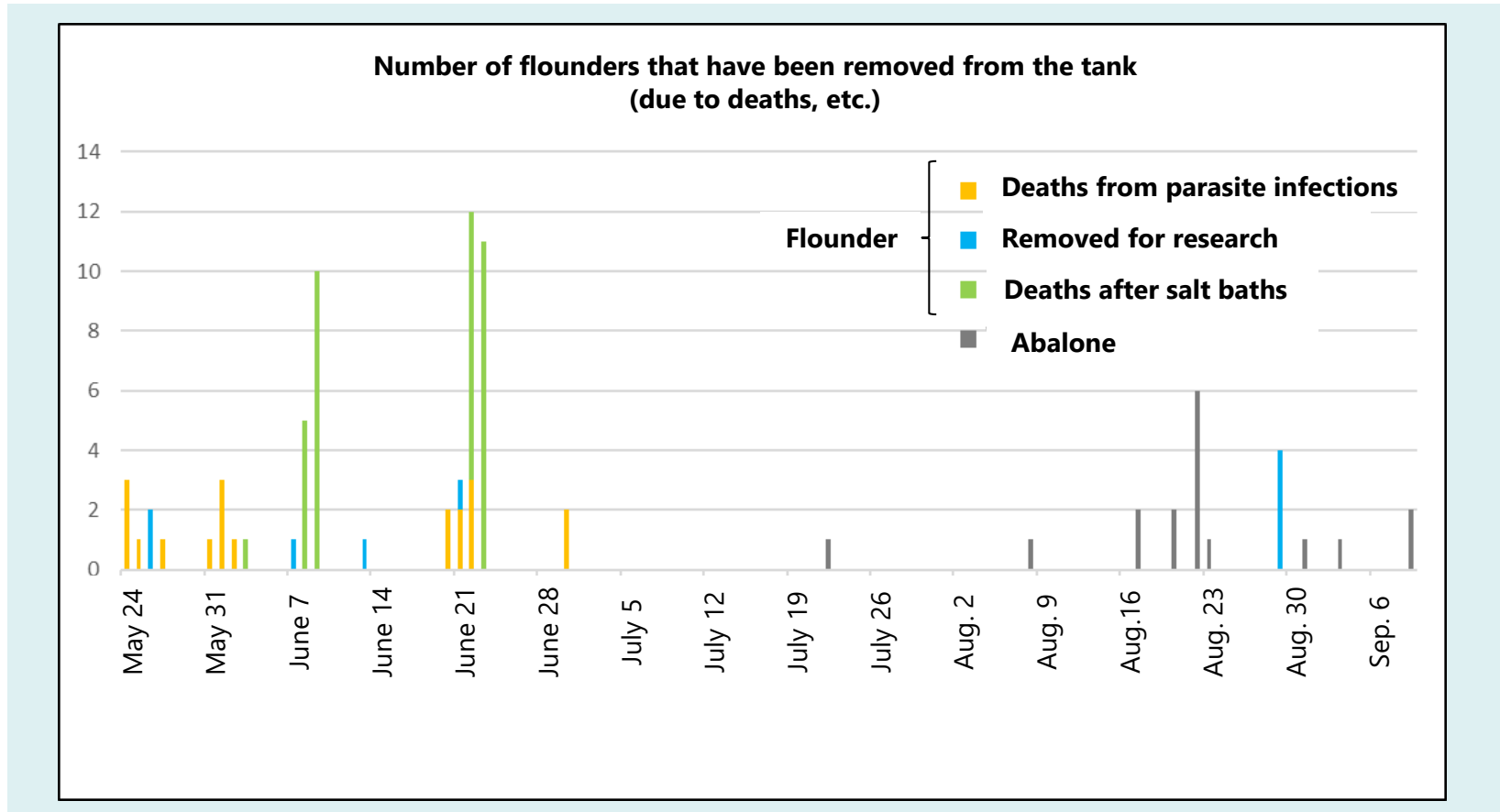


Test tank 2: ALPS treated water diluted using seawater around the power station  
(Tritium concentration approx. 30 and 1,500Bq/L)



# [Reference] Rearing status in marine organism rearing tests

| Tank series | Classification  | Changes in number of organisms   |   |
|-------------|-----------------|--|---|
|             |                 | Number of flounder removed from the tank   | Number of flounder left (as of Sep. 9, 2022 at 9AM) |
| 1           | Normal seawater | Flounder : 64 (19 deaths due to parasites, 9 for research, 36 deaths after salt baths)<br>Abalone : 17 | Flounder : 76<br>Abalone : 13                       |



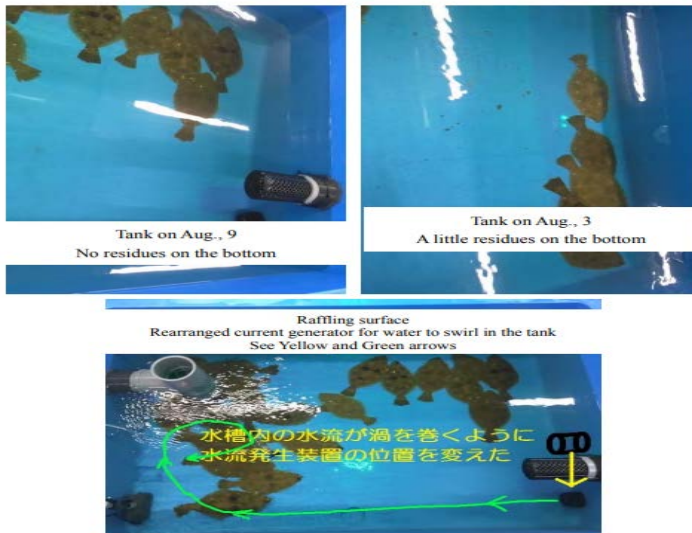


# 【Reference】 Updates on marine organisms rearing on the TEPCO's website and on Twitter

<Marine Organism Rearing Log>

9 AM, August 9, 2022  
Weather: Sunny  
Water temperature: 18.1°C

We fed them yesterday but the water remains so clear! No leftovers, nor other residues on the bottom of the tank! A little bit of those used to be left in the tank even after the cleaning. We rearranged the current generator for water to swirl in the tank to suck up the dirt on the bottom of the tank in order to efficiently remove dirt with filters on the downstream, it has made this change. These are the Days of Trial-and-Error.



【TEPCO's website】



【Twitter】 (in Japanese only)

- Since March 17, we have been updating the public on marine organisms rearing on the TEPCO's website and on Twitter.
  - Website : <https://www.tepco.co.jp/en/hd/decommission/information/newsrelease/rearing/index-e.html>
  - Twitter : <https://twitter.com/TEPCOfishkeeper> (in Japanese only)