# Fukushima Daiichi Nuclear Power Station
# Progress in preparations for the marine organisms rearing test

<Reference Material>
July 14, 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 plan to start marine organism rearing test in seawater and in seawater containing ALPS treated water around September 2022. Before starting the rearing tests, we have started practicing rearing flounder in seawater found around the station in March to learn how to rear marine organisms and to verify equipment design.

<Announced as of March 17, 2022>

- In practicing rearing with the experienced flatfish breeder within this company and technical help of external experts, we have been routinely managing tanks and water quality and checking on the growth of flounder, and have been able to train in-house staff in flounder rearing.
- Having also experienced parasites-related deaths and deaths due to the difference of salinity in salt baths※ to eliminate parasites, we have also decided to make 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.
- In rearing practice that we will be starting in the mockup tanks in late July, we will equip each tank with a UV sterilizer to prevent the spread of parasites and their eggs to other tanks. To prevent new flounder from bringing in parasites into the tanks, the new flounder will be bathed in salt water. All flounder will be periodically tested for parasites. Abalone and seaweed will also be reared in these mockup tanks.
- The actual rearing tests on schedule to start in September as planned as the design of the mockup tanks will be used for the actual rearing test tanks, and the bacteria is being grown in separate tanks.

※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.

# 1.1 Overview of the practice for rearing tests
## （Preparation stage ①-1　Rearing preparation tank）

- During Preparation stage① （Rearing practice), we have been rearing 140 flounder (100 for rearing practice, 40 for analysis practice) in the rearing preparation tanks on station premises (outside of the controlled area) in seawater around the station since March to learn how to rear marine organisms and to establish detailed design of the rearing test tank.

**Preparation stage ①**
- **Rearing practice**
  - **Learning how to rear fish**
  - **Confirmation of equipment design**

**Preparation stage ②**
- **Rearing test preparations**
  - Getting the organisms used to the seawater environment
  - Check functionality of tanks and other equipment

**Rearing tests**
- **Rear organisms in seawater and ALPS treated water diluted with seawater**
  - Check on the growth of organisms in seawater and in ALPS treated water diluted with seawater
  - Publish data

| Test stage | | Details | Goals (deliverables) | Location |
|---|---|---|---|---|
| Rearing practice<br>Learn how to rear marine organisms for Rearing test | Rearing preparation tank | ● Equipment: 1 rearing tank series<br>(Normal seawater)<br>● Rearing：Flounder<br>140 flounder | • Learn how to rear marine organisms | On station premises<br>- Outside of the controlled area -<br>- Near the contractor buildings - |
| | Mockup tank | ● Equipment: 1 rearing tank series<br>(Normal seawater)<br>● Rearing：Flounder, abalone, seaweed<br>Flounder will be transported from the rearing preparation tank (approx. 80), approx. 30 abalone, around 2 kg of seaweed | • Learn how to rear marine organisms<br>• Finalize detailed design of rearing test tanks<br>• Exact requirements necessary for rearing equipment other than tanks<br>• Create rearing and operating procedures | On station premises<br>- Outside of the controlled area -<br>- Near the west gate - |

# 1.2 Knowhow and experience gained in rearing practice

- In practicing rearing with the experienced flatfish breeder within this company and technical help of external experts, we have been routinely managing tanks and water quality and checking on the growth of flounder.
- Meanwhile we also experienced parasites-related deaths and determined the effects of the difference of salinity in salt baths to eliminate parasites.

- Through rearing practice, we have learned about the appropriate timing and amount of feed, and the appropriate water environment in terms of ammonia levels and alkalinity.
- We will be reviewing the tank design to eliminate or reduce parasites, and the way to bath the flounder in salt baths to get rid of the parasites when they first come into the facility.
  - Salt baths of different concentrations and lengths are being tested to find the sweet spot between the effects of salt bath on flounder health and the effects on parasites. (Outside of the salt bath testing, 5 flounders have died for the investigation thus far)

■ Overview of salt bath investigation

| Tank | Number of deaths due to parasites | Salt bath conditions | Number of deaths from the salt bath |
|---|---|---|---|
| Tank #1 | 12 | Bathed in seawater with a small amount of salt for a long period of time | 1 |
| Tank #2 | 0 | Bathed in seawater with a large amount of salt added for a very short period of time | 15 |
| Tank #3 | 0 | Bathed in seawater with a medium amount of salt added for a short amount of time | 0 |
| Tank #4 | 7 | Bathed in seawater with a medium amount of salt added for longer period of time | 20 |

＊Analysis of the dead flounder has found that salt baths of all conditions are effective in eliminating parasites.
＊Each of the four tanks had 35 flounders in it at the begining.

## 2. Using the knowhow and experience, and expanding the number of species reared

**（Preparation ①-2　Mockup tank)**

- To achieve the rearing test objective, we have decided to make improvements such as reviewing the 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.
- In the rearing practice that will be starting in the mockup tanks in late July, we will start rearing abalone and seaweed in addition to the flounder after making some improvements to the tank design to treat parasites.

### Major parasite measures

– 〔Measures to prevent parasites from coming into the tanks〕 Change operations

Bath the flounder before they enter the tanks to ensure parasites are not brought into the mockup tanks.

– 〔Measures to prevent the spread of parasites〕 Change tank design

Equip each tank with UV sterilizers and get rid of parasites and their eggs before they spread to other tanks.

– 〔Measures to detect parasites〕 Change operations

Take out and test flounder periodically to detect and address parasites early on.

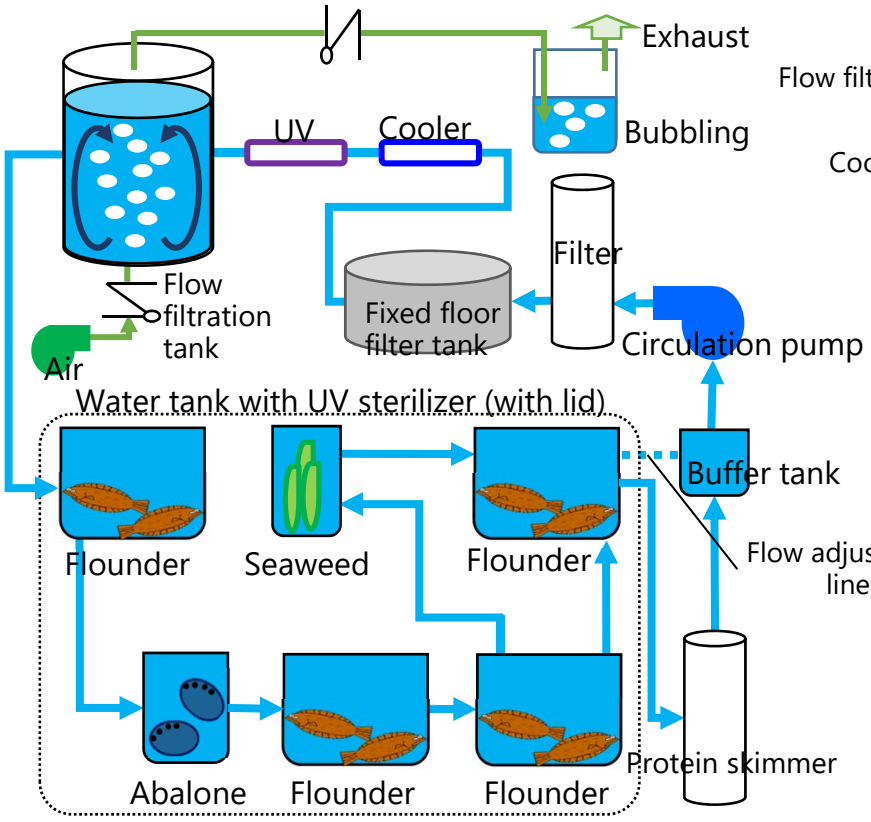
Investigate the location of the parasite eggs in the rearing preparation tanks and implement additional measures as necessary.

- The actual rearing tests in diluted ALPS treated water is scheduled to start in September as planned as the design of the mockup tanks will be used for the actual rearing test tanks and the bacteria is being grown in separate tanks.

## 2. Using the knowhow and experience, and expanding the number of species reared

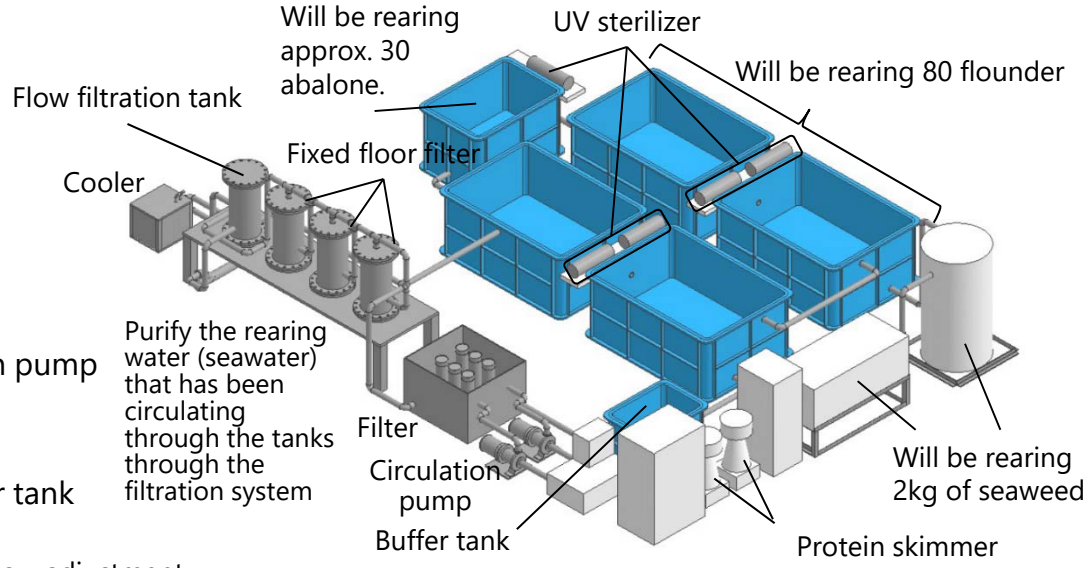
(Preparation ①-2　Mockup tank)

- While the initial design had one UV sterilizer per series of mockup tanks, the design was updated to accommodate the need to eliminate and reduce parasites. Each tank will be equipped with one UV sterilizer to prevent parasites and their eggs from spreading to other tanks.




※The seaweed tank will not have UV sterilizers

Mockup tank series
(one series for the rearing test)



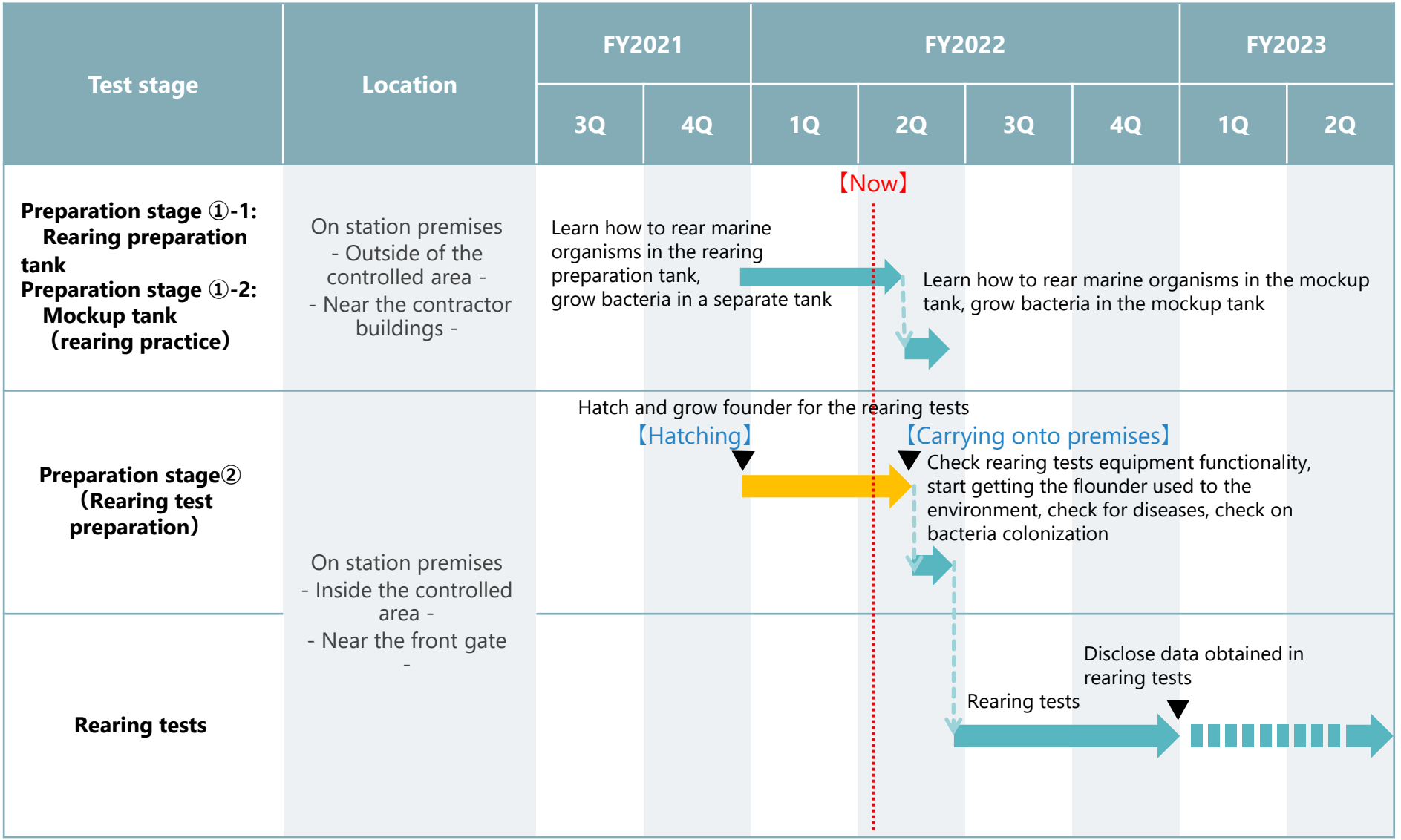

Mockup tank series
(one series for the rearing test)

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

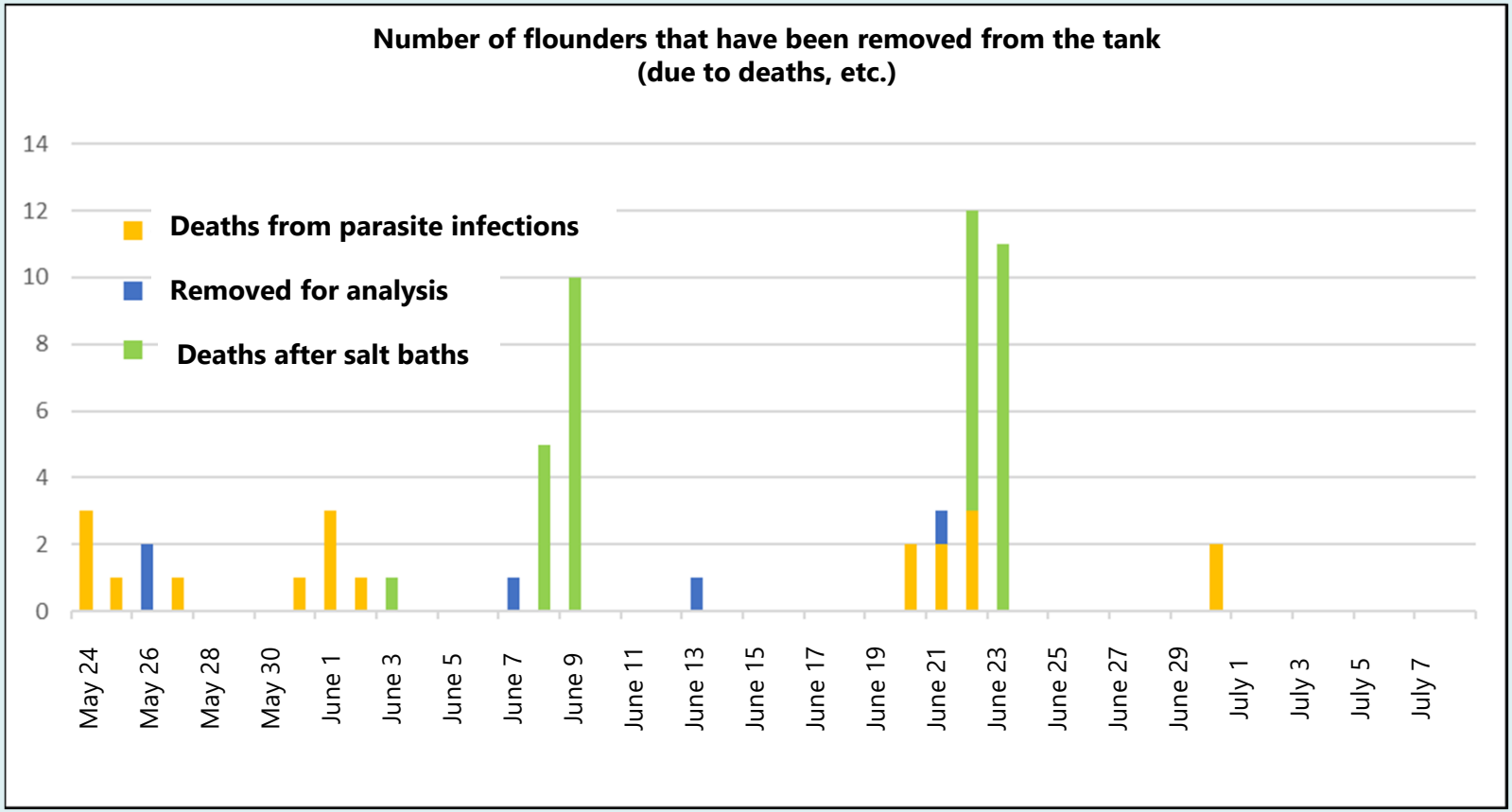
# 3．Schedule




The schedule is subject to change based on progress made

# 【Reference】Progress in marine organism rearing tests

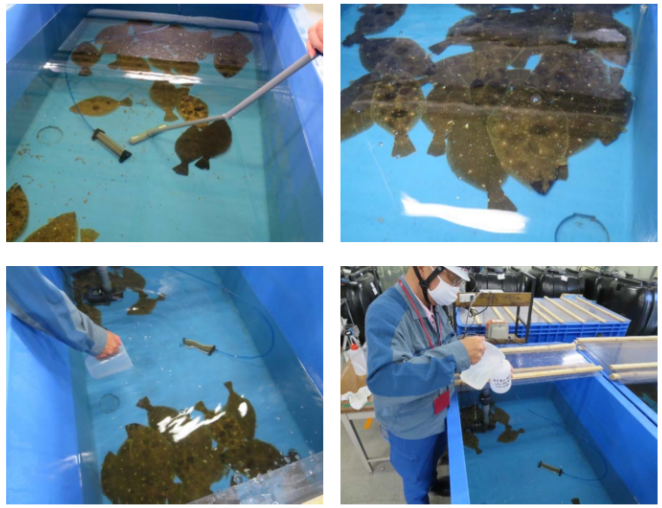
| Tank series | Classification | Changes in number of flounder | |
|---|---|---|---|
| | | Number of flounder removed from the tank | Number of flounder left |
| 1 | Normal seawater | 60（19 deaths due to parasites, 5 removed for testing, 36 deaths after salt baths) | 80 (as of July 8, 2022) |



# 【Reference】Updates on marine organisms rearing on the TEPCO website and on Twitter (in Japanese only)

Marine organisms rearing log

9 am May 30, 2022
Weather: Sunny
Water temperature: 20 ℃
We are currently practicing rearing in normal seawater. Today was cleaning day. We carefully cleaned the tank and the protein skimmer (filtering device). The flounder are doing well.
We are currently consulting with experts to try to improve the water quality.



【TEPCO website】

TEPCO (Marine organisms observation log)
@TEPCOfishkeeper

9 am May 13, 2022
Weather: Rain
Water temperature: 19.8 ℃
The flounder in the tanks has never actually seen sand for themselves but sometimes move as if they are trying to burrow into it at the bottom of the tank. We tried adding sand to the small tank and as you can see. In the wild, they hide in the sand like this, waiting to pounce on their prey.
<The next update will be on May 16.>

午後5:52 · 2022年5月13日 · Twitter Web App

【Twitter】

- Since March 17, we have been updating the public on marine organisms rearing on the TEPCO website and on Twitter.
  - Website：http://www.tepco.co.jp/decommission/information/newsrelease/breedingtest/index-j.html
  - Twitter：https://twitter.com/TEPCOfishkeeper