English

For safe and secure fish consumption

Facts on monitoring

of radioactivity in fish

2024

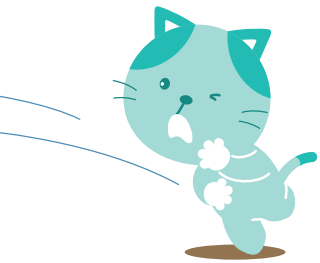
Fisheries Agency of Japan

Preface

Thirteen years have passed since the Fukushima Daiichi Nuclear Power Station accident.

The Fisheries Agency has continued to inspect and publish the concentration of radionuclides in seafood since the accident to ensure its safety. This brochure explains that the concentration of radioactive cesium in seafood has dropped significantly, and also describes the internationally recognized methods that began in fiscal 2022 and the rapid tritium analysis that began in fiscal 2023.

Table of Contents



Structure of the monitoring inspection for radioactive cesium in food

What do the “maximum levels” mean?

The Japanese maximum levels (JMLs) for radioactive cesium in general food is set at **100 becquerels (Bq)/kg** with the aim of keeping the additional exposure from food after the nuclear power station accident below the level where the lifetime effects are sufficiently small to pose no problem (1 millisievert per year). The JMLs are lowered from the maximum value (120 Bq/kg), which was calculated by taking into account the differences in intake items and amounts according to age and gender, and are designed for all generations, including infants. As the result of measures preventing the distribution of food products containing radioactive cesium concentrations above these levels, a survey conducted by the Ministry of Health, Labour and Welfare and the Fukushima Prefectural Government found that the amount of exposure from food due to radioactive cesium originating from the nuclear power plant accident is less than one-hundredth of one millisievert per year, which is the intended level.

Source :

The Story of Food and Radioactive Materials (Ministry of Health, Labour and Welfare and others)

Response to Radionuclides in Food (Ministry of Health, Labour and Welfare)

https://www.mhlw.go.jp/shinsai_jouhou/shokuhin-detailed.html#kijun

Results of Radiation Monitoring of Daily Foods (Fukushima Prefectural Government)

http://www.pref.fukushima.lg.jp/site/portal/nichijoshoku-moni.html

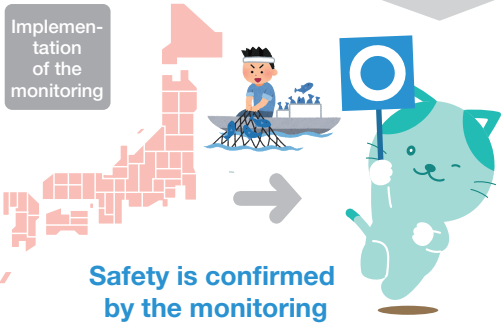
Framework of the monitoring

Monitoring plan is developed mainly by local governments

- ☑ Monitoring areas
- ☑ Target species
- ☑ Frequency

Discussion on left items and development of plans.

Implementation of the monitoring



Safety is confirmed by the monitoring

100 Bq/kg or less

Shipping

Shipping

To the dining table

Result exceeded the Japanese maximum level (100 Bq/kg)

Request for suspension of shipment by national or local government

- If the radioactive cesium concentration is higher than JMLs in particular produce at a single location, the relevant local government requests the producer to **suspend the shipment**.
- If the radioactive cesium concentration is higher than JMLs at multiple locations, the national government designates/instructs the produce and the area from where the **shipment is suspended**.

If the radioactivity level of the product exceeds JMLs?

The lot of the product is recalled and disposed of and further shipments are suspended, **thereby not distributed at the market.**

Process of the laboratory test

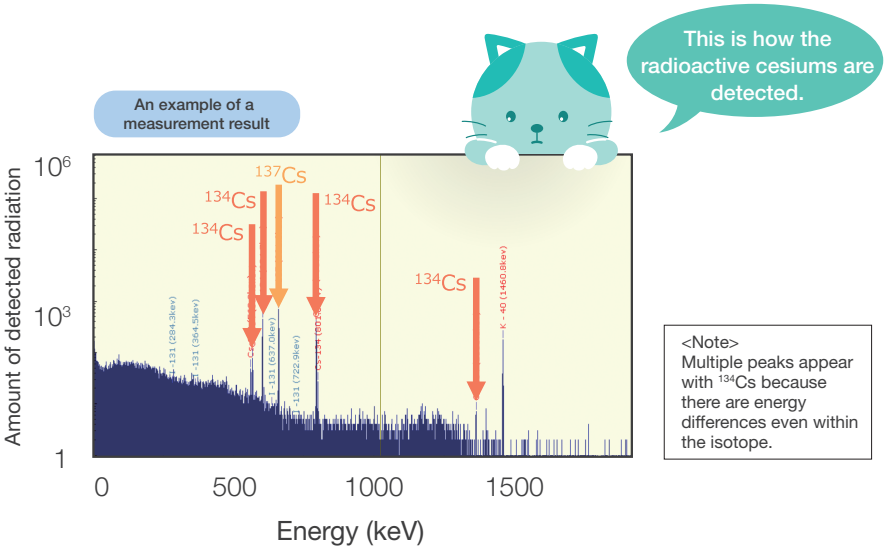
1 Receipt of fishery products

Fishery products sent from local ports are received, and checked for catch location and species.

Measurement of body length and weight 2

3 Preparation of mince

Edible parts of the fish (mainly muscle) are thoroughly minced for the test.

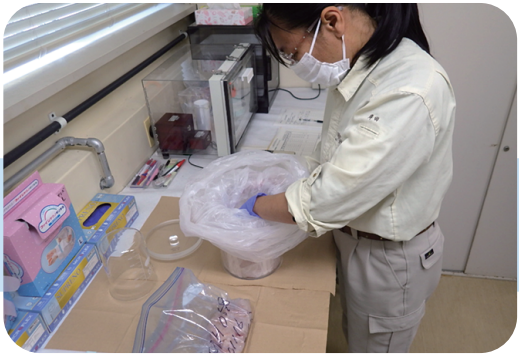


<Note>
Multiple peaks appear with ^{134}Cs because there are energy differences even within the isotope.

5 Analysis

The concentration of radioactive cesium per kilogram (Bq/kg) for the edible portion is obtained as the result of the measurement.

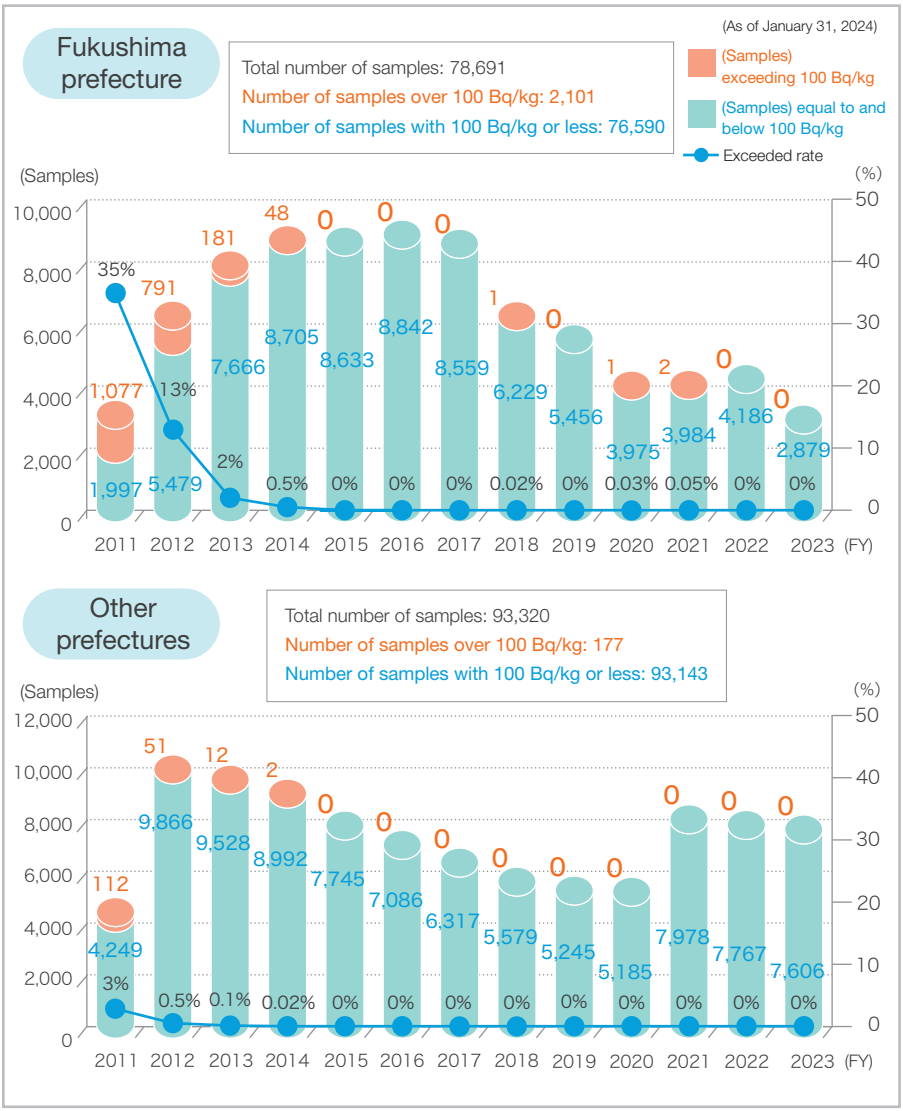
4 Place into an analytical beaker



Concentration of radioactive cesium in marine fish species

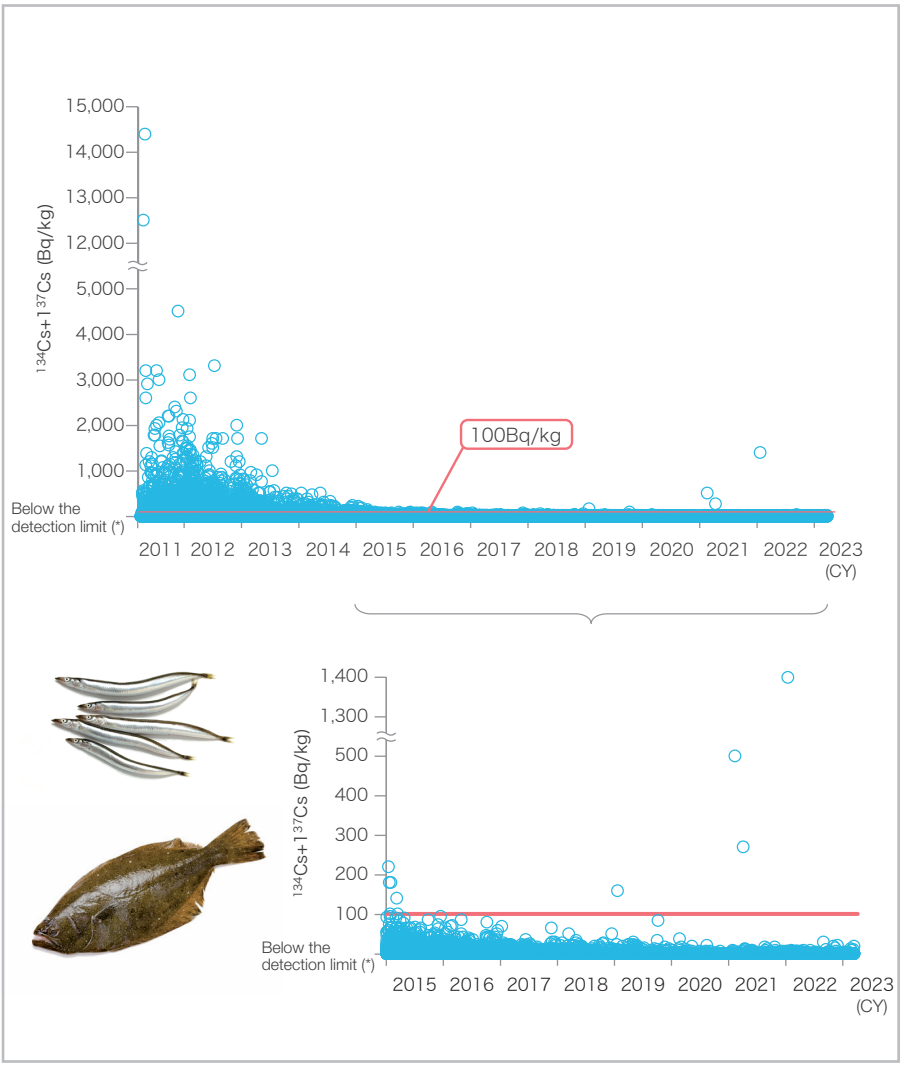
Results of the analysis of radioactive cesium in marine fish species

After the nuclear power station accident, the number of samples exceeding the JMLs has decreased over time. In Fukushima Prefecture, there have been only four samples exceeding JMLs since FY (Japanese fiscal year, 1 April to 31 March) 2015, and in prefectures other than Fukushima, no sample has exceeded JMLs since September 2014.



Changes in radioactive cesium concentration in marine fish species

After the accident, concentrations of radioactive cesium in specimens have promptly decreased with the passage of time. Today, although radioactive cesium concentrations do exceed the JMLs on extremely rare occasions, virtually all measurements fall below the detection limit.



*Detailed information about BDL (below detection limit) is provided in the column on the last page.

Concentration of radioactive cesium in freshwater fish species

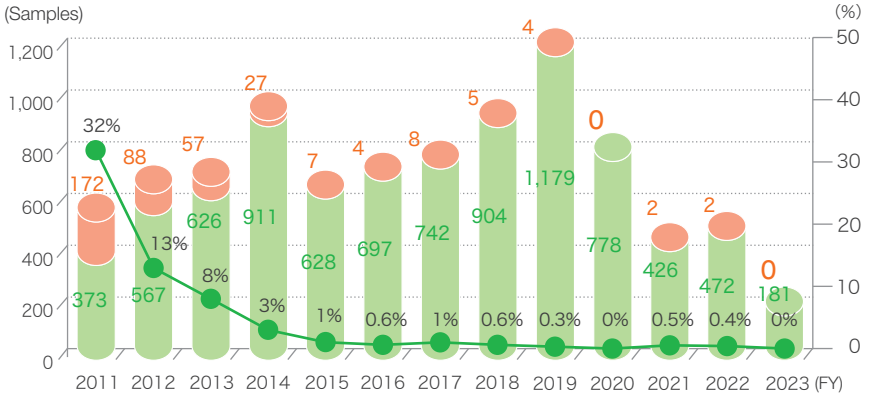
Results of the analysis of radioactive cesium in freshwater fish species

The number of samples exceeding JMLs is decreasing with the passage of time.

(As of January 31, 2024)

Fukushima prefecture

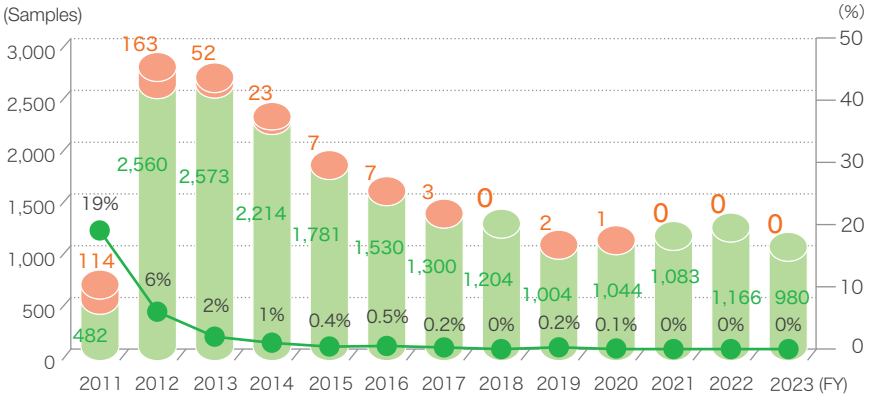
Total number of samples: 8,860
Number of samples over 100 Bq/kg: 375
Number of samples with 100 Bq/kg or less: 8,485



Other prefectures

Total number of samples: 19,293
Number of samples over 100 Bq/kg: 372
Number of samples with 100 Bq/kg or less: 18,921

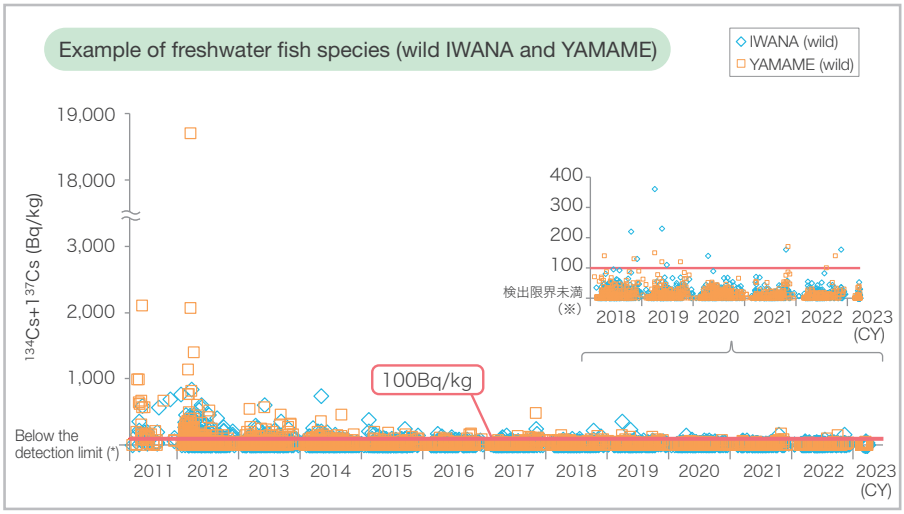
The number of samples exceeding the limit is gradually decreasing.

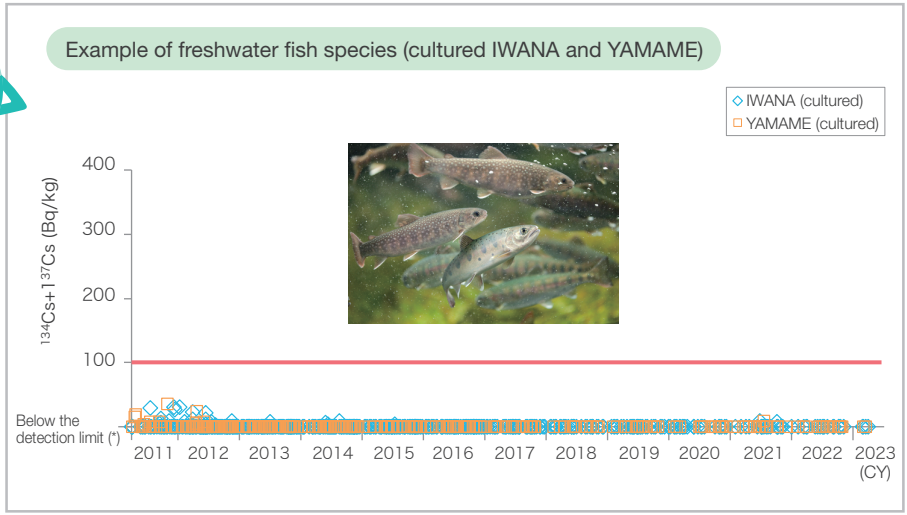


Changes in radioactive cesium concentration in major freshwater fish species

Cesium is very similar to potassium, a kind of salt that is essential for life. Freshwater has a much lower salinity than seawater, so freshwater species tend to keep salts (such as sodium and potassium) once absorbed into their bodies, so the cesium is also hardly excreted from the body.

Since cultured IWANA (char) and YAMAME (land-locked cherry salmon) are raised on a controlled diet with adequate salts, no case has exceeded the JMLs.





*Detailed information about BDL (below detection limit) is provided in the column on the last page.

What is ALPS Treated Water?

ALPS treated water refers to water purified by multi-nuclide removal equipment (ALPS: Advanced Liquid Processing System), etc. for nuclides other than tritium until it meets the regulatory standards specified by the state for release to the environment.

ALPS treated water is released after diluting the tritium concentration with seawater to less than 1,500 Bq/L. This is about one-seventh of the World Health Organization's (WHO) drinking water quality guidelines.

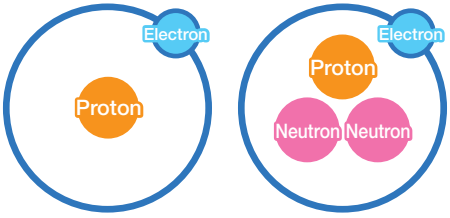
What is Tritium?

Tritium (^3H) is a type of hydrogen. In addition to being naturally generated when hydrogen is struck by cosmic rays, it is also generated by nuclear power plant operations and nuclear tests. Tritium emits low energy β-ray, and within 12.3 years, half of the tritium turns into helium-3, which emits no radiation.

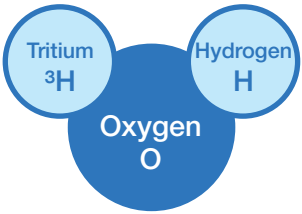
Tritium is commonly found in seawater, fresh water, rainwater, and tap water as tritium water combined with oxygen, and there are always dozens of becquerels of tritium in our body.

The beta radiation emitted by the tritium is so weak that it cannot pass through a single piece of paper. Therefore, the degree of impact on the human body (effective dose coefficient) is about 1/700 of cesium-137. In addition, the effects of tritium are not included in the regulatory scope of food standards, as it is not considered necessary to consider them in food.

Also, tritium ingested in humans and fish and shellfish behaves almost the same as water and is excreted relatively quickly outside the body, so unlike radioactive cesium, it does not accumulate in the body and is not concentrated.



Difference between hydrogen and tritium atoms (schematic)

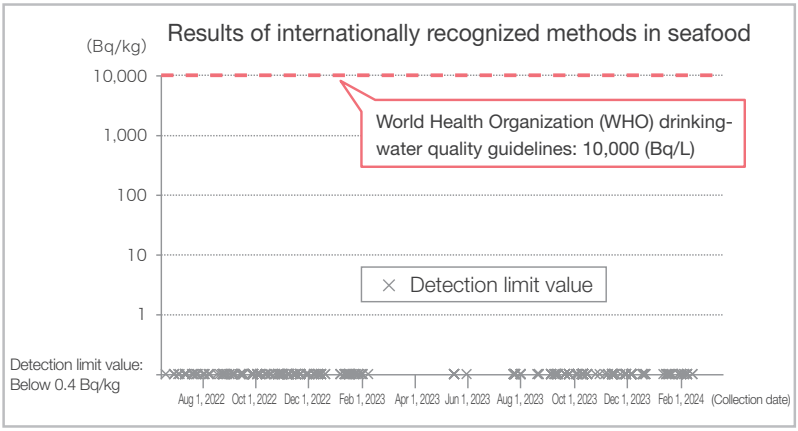


Tritium water molecule (schematic)

Fisheries Agency website Effects of Radioactive Substances on Fishery Products and Responses About Tritium
https://www.jfa.maff.go.jp/j/koho/saigai/index.html

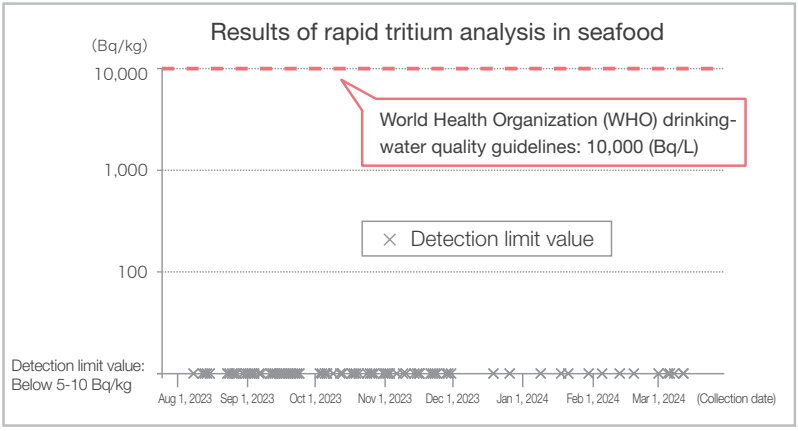
Status of internationally recognized methods

Internationally recognized methods are conducted on seafood (including fish, cephalopods, and shellfish) landed in the region from Hokkaido to Chiba, mainly in with a primary focus on catches from Fukushima Prefecture. In fiscal 2022, 216 samples were analyzed (86 in Fukushima Prefecture and 130 outside Fukushima Prefecture), and in fiscal 2023, 204 samples were analyzed (80 in Fukushima Prefecture and 124 outside Fukushima Prefecture). All results were below the detection limit.



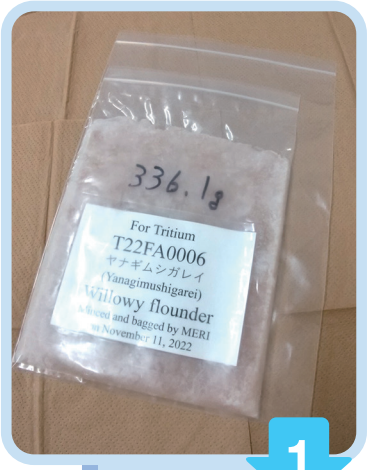
Status of rapid tritium analysis

Tokyo Electric Power Company subjects samples taken at the same locations, T-S3 (approximately 4 km north-northeast of the point of release) and T-S8 (approximately 5 km south-southeast of the point of release), to rapid tritium analysis. In fiscal 2023, a total of 174 samples were tested (of a total of eight species, including flounders), and all results were below the detection limit.



Reference 1 Internationally recognized methods

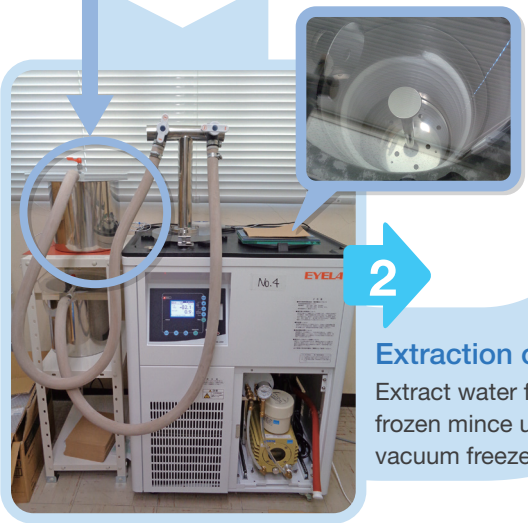
Internationally recognized methods are performed using the tritium water contained in the sample, so care must be taken to ensure that the sample does not come into contact with other water that may affect the test results. Unlike cesium analysis, tritium analysis takes time. Results of the analysis are usually available about 1 to 1.5 months after seafood has been transported to an analysis facility. The analysis can detect at a lower detection limit (approximately 0.4 Bq/kg) than the limit for the rapid tritium analysis method in Reference 2.



1

Preparation of mince

Make the finely minced edible part into a thin plate and freeze it.



2

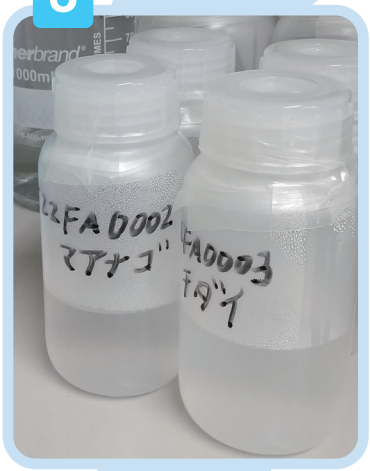
Extraction of water

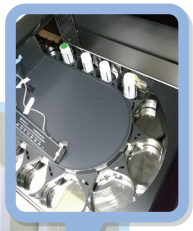
Extract water from the frozen mince using a vacuum freeze dryer.

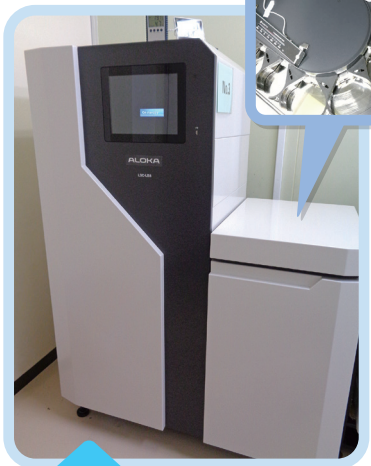
3

Collected water

Dissolve the collected moisture on ice.







4

Distillation of collected water

Decompose oil and protein contained in the collected water for purification.

6

Analysis

Measure the sample using a liquid scintillation counter.

5

Mixing with reagent and settling

Mix the purified water with a reagent and leave to settle in a cool dark location.

Reference 2 Rapid tritium analysis method

The rapid tritium analysis is conducted using the tritium water contained in a small sample, approximately 10 g in size. With a detection limit of 5-10 Bq/kg for such a sample, the analysis results can be obtained around one day after sample collection, which is a shorter period than that required for the internationally recognized methods.

1

Preparation of mince

A small amount of the sample, around 10 g, is thoroughly minced.

2

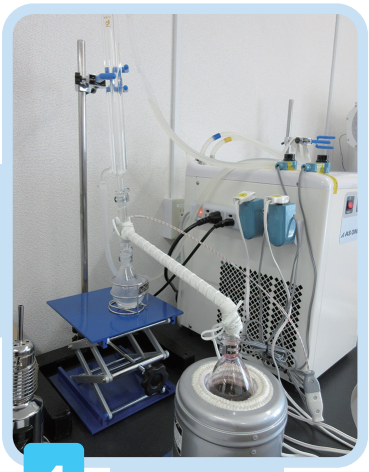
Extraction of water

Extract water from the mince using a combustion device.

Collected water

Collect approximately 9 g of water.

3



4

Distillation of collected water

Decompose oil and protein contained in the collected water for purification.

6

Analysis

Measure the sample using a liquid scintillation counter.

5

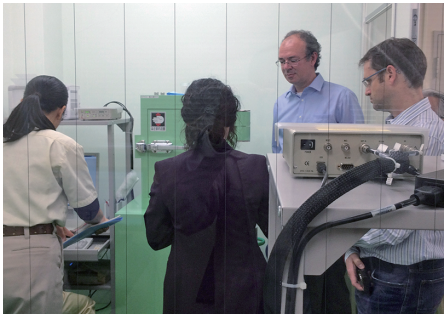
Mixing with reagent and settling

Mix the purified water with a reagent and leave to settle.

Column

Cooperation with the International Atomic Energy Agency (IAEA)

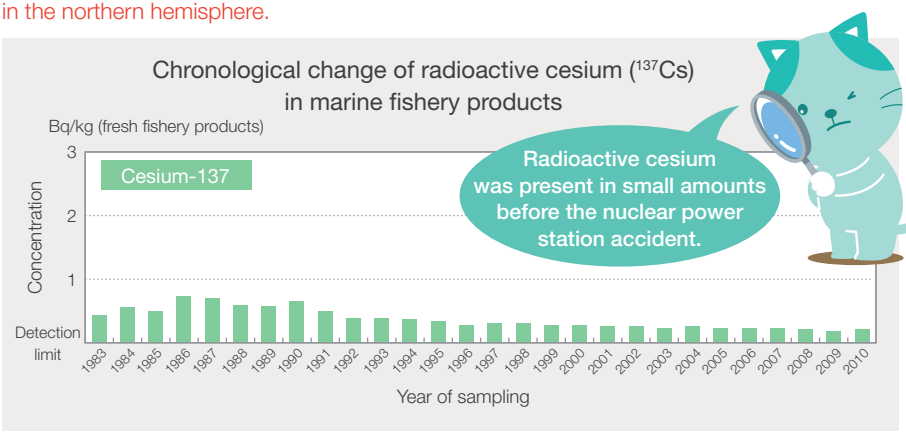
The IAEA and Japanese laboratories measured radionuclides using the same specimens extracted from fishery products, and the results confirmed that the measurement method of the Japanese laboratories is appropriate and has a high level of accuracy and competency.



Column

Change in radioactive cesium concentration in marine fishery products before the nuclear power plant accident

The concentration of radioactive cesium (^{137}Cs) in marine fishery products such as fish and octopus had remained below 1Bq/kg from 1983 to 2010. Radioactive cesium was present in the environment previously due to the effect of atmospheric nuclear tests conducted mainly in the northern hemisphere.



The graph above indicates the radioactive cesium levels measured in the waters around nuclear power stations in Japan. For details, please refer to “Protection of Fishing Grounds” (in Japanese) on the website of the Marine Ecology Research Institute. (URL: https://www.kaiseiken.or.jp/publish/itaku/itakuseika.html)

Column

What is the detection limit?

● **The detection limit means the lowest concentration of target substance that an analytical device can detect.**

Differences in detection limits occur when performing analyses even using the same device if the weight of the sample placed into the beaker and/or the duration of the measurement are different. The monitoring of radionuclides in food is implemented in accordance with the official testing method, "Testing Methods for Radioactive Substances in Food" and "Application of testing methods for radioactive substances in food" provided by the Ministry of Health, Labour and Welfare. The detection limit is set well below the Japanese maximum levels in food, generally at around 20-30 Bq/kg.

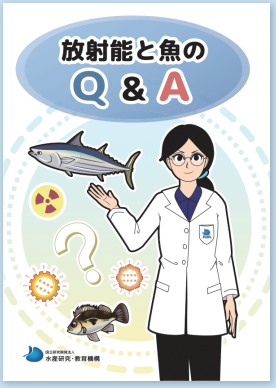
No.	Fish species	Prefecture	Radioactive cesium (^{137}Cs) [unit: Bq/kg]
9617	Chub mackerel	Miyagi	Below the detection limit (<0.571)
9618	Chub mackerel	Miyagi	Below the detection limit (<2.98)
9619	Hilgendorf saucord	Miyagi	Below the detection limit (<3.59)
9620	Japanese sardine	Miyagi	Below the detection limit (<4.34)

(Source) the website of the Fisheries Agency

Table: Example of the result of the monitoring of radionuclides in fishery products.

This value is the detection limit.

Results of the monitoring of radionuclides in fishery products are available on the website of the Fisheries Agency. Pamphlets discussing various questions concerning radionuclides in fish from a scientific perspective are also available on the website of the Japan Fisheries Research and Education Agency.



Website of the Fisheries Agency (in English):
https://www.jfa.maff.go.jp/j/housyanou/kekka.html

Website of the Japan Fisheries Research and Education Agency:
FAQ for Radioactivity and Fish (in Japanese)
http://www.fra.affrc.go.jp/bulletin/radioactivity_pamphlet2018/cover_index.html

Fisheries Agency Radioactive Materials Search

水産庁 **Research and Technological Guidance Division,**
Resources Enhancement Promotion Department, Fisheries Agency of Japan
1-2-1 Kasumigaseki, Chiyoda-ku, Tokyo 100-8907 TEL: 03-6744-2030

Central Laboratory, Marine Ecology Research Institute
300 Iwawada, Onjuku-machi, Isumi-gun, Chiba 299-5105 TEL: 0470-68-5111