English

For safe and secure fish consumption

Facts on monitoring

of radioactivity in fish

2023

Fisheries Agency of Japan

Preface

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

The Fisheries Agency has continued to inspect and publish the concentration of radiation 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 tritium analysis that began in fiscal 2022.

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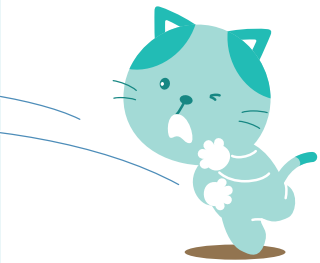


Structure of the monitoring inspection for radioactive cesium in food

What does 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)

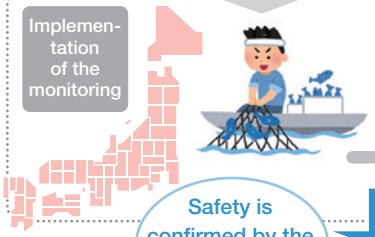
Results of Radiation Monitoring of Daily Foods (Fukushima Prefectural Government) (http://www.pref.fukushima.lg.jp/site/portal/nichijoshoku-moni.html)

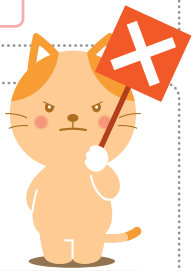
Framework of the monitoring

Monitoring plan is developed mainly by local governments

- ☑ Monitoring areas
- ☑ Target species
- ☑ Frequency

Discussion on left items and development of plans.





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

100 Bq/kg or less

Safety is confirmed by the monitoring

Shipping

To the dining table

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.**

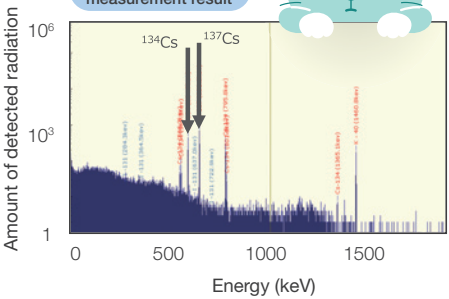
Process of the laboratory test

1 Receipt of fishery products

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

This is how the radioactive cesiums are detected.

An example of a measurement result



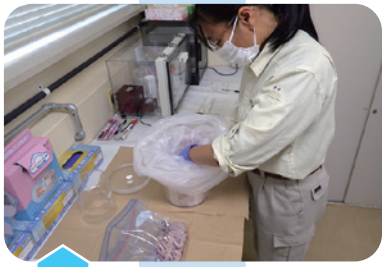
2 Measurement of body length and weight

5 Analysis

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

3 Preparation of mince

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



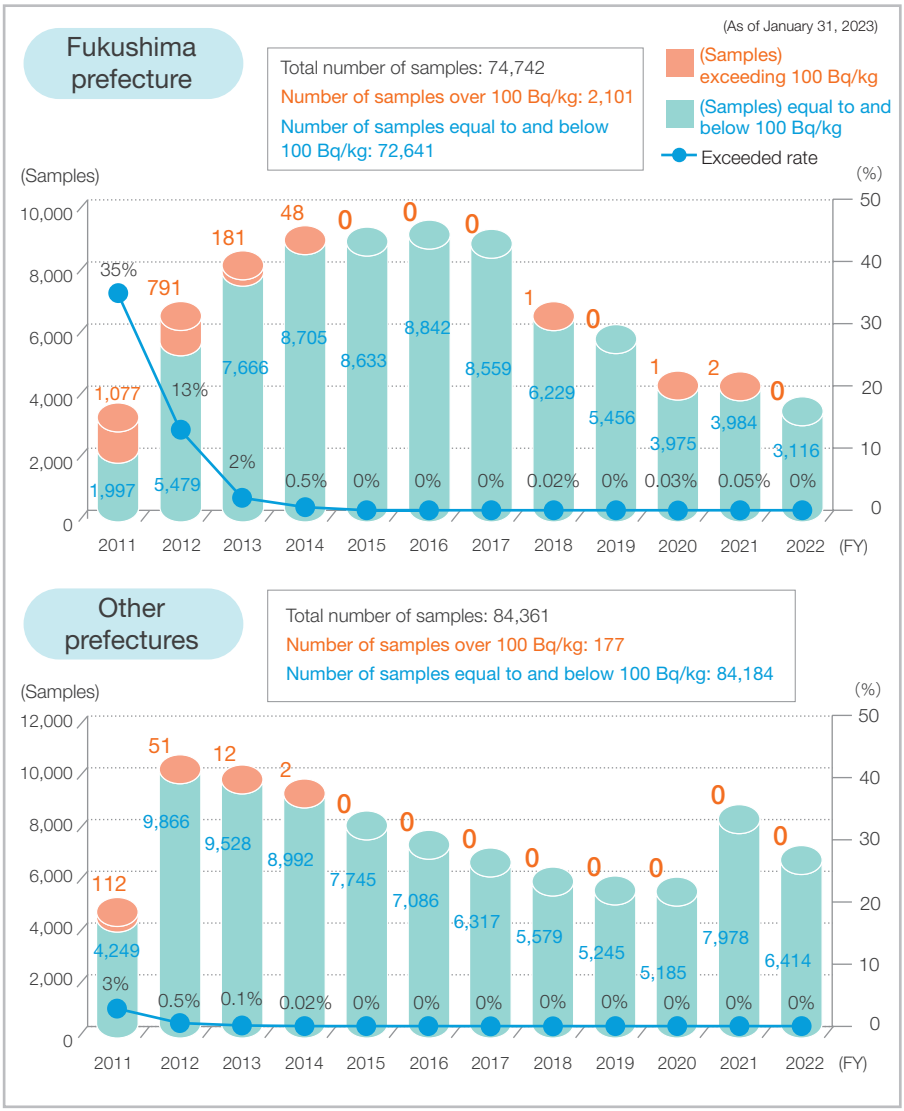
4 Place into an analytical beaker

Fishery products are properly tested.

Concentration of radioactive cesium in marine fish species

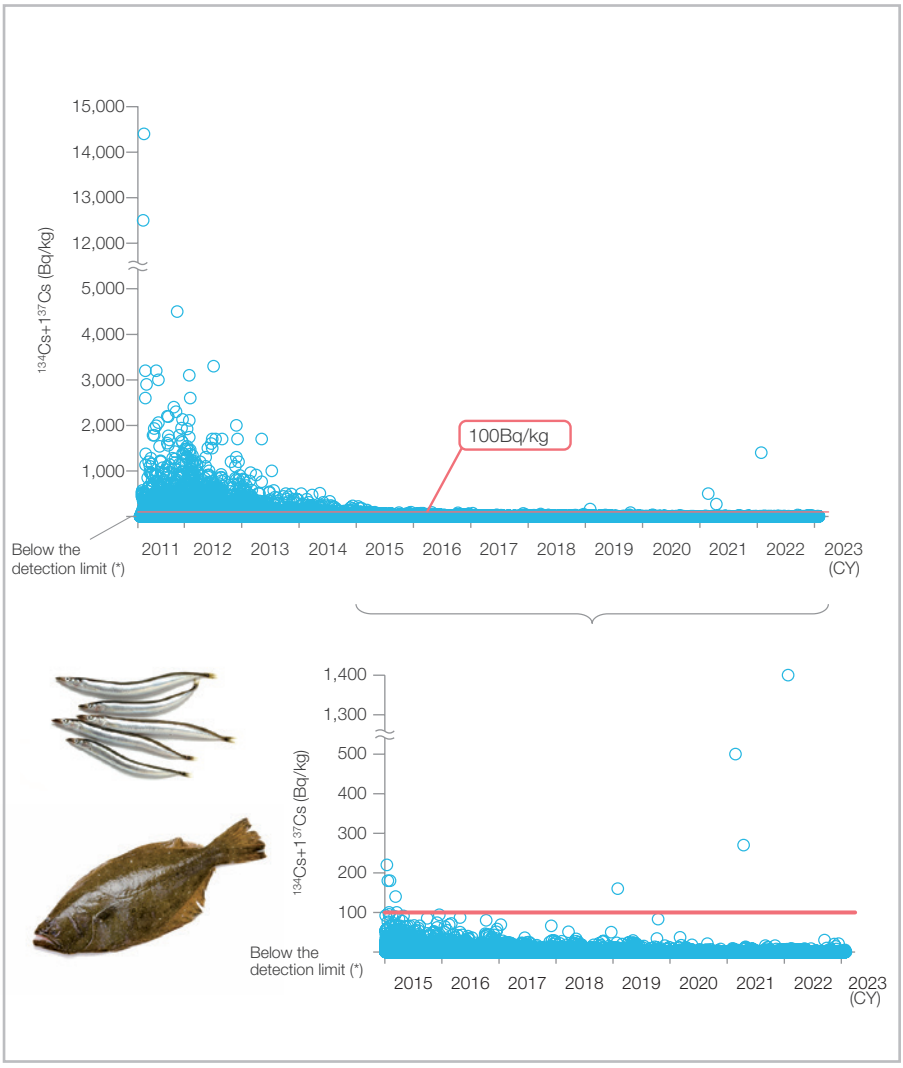
Results of the analysis of radioactive cesium in marine fish species

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

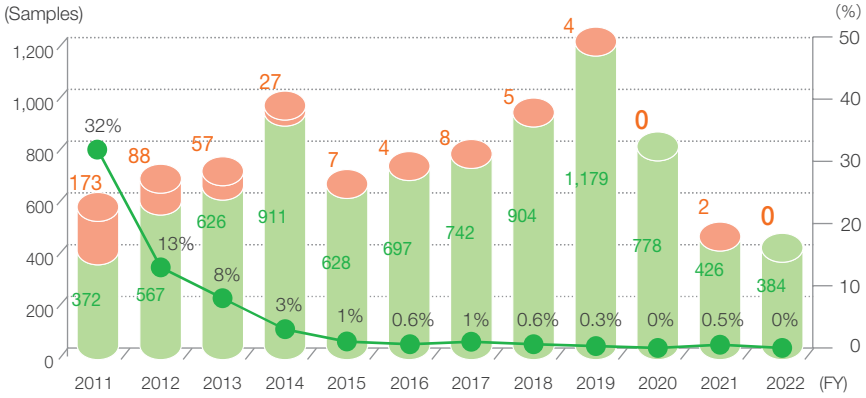
Radioactive cesium in freshwater fish species

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

(As of January 31, 2023)

Fukushima prefecture

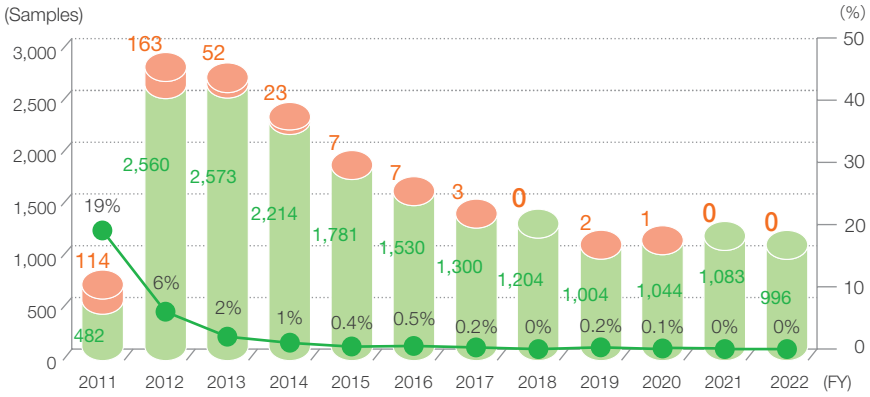
Total number of samples: 8,589
Number of samples over 100 Bq/kg: 375
Number of samples equal to and below 100 Bq/kg: 8,214



Other prefectures

Total number of samples: 18,143
Number of samples over 100 Bq/kg: 372
Number of samples equal to and below 100 Bq/kg: 17,771

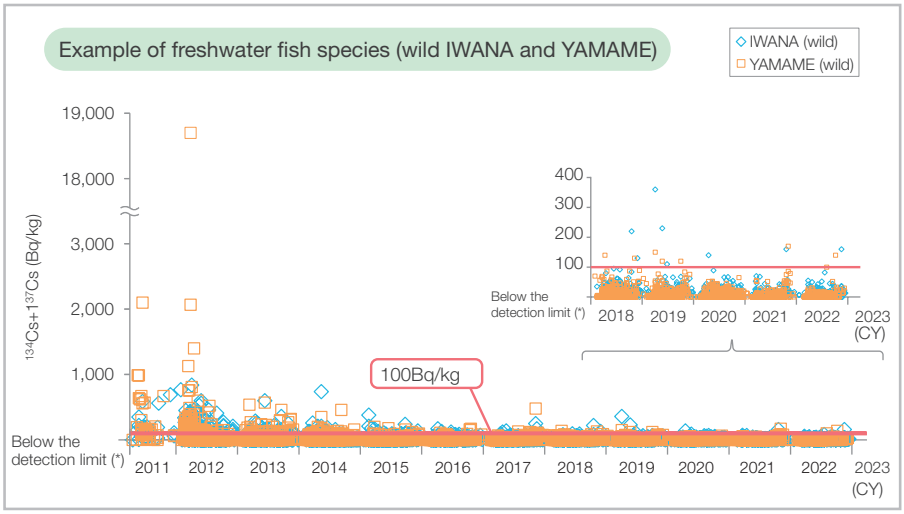
The number of samples exceeding the limit is gradually decreasing.

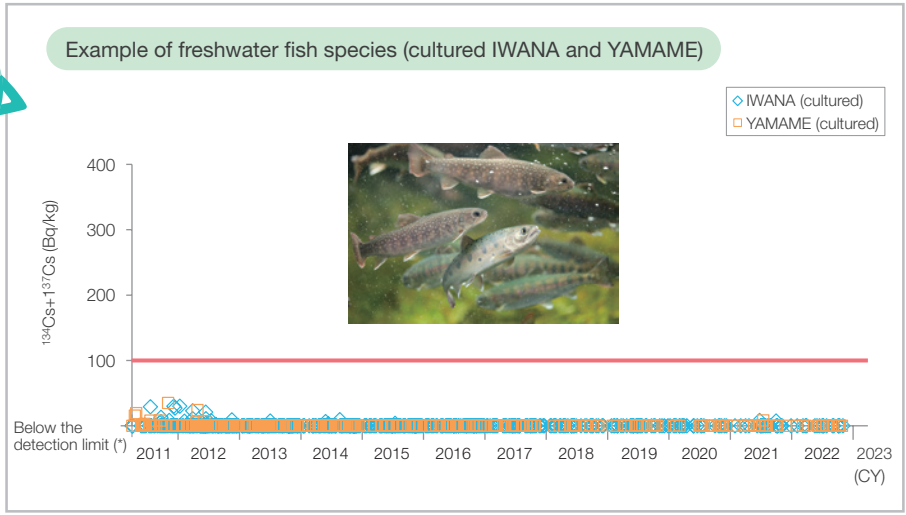


Changes in radioactive cesium concentration in major freshwater fish species

Cesium is very similar to potassium, a kind of salt that is essential for life. Due to the lower concentrations of salts in water environment, compared to marine species, freshwater species tend to keep salts (such as sodium and potassium) once taken into their bodies, so the cesium is also hardly expelled 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 JML.





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

ALPS Treated Water and Tritium Testing

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.

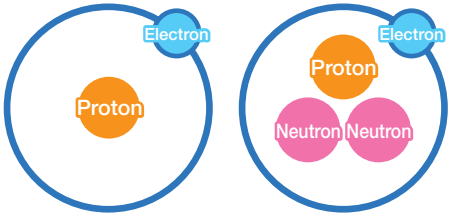
What is Tritium?

Tritium (^{3}H) 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 beta radiation, and within 12.3 years, half of the tritium turns into helium-3, which emits no radiation.

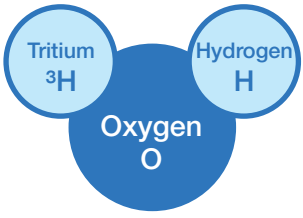
Tritium is commonly found in seawater, fresh water, rainwater, and tap water as tritium water combined with oxygen, and there are always dozens of becquerels of tritium in our body.

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)

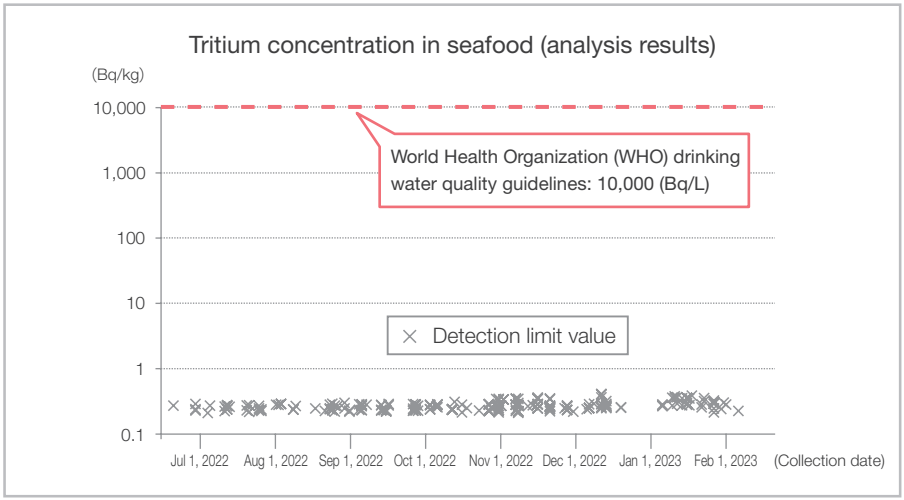


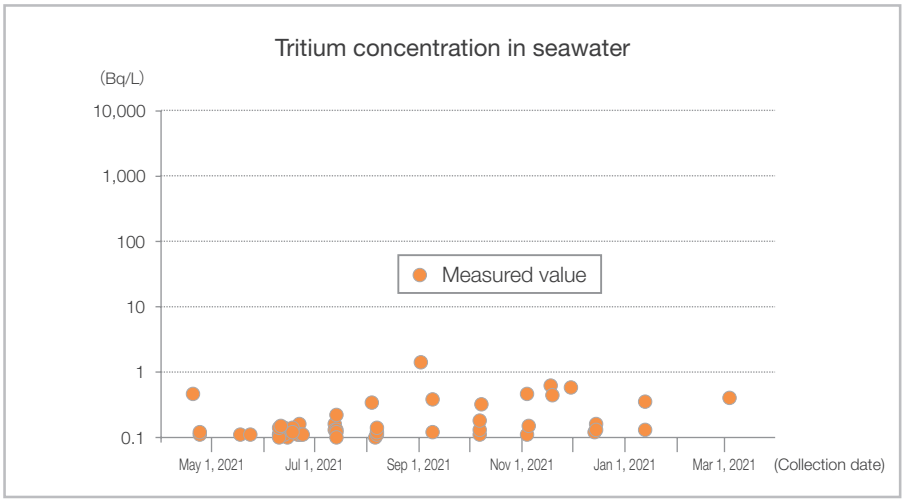
Tritium water molecule (schematic)

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 tritium analysis

Inspections of tritium are carried out for seafood landed from Hokkaido to Chiba, mainly in Fukushima Prefecture. In fiscal 2022, 86 samples were tested in Fukushima Prefecture and 130 samples were tested outside Fukushima Prefecture for a total of 216 samples (46 species including shellfish, seaweed, etc.). All results were below the detection limit.



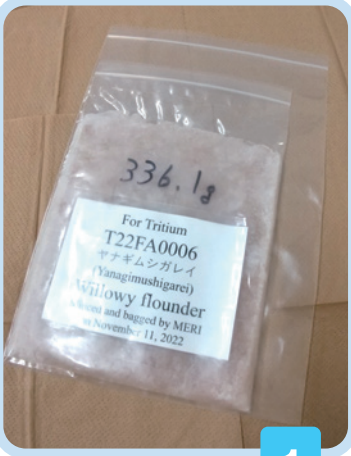


The graph of tritium concentration in seawater was prepared by the Fisheries Agency based on the Environmental Radiation Database.

Environmental Radiation Database
https://www.kankyo-hoshano.go.jp/data/database/

Reference Tritium analysis method

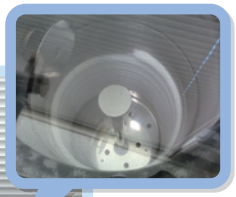
Tritium testing is performed using the tritium water contained in the sample, so care must be taken to ensure that the sample does not come into contact with other water that may affect the test results. Unlike cesium analysis, tritium analysis takes time. It usually takes about one to two months for the results of the analysis to be available after the seafood has been transported to the analysis facility.



1

Preparation of mince

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



2

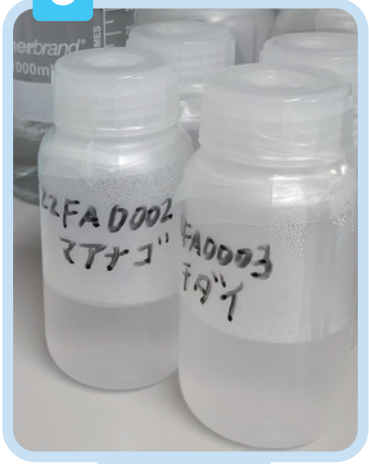
Extraction of water

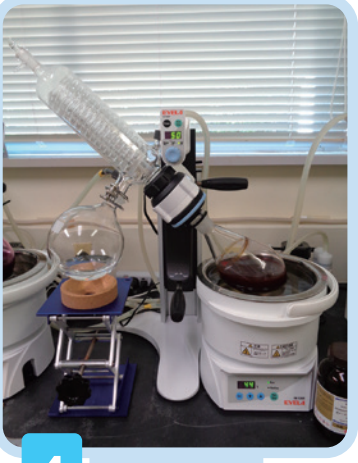
Extract moisture from the frozen mince using a vacuum freeze dryer.

3

Collected moisture

Dissolve the collected moisture from the ice.

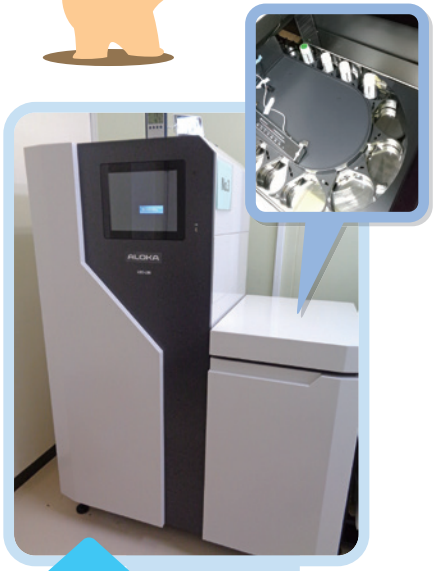




4

Refinement of collected water

Decompose the oil and protein contained in the collected water and refine the sample into clean water.



6

Analysis

Measure the sample using a liquid scintillation counter.

5

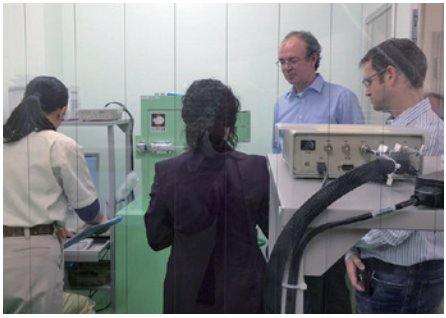
Mixing with reagent and settling

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

Column

Cooperation with the International Atomic Energy Agency (IAEA)

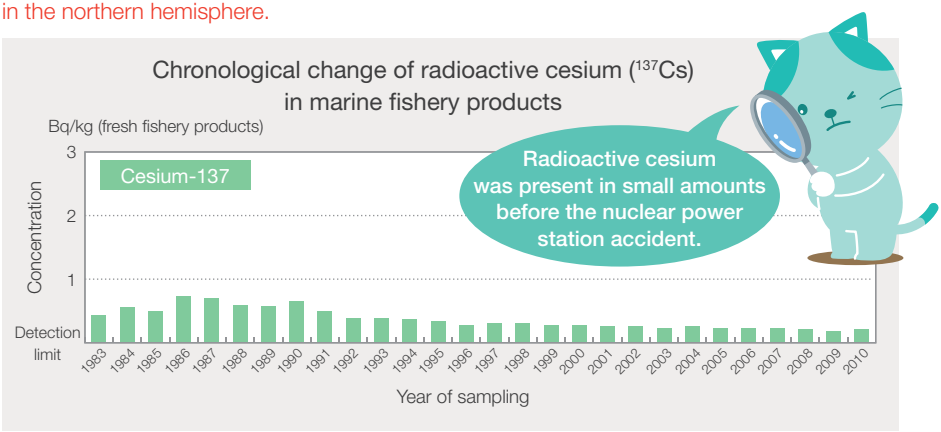
The IAEA and Japanese laboratories measured radionuclides using the same specimens extracted from fishery products, and the results confirmed that the measurement method of the Japanese laboratories is appropriate and has a high level of accuracy and competency.



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

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