

FY2018
Results of the Radioactive Material Monitoring in the Water Environment

March 2020
Ministry of the Environment

Contents

Outline	1
Part 1: National Radioactive Material Monitoring in the Water Environment throughout Japan (FY2018) .	6
1 Objective and Details.....	6
1.1 Objective	6
1.2 Details	6
2 Survey Methods and Analysis Methods	19
2.1 Survey methods	19
2.2 Analysis methods	20
3 Results.....	22
3.1 Detection of total β radioactivity and γ -ray emitting radionuclides	22
(1) Public water areas.....	22
1) Water.....	22
2) Sediment.....	24
(2) Groundwater	26
3.2 Discussion regarding detected radionuclides.....	28
(1) Detection of naturally occurring radionuclides.....	28
1) Correlation between activity concentrations of K-40 in water samples and seawater.....	28
2) K-40 in sediments	30
3) Uranium and thorium series radionuclides in sediment samples.....	31
(2) Detection of artificial radionuclides	34
1) Cs-134 and Cs-137 in water samples from public water areas	34
2) Cs-134 and Cs-137 in sediment samples from public water areas.....	35
3) Cs-134 and Cs-137 in groundwater.....	40
3.3 Survey results on seasonal variations	41
Part 2: Radioactive Material Monitoring in the Water Environment in and around Fukushima Prefecture (FY2018).....	47
1 Objective and Details.....	47
1.1 Objective	47
1.2 Details	47
2 Survey Methods and Analysis Methods	49
2.1 Survey methods	49
2.2 Analysis methods	49
3 Outlines of the Results	50
3.1 Detection of radioactive cesium.....	50
3.2 Detection of radionuclides other than radioactive cesium.....	53
4 Results	54
4.1 Radioactive cesium.....	54

4.1 -1 Water.....	54
(1) Public water areas.....	54
1) Rivers	54
2) Lakes.....	54
3) Coastal areas.....	54
(2) Groundwater	54
4.1-2 Sediment.....	58
(1) Detection status	58
1) Rivers	58
2) Lakes.....	58
3) Coastal areas.....	58
(2) Changes in concentration levels.....	62
1) Rivers	62
2) Lakes.....	63
3) Coastal areas.....	63
(3) Detection of radioactive materials in sediment by location.....	64
1) Evaluation policy	64
2) Concentration levels in sediment samples from rivers, lakes, and coastal areas and their changes by prefecture.....	67
2)-1 Rivers.....	67
2)-2 Lakes	85
2)-3 Coastal areas.....	101
2)-4 Conclusion	111
4.2 Results (Radionuclides other than radioactive cesium)	120
4.2-1 Radioactive strontium (Sr-90 and Sr-89).....	120
(1) Public water areas.....	120
(2) Groundwater	123
4.2-2 Other γ -ray emitting radionuclides.....	124
 Part 3: Other Radioactive Material Monitoring Conducted Nationwide (FY2018).....	 126
1 Outline of the Monitoring	126
1.1 Covered monitoring.....	126
1.2 Compilation methods	126
2 Results	129
2.1 Water.....	129
(1) Inland water.....	129
(2) Seawater	130
2.2 Sediment.....	131
(1) Inland water sediment (river sediment).....	131
(2) Sea sediment	132

Note: In this report,

ND stands for “Not Detectable,”

FY stands for “Fiscal Year,” beginning in April and ending in March.

Outline

The following is an outline of the results of monitoring for radioactive material carried out in FY2018 based on the Water Pollution Control Act. Monitoring locations are as shown in Figure 1 and Figure 2.

1. National Radioactive Material Monitoring in the Water Environment throughout Japan (FY2018)

- Monitoring commenced in FY2014 at 110 public water areas and groundwater locations in 47 prefectures in Japan for the purpose of clarifying the distribution of radioactive materials in those areas nationwide (hereinafter referred to as "Nationwide Monitoring"), in accordance with the Water Pollution Control Act.

- A summary of the results for FY2018 is as follows.

<Overall outline>

- The total β radioactivity and the detected γ -ray emitting nuclides were within the past measurement trends¹. Detection limits differ by nuclide and sampling location, but overall were around 0.001 to 0.1 Bq/L for water and around 1 to 100 Bq/kg for sediment², ("Bq/kg" of sediment indicates "dried sediment" in this report, and the same shall apply to Radioactive Material Monitoring performed in Fukushima Prefecture and the surrounding areas, and other national radioactive material monitoring.).

<Naturally occurring radionuclides>

- There were some locations where the value of K-40 and total β radioactivity were elevated in sediment samples from public water areas, but these levels were thought to have been influenced by natural rocks and soils.
- K-40 and total β radioactivity were detected at higher concentrations in groundwater samples at some locations, but they were thought to have been influenced by natural soils/rocks/ sea water.

<Artificial radionuclides>

- At some public water area monitoring locations, the artificial radionuclides Cs-134 and Cs-137 were detected exceeding their detection limits, but their values were within the past measurement trends.

- It is appropriate to continue this monitoring from the following fiscal year onwards in order to clarify the distribution of radioactive materials in water environments.

2. Radioactive Material Monitoring in the Water Environment in and around Fukushima Prefecture (FY2018)

- In response to the accident at the Tokyo Electric Power Company's Fukushima Daiichi NPS (hereinafter referred to as the "Fukushima NPS Accident"), monitoring has been conducted continuously since August 2011 at around 600 public water area locations and around 400 groundwater locations in and around

¹ "Within the past measurement trends" means that the results of the latest monitoring survey are evaluated from a technical perspective as not displaying extreme deviation from the results of past similar monitoring surveys.

² See Table 3.1-1, Table 3.1-2, and Table 3.1-3 in Part 1 of this report for the details of the detection limits.

Fukushima prefecture for the purpose of clarifying the distribution of the accident-derived radioactive materials in water environments (hereinafter referred to as "Post-Earthquake Monitoring").

○ A summary of the results for FY2018 is as follows.

(1) Radioactive cesium

<Public water areas>

1) Water (detection limit: 1 Bq/L for both Cs-134 and Cs-137)

- While several locations showed a positive result for these radionuclides, they were not detectable in other locations.

2) Sediment (detection limit: 10 Bq/kg for both Cs-134 and Cs-137)

[Rivers]

- Out of all monitoring locations, the levels of both Cs-134 and Cs-137 were less than 200 Bq/kg at 3/4 of the locations, though they were detected at relatively higher levels at some limited locations, such as those within 20 km of Tokyo Electric Power Company's Fukushima Daiichi Nuclear Power Plant (hereinafter referred to as the "Within 20km"). The average values including past years were 100 Bq/kg or less at approximately half of the monitoring locations, while more than 90% of the other locations showed decreasing trends.

[Lakes]

- Out of all monitoring locations, the levels of both Cs-134 and Cs-137 were less than 3,000 Bq/kg at 3/4 of the locations, though they were detected at relatively high levels at some limited locations, such as those within 20 km of the power plant. The average values including past years were 100 Bq/kg or less at approximately 10% of the monitoring locations, while approximately 30% of the other locations showed fluctuations with approximately 70% of the monitoring locations showing either decreasing or unchanged trends.

[Coastal areas]

- Out of all monitoring locations, the levels of both Cs-134 and Cs-137 were less than 200 Bq/kg at 3/4 of the locations. The average values including past years were 100 Bq/kg or less at approximately 60% of the monitoring locations with over 80% of the other locations showing decreasing trends.

< Groundwater >

- Radioactive cesium was not detected in groundwater at any surveyed locations in FY2018 (detection limit: 1 Bq/L for both Cs-134 and Cs-137).

(2) Radionuclides other than radioactive cesium

- Sr-89: Was not detected at any surveyed groundwater locations.
- Sr-90: Was detected in collected sediment at several public water area locations, but remained at relatively low levels; was not detectable in water samples at any surveyed public water areas and at groundwater locations.

- Measured activity concentrations have fluctuated at some locations. There is a possibility that this is due to the effects from the Fukushima nuclear accident, but the fluctuations could also be due to slight differences in sampling locations and the properties of individual samples. Therefore, it is appropriate to continue this monitoring on an ongoing basis over the following fiscal years.

3. Other Radioactive Material Monitoring Conducted Nationwide (FY2018)

- The results of the Monitoring of Environmental Radioactivity Levels (hereinafter referred to as “Monitoring of Levels”), which has been conducted by the Nuclear Regulation Authority for the purpose of clarifying the existence or nonexistence of the effects from nuclear facilities, etc., nationwide, were all within the past measurement trends.

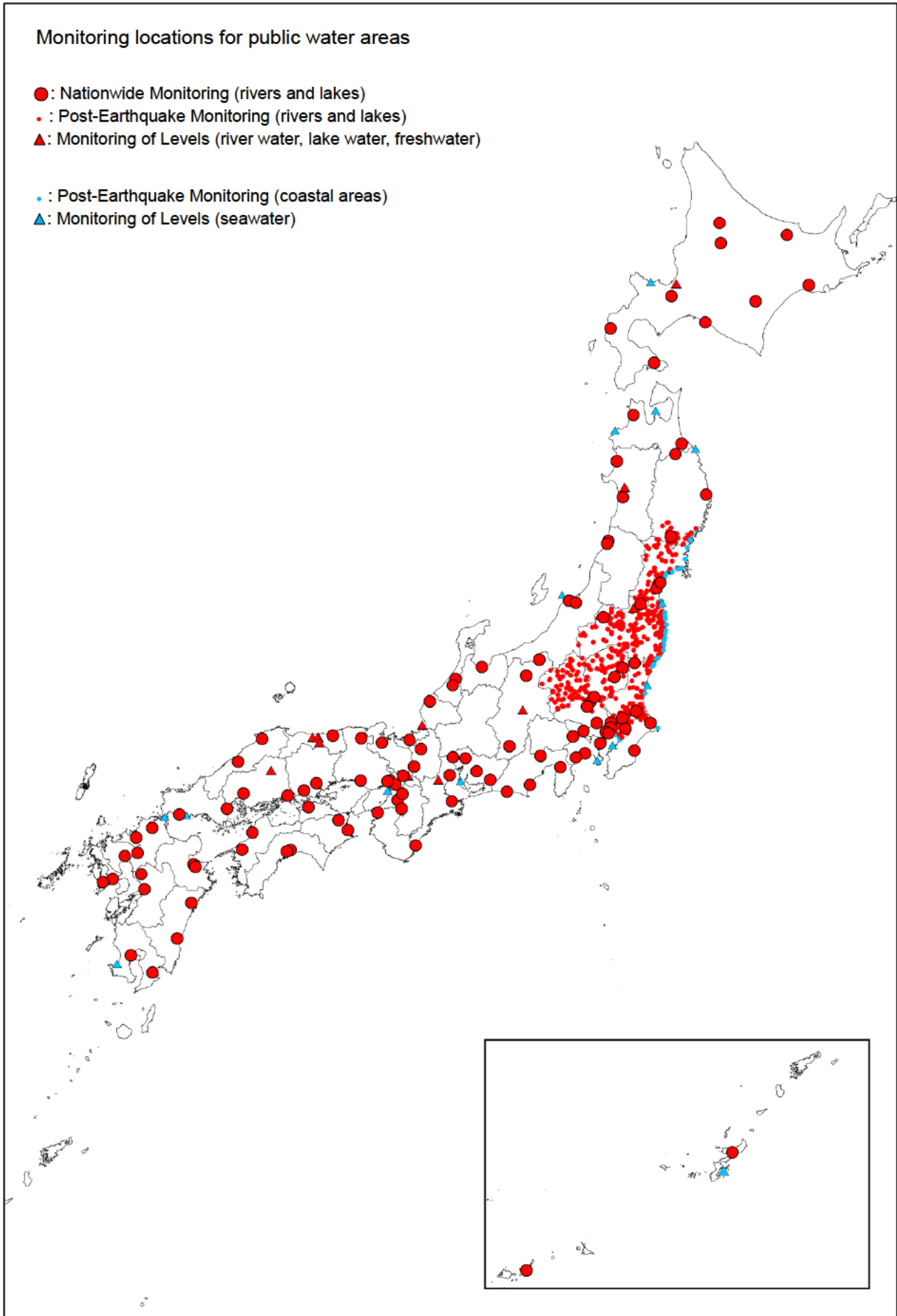


Figure 1 Locations for monitoring radioactive materials (public water areas)

Monitoring locations for groundwater

- : Nationwide Monitoring (Fixed point monitoring)
- : Nationwide Monitoring (Rolling monitoring)
- : Post-Earthquake Monitoring

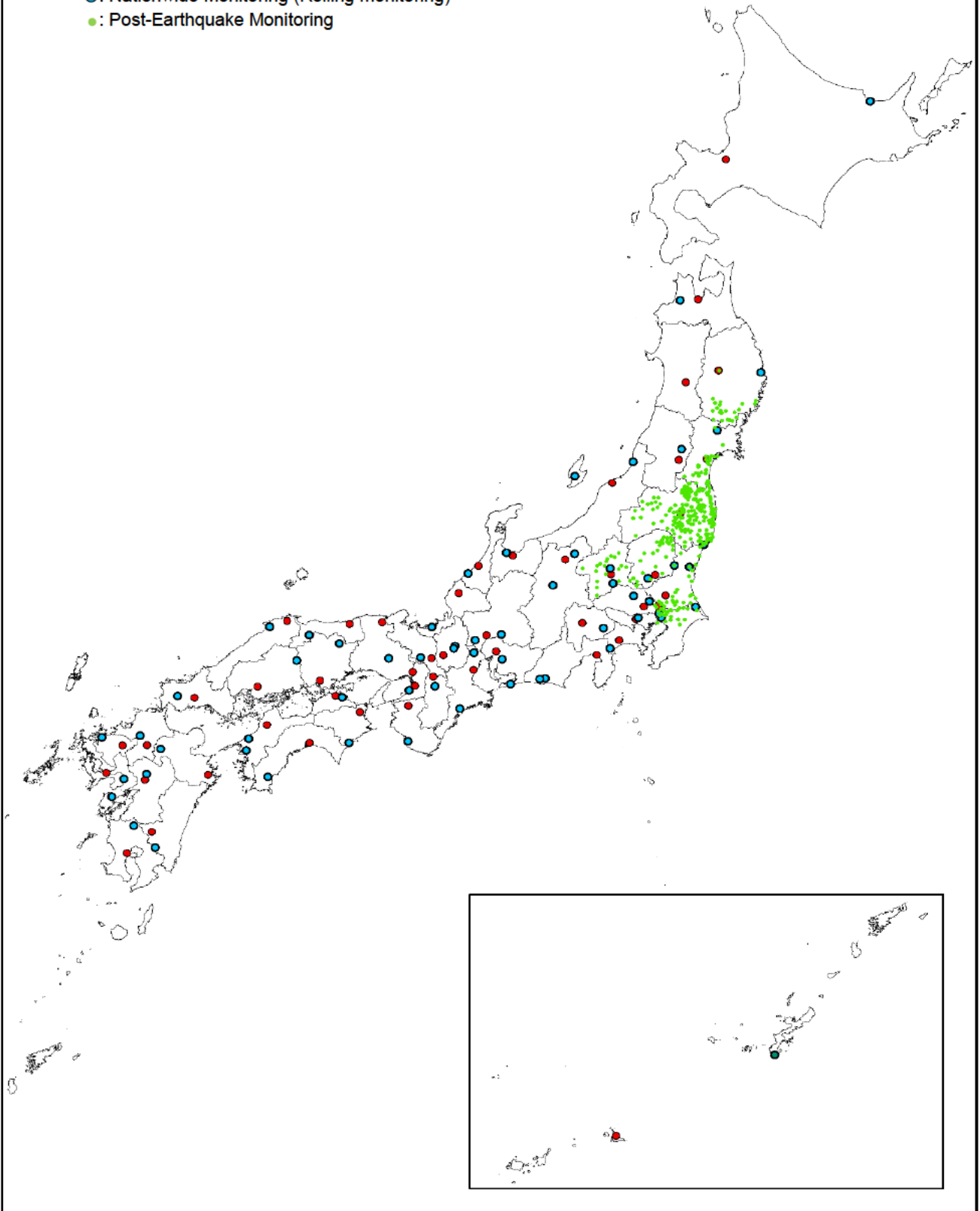


Figure 2 Locations for monitoring radioactive materials (groundwater)

Part 1: National Radioactive Material Monitoring in the Water Environment throughout Japan (FY2018)

1 Objective and Details

1.1 Objective

In response to the Fukushima NPS Accident, during which radioactive materials were discharged causing environmental pollution, the Water Pollution Control Act was amended. It was decided that the Minister of the Environment should monitor pollution caused by radioactive materials in public water areas and groundwater and release the results from the perspective of preserving the health and living environment of the people.

Based on the above, this monitoring aims to clarify the distribution of radioactive materials in public water areas and groundwater nationwide.

1.2 Details

(1) Monitoring locations

- Public water areas: 110 locations (rivers: 107 locations; lakes: three locations)
- Groundwater: 110 locations

Monitoring locations were selected based on the following policy with a view to ensuring balanced nationwide monitoring (specific locations are as shown in Tables 1.2-2 and 1.2-3 and Figures 1.2-1 and 1.2-2).

1) Public water areas

- At least one sampling location was selected in each prefecture, and additional locations were added according to the area and population of each prefecture.
- Locations within each prefecture were selected based on the following policy:
 - a) Select representative rivers (including lakes) within each prefecture using the same numbers listed above, taking into account the area and population in their basins.
 - b) Regarding rivers selected as explained in a), select locations from among those monitored for hazardous materials, etc., conducted under the Water Pollution Control Act, selected in consideration of water utilization points. Within a single river, give priority to a location in the lower reaches (including lakes located downstream).
 - c) As this monitoring does not aim to clarify the effects from specific sources, exclude locations close to those subject to Environmental Monitoring around Nuclear Facilities, etc. (Radiation Monitoring Grants) in principle.

2) Groundwater

- Two sampling locations were chosen in each prefecture, and one more location was added for each prefecture in which the amount of groundwater utilized had been large over the past several years.
- Locations within each prefecture were selected from the locations for continuous monitoring of environmental standard items in groundwater based on the following policy, principally.
 - a) Select regional representative wells (such as wells built for monitoring or major wells with an

especially large amount of water utilization) taking into consideration the amount of utilization of groundwater from each groundwater basin and water vein (hereinafter referred to as "groundwater basins, etc.").

- b) Prioritize wells owned or managed by local governments, etc., in consideration of the convenience of coordination in case any additional survey is required.
- c) Select one location for continuous fixed-point monitoring from among the locations selected in the manner above, taking into account that location's level of utilization and the representativeness of that groundwater basin in the wider area. Perform rolling monitoring at the remaining locations (for five years in principle).
- d) As this monitoring does not aim to clarify the effects from specific sources, exclude locations close to those subject to Environmental Monitoring around Nuclear Facilities, etc. (Radiation Monitoring Grants), in principle.

(2) Targets

- Public water areas : Water and sediment (For lakes, water surveys are conducted both at surface layer and bottom layer.)
(Additionally, as a reference, radioactive concentrations in soil and ambient dose rates around riverbeds, etc., in the environment surrounding the sampling locations are to be measured.)
- Groundwater : Water
(Additionally, as a reference, ambient dose rates near the sampling locations are to be measured.)

(3) Frequencies and periods

- Public water areas : Once a year
However, monitoring was conducted four times a year at two locations (one location in eastern and western Japan, respectively) in order to check for any seasonal variations.
- Groundwater : Fixed point monitoring was conducted once a year, and rolling monitoring was conducted once every five years for each location in principle.

FY2018 monitoring periods are as shown in Table 1.2-4.

(4) Conducted analyses

The following analyses were conducted for collected samples:

- Measurement of total β radioactivity concentrations.
- γ -ray spectrometry measurement using a germanium semiconductor detector (In principle, all detectable radionuclides, including artificial radionuclides and major naturally occurring radionuclides, were analyzed).

(5) Evaluation of measurement results

The measurement results were evaluated upon the guidance/advice of “Evaluation Committee on the National Radioactive Material Monitoring in the Water Environment for the whole of Japan” (Table 1.2-1) comprised of professionals.

1) Comparison with the past measurement trends

Obtained values were compared with the past measurement trends, and if any deviation was suspected, the validity of the measured values was rechecked (potential number transcription errors, incorrect calibration of equipment, etc.).

Because this monitoring has just commenced, there are no accumulated data for some locations. Therefore, results from similar environmental monitoring surveys conducted so far will be used for comparison for the time being. Specifically, results from the Monitoring of Environmental Radioactivity Levels and Monitoring of the Surrounding Environment conducted by the Nuclear Regulation Authority, as well as the results from the Radioactive Material Monitoring in Water Environments in and around Fukushima Prefecture conducted by the Ministry of the Environment were utilized. When making comparisons, due consideration was given to the possibility that the values of Cs-137 and other accident-derived radionuclides would have increased after the Fukushima NPS Accident.

Essentially, nationwide data for the past two decades were used for comparison. Considering the effects from the Fukushima NPS Accident and informed by actual measurements, “three years after the accident” was assumed to be a steady state, and therefore, data of artificial radionuclides from between Mar 11, 2011 to Mar 10, 2014 were excluded.

2) Measures to be taken when a value deviating from the past measurement trends was detected

The following measures were taken when a value deviating from the past measurement trends was detected (see Figure 1.2-3).

2)-1 Release of preliminary values

Any value that is suspected of deviating from the past measurement trends should be immediately evaluated professionally by the chair and the deputy chair, and if it is judged highly urgent (when it has been confirmed that the value is highly likely to deviate from the past measurement trends, and additional detailed analyses are considered to be necessary), a preliminary report should be released as promptly as possible.

In such a case, the following related data should be compiled as basic data for professional evaluation. Members of the Evaluation Committee other than the chair and the deputy chair should be informed of the relevant information together with the professional evaluation by the chair and the deputy chair (see Table 1.2-1 for the chair and other committee members).

- i) Results of the measurement concerning water and sediment (γ -ray spectrometry and total β radioactivity concentrations), and ambient dose rates
- ii) Sampling dates, sampling locations (maps, water depth, river width, etc.), sampling methods, and sampling circumstances (photos)
- iii) Weather data for about one week close to the measurement date (the amount of precipitation, in particular)

iv) Ambient dose rates measured for the past month or so at neighboring points

v) Changes in detected values of a relevant radionuclide compared to the past

2)-2 Detailed analyses and release of the results

For data for which the preliminary report was released as explained in 2)-1 above, the following detailed analyses are to be conducted and the results are to be released.

- Specific analyses to identify radionuclides (including measurement of individual radionuclides through radiochemical analyses)
- Additional measurements in the surrounding areas of the relevant surveyed location

(6) Disclosure of measurement results

The measurement results data are made publicly available on the following Ministry of the Environment website:

<http://www.env.go.jp/en/water/rmms/surveys.html>

Table 1.2-1 List of members of the Evaluation Committee on the National Radioactive Material Monitoring in the Water Environment for the whole of Japan

IIMOTO Takeshi (Deputy chair)	Professor, Division for Environment, Health and Safety, the University of Tokyo
ISHII Nobuyoshi	Principal Researcher, Environmental Transfer Parameter Research Group, Department of Radioecology and Fukushima Project, Center for Advanced Radiation Emergency Medicine, Quantum Medical Science Directorate, National Institutes for Quantum and Radiological Science and Technology
TOKUNAGA Tomochika	Professor, Department of Environment Systems, Graduate School of Frontier Sciences, the University of Tokyo
HAYASHI Seiji	Research Group Manager & Head of Environmental Assessment Section, Fukushima Branch, National Institute for Environmental Studies
FUKUSHIMA Takehiko (Chair)	Director of the Center, Ibaraki Kasumigaura Environmental Science Center

Table 1.2-2 List of locations for FY2018 Nationwide Monitoring (public water areas) (No. 1)

No.	Prefecture	Property	Sampling location		
			Water area	Location	Municipality
1	Hokkaido Prefecture	River	Ishikari River	Domestic water intake at Ish kari River in Asahikawa City	Asahikawa City
2		River	Ishikari River	Intake at the Shirakawa water purification plant in Sapporo City	Sapporo City
3		River	Teshio River	Nakashibetsu Bridge (Intake at the Higashiyama water purification plant in Shibetsu City)	Shibetsu City
4		River	Tokoro River	Tadashi Bridge	Kitami City
5		River	Kushiro River	Intake at the Aikoku water purification plant in Kushiro City	Kushiro City
6		River	Tokachi River	Nantai Bridge	Obihiro City
7		River	Sarugawa River	Sarugawa Bridge (Tomigawa)	Hidaka Town
8		River	Matsukura River	Mitsumori Bridge (Before the confluence with Torasawa River)	Hakodate City
9		River	Shir beshi-toshibetsu River	Intake at the Kitahiyama simple water plant in Kitahiyama Town	Setana Town
10	Aomori Prefecture	River	Iwaki River	Tsugaru-ohashi Bridge	Nakadomari Town
11	Iwate Prefecture	River	Mabechi River	Shiriuchi Bridge	Hachinohe City
12		River	Mabechi River	Fugane Bridge	Ninohe City
13		River	Heigawa River	Miyako Bridge	Miyako City
14		River	Kitakami River	Chitose Bridge	Ichinoseki City
15	Miyagi Prefecture	River	Abukuma River	Iwanuma (Abukuma Bridge)	Iwanuma City
16	Akita Prefecture	River	Natori River	Yuriage-ohashi Bridge	Natori City
17		River	Yoneshiro River	Noshiro Bridge	Noshiro City
18		River	Omono River	Kurose Bridge	Akita City
19	Yamagata Prefecture	River	Mogami River	Ryou Bridge	Sakata City
20	Fukushima Prefecture	River	Akagawa River	Shinkawa Bridge	Sakata City
21		River	Agano River	Shingo Dam	Kitakata City
22		River	Abukuma River	Taisho Bridge (Fushiguro)	Date City
23		River	Kujigawa River	Takachihara Bridge	Yamatsuri Town
24	Ibaraki Prefecture	Lake	Lake Kasumigaura	Center of the lake	Miho Village
25	Tochigi Prefecture	River	Kokai River	Fumimaki Bridge	Toride City
26		River	Nakagawa River	Shinnaka Bridge	Nakagawa Town
27		River	Kinugawa River	Kinugawa Bridge (Hoshakuji Temple)	Utsunomiya City
28	Gunma Prefecture	River	Tonegawa River	Tonezeki Weir	Chiyoda Town / Gyoda City (Saitama Prefecture)
29	Saitama Prefecture	River	Watarase River	Watarase-ohashi Bridge	Tatebayashi City
30		River	Arakawa River	Kuge Bridge	Kumagaya City
31		River	Arakawa River	Akigase Intake Weir	Saitama City / Shiki City
32		River	Edogawa River	Nagareyama Bridge	Nagareyama City (Chiba Prefecture) / Misato City
33	Chiba Prefecture	River	Tonegawa River	Kakozeki Weir	Tonosho Town
34		River	Ichinomiya River	Nakano Bridge	Ichinomiya Town
35		Lake	Lake Inbanuma	Lower area of water supply intake	Sakura City
36	Tokyo Metropolis	River	Edogawa River	Shinkatsushika Bridge	Katsushika City
37		River	Tamagawa River	Hajima raw water supply point	Akishima City
38		River	Sumida River	Ryogoku Bridge	Chuo City / Sumida City
39		River	Arakawa River	Kasai Bridge	Koto City / Edogawa City
40	Kanagawa Prefecture	River	Tsurumi River	Rinko Tsurumigawa Bridge	Yokohama City
41		River	Sagami River	Banyu Bridge	Hiratsuka City
42		River	Sakawa River	Sakawa Bridge	Odawara City
43	Niigata Prefecture	River	Shinano River	Heisei-ohashi Bridge	Niigata City
44		River	Agano River	Oun Bridge	Niigata City
45	Toyama Prefecture	River	Jinzu River	Hagiura Bridge	Toyama City
46	Ishikawa Prefecture	River	Saigawa River	Okuwa Bridge	Kanazawa City
47		River	Tedori River	Hakusangoguchi Dike	Hakusan City
48	Fukui Prefecture	River	Kuzuryu River	Fuseda Bridge	Fukui City
49		River	Kitagawa River	Takatsuka Bridge	Obama City
50	Yamanashi Prefecture	River	Sagami River	Katsuragawa Bridge	Uenohara City
51	Nagano Prefecture	River	Fujikawa River	Nanbu Bridge	Nanbu Town
52		River	Shinano River	Ozeki Bridge	Iiyama City
53		River	Saigawa River	Koichi Bridge	Nagano City
54		River	Tenryu River	Tsutsuji Bridge	Iida City

Table 1.2-2 List of locations for FY2018 Nationwide Monitoring (public water areas) (No. 2)

No.	Prefecture	Property	Sampling location		
			Water area	Location	Municipality
55	Gifu	River	Kisogawa River	Tokai-ohashi Bridge (Naruto)	Kaizu City
56	Prefecture	River	Nagara River	Tokai-ohashi Bridge	Kaizu City
57	Shizuoka Prefecture	River	Kanogawa River	Kurose Bridge	Numazu City
58		River	Ooi River	Fujimi Bridge	Yaizu City / Yoshida Town
59		River	Tenryu River	Kaketsuka Bridge	Iwata City / Hamamatsu City
60	Aichi Prefecture	River	Shonai River	Mizuwake Bridge	Nagoya City
61		River	Yahagi River	Iwazutenjin Bridge	Okazaki City / Toyota City
62		River	Toyogawa River	Eshima Bridge	Toyokawa City
63	Mie	River	Suzuka River	Ogura Bridge	Yokkaichi City
64	Prefecture	River	Miyakawa River	Watarai Bridge	Ise City
65	Shiga	River	Adogawa River	Joan Bridge	Takashima City
66	Prefecture	Lake	Lake Biwako	Karasakioki-Chuo	—
67	Kyoto Prefecture	River	Yuragawa River	Yuragawa Bridge	Maizuru City
68		River	Katsura River	Before the confluence of three tributaries of Katsura River	Oyamazaki Town
69	Osaka Prefecture	River	Inagawa River	Gunko Bridge	Itami City (Hyogo Prefecture)
70		River	Yodogawa River	Sugaharashirokita-ohashi Bridge	Osaka City
71		River	Ishikawa River	Takahashi	Tondabayashi City
72	Hyogo Prefecture	River	Kakogawa River	Kakogawa Bridge	Kakogawa City
73		River	Mukogawa River	Hyakkenbi	Takarazuka City
74		River	Maruyama River	Kaminogo Bridge	Toyooka City
75	Nara	River	Yamato River	Fujii	Oji Town
76	Prefecture	River	Kinokawa River	Okura Bridge	Gojo City
77	Wakayama	River	Kinokawa River	Shinrokkaizeki Weir	Wakayama City
78	Prefecture	River	Kumano River	Kumano-ohashi Bridge	Shingu City
79	Tottori Prefecture	River	Sendai River	Gyotoku	Tottori City
80	Shimane	River	Hiikawa River	Kandatsu Bridge	Izumo City
81	Prefecture	River	Gonokawa River	Sakurae-ohashi Bridge	Gotsu City
82	Okayama	River	Asahikawa River	Otoite Weir	Okayama City
83	Prefecture	River	Takahashi River	Kasumi Bridge	Kurashiki City
84	Hiroshima	River	Ota River	Water supply intake in Hesaka	Hiroshima City
85	Prefecture	River	Ashida River	Kominomi Bridge	Fukuyama City
86	Yamaguchi	River	Nishiki River	Domestic water intake for the city	Iwakuni City
87	Prefecture	River	Koto River	Suenobu Bridge	Ube City
88	Tokushima	River	Yoshino River	Takase Bridge	Ishii Town
89	Prefecture	River	Nakagawa River	Nakagawa Bridge	Anan City
90	Kagawa Prefecture	River	Dokigawa River	Marugame Bridge	Marugame City
91	Ehime	River	Shigenobu River	Deai Bridge	Matsuyama City
92	Prefecture	River	Hijikawa River	Hijikawa Bridge	Ozu City
93	Kochi	River	Kagami River	Kachuzeki Weir	Kochi City
94	Prefecture	River	Niyodo River	Hatazeki Weir (1) Center of flow	Ino Town
95	Fukuoka Prefecture	River	Onga River	Hinode Bridge	Nogata City
96		River	Nakagawa River	Shiobara Bridge	Fukuoka City
97		River	Chikugo River	Senoshita	Kurume City
98	Saga Prefecture	River	Kasegawa River	Kase Bridge	Saga City
99	Nagasaki	River	Honmyo River	In front of Tenma Park	Isahaya City
100	Prefecture	River	Uragami River	Ohashizeki Weir	Nagasaki City
101	Kumamoto	River	Kuchi River	Shiroishi	Nagomi Town
102	Prefecture	River	Midori River	Uesugizeki Weir	Kumamoto City
103	Oita	River	Oita River	Funaichi-ohashi Bridge	Oita City
104	Prefecture	River	Oono River	Shirataki Bridge	Oita City
105	Miyazaki	River	Gokase River	Miwa	Nobeoka City
106	Prefecture	River	Oyodo River	Shinaioi Bridge	Miyazaki City
107	Kagoshima	River	Kotsuki River	Iwasaki Bridge	Kagoshima City
108	Prefecture	River	Kimotsuki River	Matase Bridge	Kanoya City
109	Okinawa	River	Genka River	Water intake	Nago City
110	Prefecture	River	Miyara River	Omoto water intake	Ishigaki City

Table 1.2-3 List of locations for FY2018 Nationwide Monitoring (groundwater) (No. 1)

No.	Prefecture	Property	Municipality	District	Monitoring method
1	Hokkaido Prefecture	Groundwater	Sapporo City	Kitananjonishi, Chuo Ward	Fixed point monitoring
2		Groundwater	Abashiri City	Onnenai	Rolling monitoring
3	Aomori Prefecture	Groundwater	Aomori City	Shinmachi	Fixed point monitoring
4		Groundwater	Tsugaru City	Kizukurisuehiro	Rolling monitoring
5	Iwate Prefecture	Groundwater	Morioka City	Motomiya	Fixed point monitoring
6		Groundwater	Miyako City	Shinkawacho	Rolling monitoring
7	Miyagi Prefecture	Groundwater	Sendai City	Honcho, Aoba Ward	Fixed point monitoring
8		Groundwater	Kurihara City	Wakayanagi Kamihataoka	Rolling monitoring
9	Akita Prefecture	Groundwater	Daisen City	Niiyaji	Fixed point monitoring
10		Groundwater	Akita City	Kawabematsubuchi	Rolling monitoring
11	Yamagata Prefecture	Groundwater	Yamagata City	Hatagomachi	Fixed point monitoring
12		Groundwater	Higashine City	Chuo	Rolling monitoring
13	Fukushima Prefecture	Groundwater	Koriyama City	Asahi	Fixed point monitoring
14		Groundwater	Iwaki City	Nishikimachi	Rolling monitoring
15	Ibaraki Prefecture	Groundwater	Tsukuba City	Kenkyugakuen	Fixed point monitoring
16		Groundwater	Kamisu City	Onohara	Rolling monitoring
17		Groundwater	Hitachiota City	Kanaicho	Rolling monitoring
18	Tochigi Prefecture	Groundwater	Shimotsuke City	Machida	Fixed point monitoring
19		Groundwater	Tochigi City	Jonaicho	Rolling monitoring
20		Groundwater	Motegi Town	Iino	Rolling monitoring
21	Gunma Prefecture	Groundwater	Maebashi City	Shikishimacho	Fixed point monitoring
22		Groundwater	Shibukawa City	Akagimachi Takizawa	Rolling monitoring
23		Groundwater	Fujoka City	Tatsuishi	Rolling monitoring
24	Saitama Prefecture	Groundwater	Saitama City	Mikura, Minuma Ward	Fixed point monitoring
25		Groundwater	Kasukabe City	Hiro	Rolling monitoring
26		Groundwater	Konosu City	Mida	Rolling monitoring
27	Chiba Prefecture	Groundwater	Kashiwa City	Funato	Fixed point monitoring
28		Groundwater	Funabashi City	Natsumidai	Rolling monitoring
29		Groundwater	Matsudo City	Tokiwadaira	Rolling monitoring
30	Tokyo Metropolis	Groundwater	Koganei City	Kajinocho	Fixed point monitoring
31		Groundwater	Nerima City	Sekimachikita	Rolling monitoring
32	Kanagawa Prefecture	Groundwater	Hadano City	Imazumi	Fixed point monitoring
33		Groundwater	Hakone Town	Kowakudani	Rolling monitoring
34	Niigata Prefecture	Groundwater	Niigata City	Nagata, Chuo Ward	Fixed point monitoring
35		Groundwater	Sado City	Yahata	Rolling monitoring
36		Groundwater	Murakami City	Matsubaracho	Rolling monitoring
37	Toyama Prefecture	Groundwater	Toyama City	Funahashikitamachi	Fixed point monitoring
38		Groundwater	Imizu City	Imai	Rolling monitoring
39	Ishikawa Prefecture	Groundwater	Hakusan City	Kuramitsu	Fixed point monitoring
40		Groundwater	Komatsu City	Hamasamimachi	Rolling monitoring
41	Fukui Prefecture	Groundwater	Fukui City	Ote	Fixed point monitoring
42		Groundwater	Obama City	Horiyashiki	Rolling monitoring
43	Yamanashi Prefecture	Groundwater	Showa Town	Saijyoshinden	Fixed point monitoring
44		Groundwater	Tsuru City	Shimoya	Rolling monitoring
45	Nagano Prefecture	Groundwater	Nagano City	Tsurugamidori	Fixed point monitoring
46		Groundwater	Nakano City	Chuo	Rolling monitoring
47		Groundwater	Matsumoto City	Chuo	Rolling monitoring
48	Gifu Prefecture	Groundwater	Gifu City	Kanoshimizucho	Fixed point monitoring
49		Groundwater	Yoro Town	Naka	Rolling monitoring
50		Groundwater	Kani City	Imawatari	Rolling monitoring
51	Shizuoka Prefecture	Groundwater	Numazu City	Hara	Fixed point monitoring
52		Groundwater	Iwata City	Mitsuke	Rolling monitoring
53		Groundwater	Hamamatsu City	Kaminishicho, Higashi Ward	Rolling monitoring
54	Aichi Prefecture	Groundwater	Nagoya City	Kawaharatori, Showa Ward	Fixed point monitoring
55		Groundwater	Toyota City	Maebayashicho	Rolling monitoring
56		Groundwater	Tahara City	Okubocho	Rolling monitoring

Table 1.2-3 List of locations for FY2018 Nationwide Monitoring (groundwater) (No. 2)

No.	Prefecture	Property	Municipality	District	Monitoring method
57	Mie Prefecture	Groundwater	Suzuka City	Inouchi	Fixed point monitoring
58		Groundwater	Inabe City	Inabecho Kam kasada	Rolling monitoring
59		Groundwater	Kihoku Town	Nagashima	Rolling monitoring
60	Shiga Prefecture	Groundwater	Moriyama City	Miyakecho	Fixed point monitoring
61		Groundwater	Hikone City	Kamiokabecho	Rolling monitoring
62		Groundwater	Higashiomi City	Inokocho	Rolling monitoring
63	Kyoto Prefecture	Groundwater	Kyoto City	Toraishicho, Nakagyo Ward	Fixed point monitoring
64		Groundwater	Kameoka City	Amarubecho Wakunari	Rolling monitoring
65	Osaka Prefecture	Groundwater	Sakai City	Daisennakamachi, Sakai Ward	Fixed point monitoring
66		Groundwater	Kishiwada City	Harukidaikokucho	Rolling monitoring
67	Hyogo Prefecture	Groundwater	Itami City	Kuchisakai	Fixed point monitoring
68		Groundwater	Toyooka City	Saiwaicho	Fixed point monitoring
69		Groundwater	Nishiwaki City	Shimotoda	Rolling monitoring
70	Nara Prefecture	Groundwater	Nara City	Sakyo	Fixed point monitoring
71		Groundwater	Tenri City	Nakayamacho	Rolling monitoring
72	Wakayama Prefecture	Groundwater	Kinokawa City	Takano	Fixed point monitoring
73		Groundwater	Shirahama Town	Taira	Rolling monitoring
74	Tottori Prefecture	Groundwater	Tottori City	Saiwaicho	Fixed point monitoring
75		Groundwater	Kofu Town	Ebi	Rolling monitoring
76	Shimane Prefecture	Groundwater	Matsue City	Nishikawatsucho	Fixed point monitoring
77		Groundwater	Izumo City	Himebara(1)	Rolling monitoring
78	Okayama Prefecture	Groundwater	Kurashiki City	Fukui	Fixed point monitoring
79		Groundwater	Tsuyama City	Kamocho Tatsuchu	Rolling monitoring
80	Hiroshima Prefecture	Groundwater	Hiroshima City	Kamisenochi, Aki Ward	Fixed point monitoring
81		Groundwater	Shobara City	Tojocho Kushiro	Rolling monitoring
82	Yamaguchi Prefecture	Groundwater	Yamaguchi City	Ouchimihori	Fixed point monitoring
83		Groundwater	Mine City	Ominecho Nishibun	Rolling monitoring
84	Tokushima Prefecture	Groundwater	Tokushima City	Fudohoncho	Fixed point monitoring
85		Groundwater	Kaiyo Town	Takazono	Rolling monitoring
86	Kagawa Prefecture	Groundwater	Takamatsu City	Bancho	Fixed point monitoring
87		Groundwater	Sanuki City	Shido	Rolling monitoring
88	Ehime Prefecture	Groundwater	Matsuyama City	Hiraimachi	Fixed point monitoring
89		Groundwater	Seiyo City	Uwacho Kamimatsuba	Rolling monitoring
90		Groundwater	Ozu City	Shiba	Rolling monitoring
91	Kochi Prefecture	Groundwater	Kochi City	Kerako	Fixed point monitoring
92		Groundwater	Shimanto City	Fuba	Rolling monitoring
93	Fukuoka Prefecture	Groundwater	Kurume City	Tanushimarumachi Akinari	Fixed point monitoring
94		Groundwater	Chikushino City	Yamae	Rolling monitoring
95	Saga Prefecture	Groundwater	Saga City	Yamatochoni ji	Fixed point monitoring
96		Groundwater	Imari City	Hatatsucho Koba	Rolling monitoring
97	Nagasaki Prefecture	Groundwater	Isahaya City	Eidamachi	Fixed point monitoring
98		Groundwater	Shimabara City	Uenohara	Rolling monitoring
99	Kumamoto Prefecture	Groundwater	Kumamoto City	Suizenji, Chuo Ward	Fixed point monitoring
100		Groundwater	Amakusa City	Saitsumachi	Rolling monitoring
101		Groundwater	Koshi City	Sakae	Rolling monitoring
102	Oita Prefecture	Groundwater	Saiki City	Kamioka	Fixed point monitoring
103		Groundwater	Hita City	Hidaka	Rolling monitoring
104	Miyazaki Prefecture	Groundwater	Miyakonojo City	Minamiyokoichicho	Fixed point monitoring
105		Groundwater	Kobayashi City	Minaminish kata	Fixed point monitoring
106		Groundwater	Miyakonojo City	Minamiyokoichicho	Rolling monitoring
107	Kagoshima Prefecture	Groundwater	Kagoshima City	Tamazatocho	Fixed point monitoring
108		Groundwater	Isa City	Okuchimemaru	Rolling monitoring
109	Okinawa Prefecture	Groundwater	Miyakojima City	Hirarahigashinakasonezoe	Fixed point monitoring
110		Groundwater	Itoman City	Mabuni	Rolling monitoring

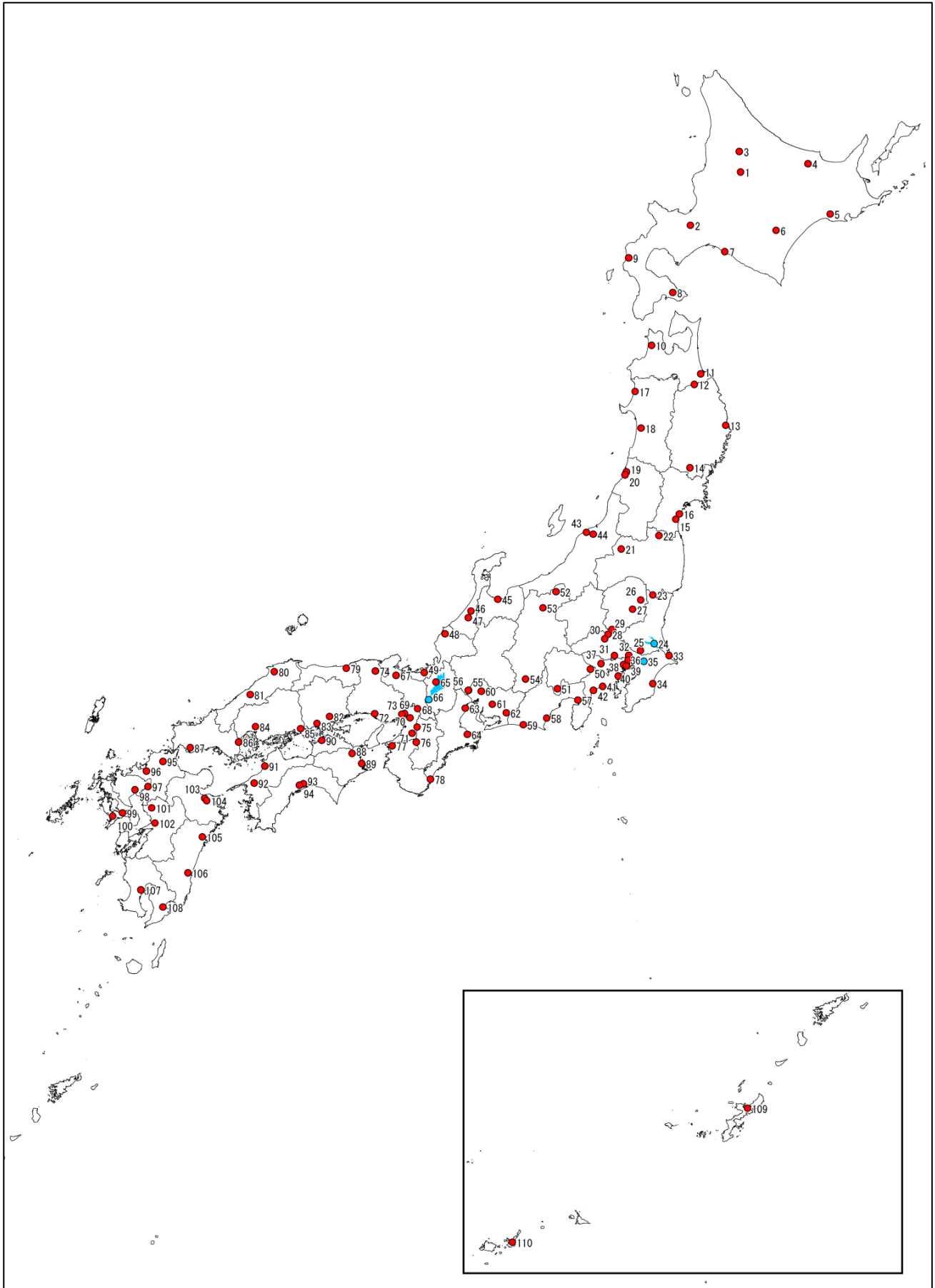


Figure 1.2-1 Map showing locations for FY2018 Nationwide Monitoring (public water areas)

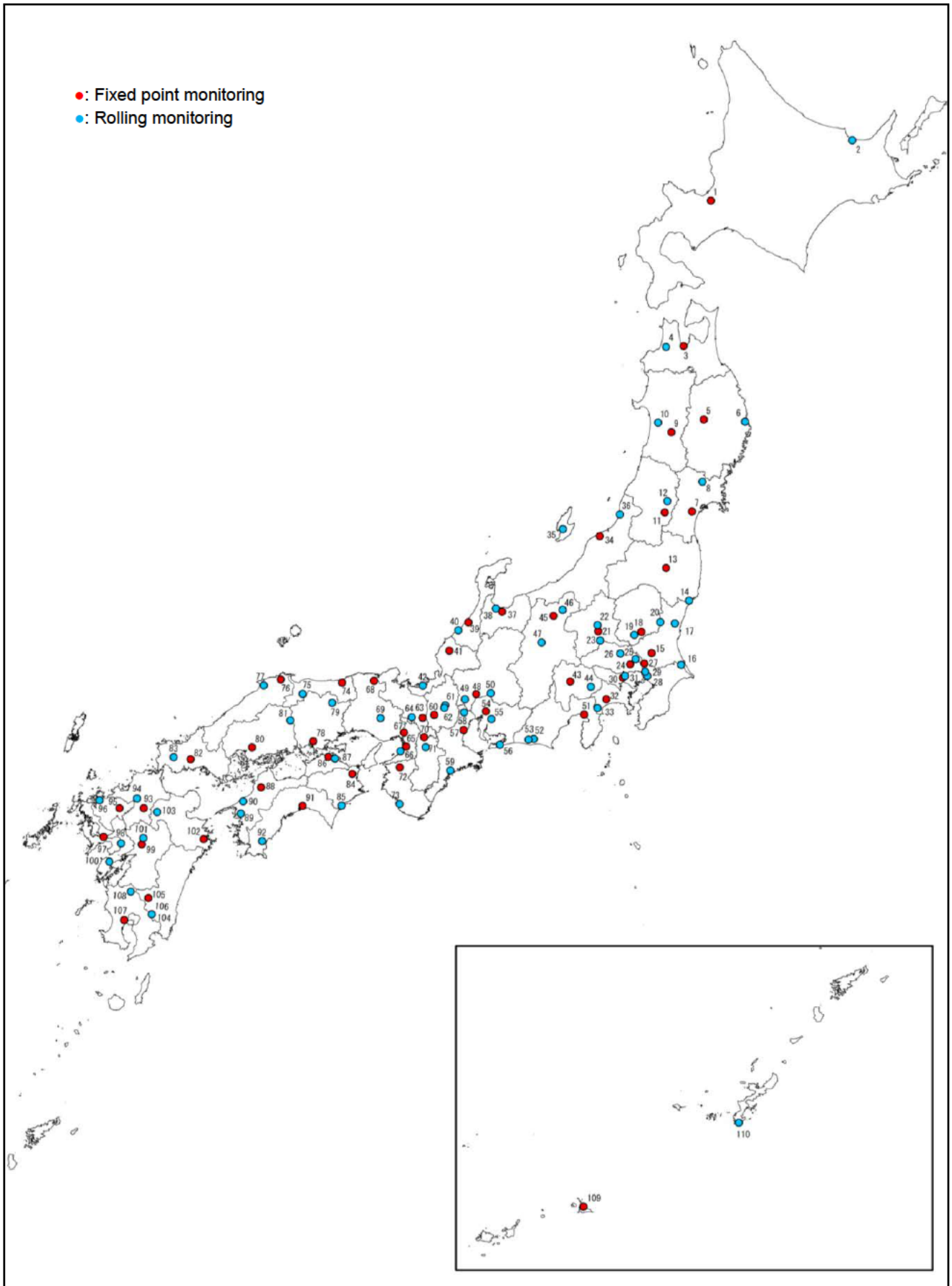


Figure 1.2-2 Map showing locations for FY2018 Nationwide Monitoring (groundwater)

Table 1.2-4 Monitoring points and period by block (FY2018)

Blocks	Prefectures	Public water areas		Groundwater	
		Number of Locations (*1)	Period	Number of locations	Period
Hokkaido block	Hokkaido	9	Aug 21 to Sep 21	2	Aug 20 to Aug 29
Tohoku block	Aomori, Iwate, Miyagi, Akita, Yamagata and Fukushima	14	Aug 20 to Oct 26	12	Aug 20 to Oct 5
Kanto block	Ibaraki, Tochigi, Gunma, Saitama, Chiba, Tokyo, Kanagawa, Niigata, Yamanashi and Shizuoka	26 (2)	Aug 20 to Oct 29	27	Aug 20 to Sep 19, Dec 10 (*2)
Chubu block	Toyama, Ishikawa, Fukui, Nagano, Gifu, Aichi and Mie	15	Aug 20 to Nov 8	18	Aug 20 to Sep 27
Kinki block	Shiga, Kyoto, Osaka, Hyogo, Nara, and Wakayama	14 (1)	Aug 22 to Oct 24	14	Aug 22 to Sep 19
Chugoku-Shikoku Block	Tottori, Shimane, Okayama, Hiroshima, Yamaguchi, Tokushima, Kagawa, Ehime, and Kochi	16	Aug 20 to Oct 19	19	Aug 20 to Oct 19
Kyushu and Okinawa block	Fukuoka, Saga, Nagasaki, Kumamoto, Oita, Miyazaki, Kagoshima, and Okinawa	16	Aug 20 to Sep 20	18	Aug 21 to Oct 9
Survey to check for seasonal variations	Gunma and Okayama	2	May 22 to Jan 18	-	-

(*1) Numbers in parentheses designate monitoring locations for lakes; plain numbers are for rivers.

(*2) The groundwater at No.53 was collected on December 10, and collection from other locations was completed by September 19.

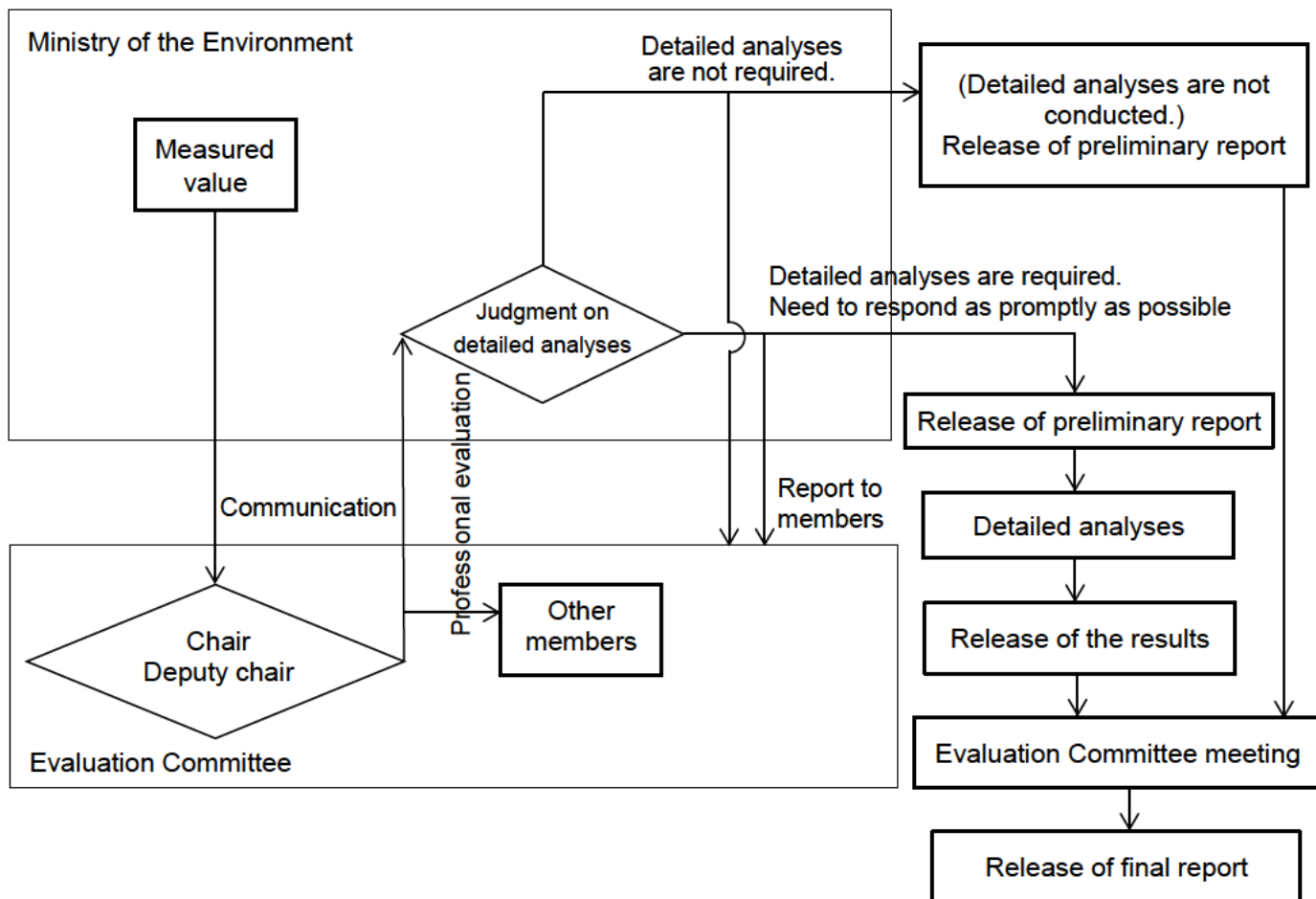


Figure 1.2-3 Procedures for professional evaluation of the results of the Nationwide Monitoring

2 Survey Methods and Analysis Methods

2.1 Survey methods

Samples were collected based on the following guidelines in principle, as outlined below.

- Water Quality Survey Method (Sep 30, 1971; Notice Kansuikan No. 30 issued by the Director General of the Water Quality Preservation Bureau, Ministry of the Environment)
- Sediment Survey Method (Aug 8, 2012; Notice Kansuikansuuhatsu No. 120725002 issued by the Director General of the Environmental Management Bureau, Ministry of the Environment)
- Groundwater Quality Survey Method (Sep 14, 1989; Notice Kansuikan No. 189 issued by the Director General of the Water Quality Preservation Bureau, Ministry of the Environment)
- Environmental Sample Collection Method (1983, Ministry of Education, Culture, Sports Science and Technology (hereinafter referred to as “MEXT”)'s Radioactivity Measurement Method Series)
- Sample Pretreatment for Instrumental Analysis Using Germanium Semiconductor Detectors (1982, MEXT's Radioactivity Measurement Method Series)

(1) Public water areas

- Water:

Water samples of around 160 L (hydrochloric acid added) and around 2 L (nitric acid added) were collected at the predetermined points. From the 160 L sample (hydrochloric acid added), 80 L was used for γ -ray spectrometry analyses and the remaining 80 L was preserved for possible detailed analyses. From the 2 L sample (nitric acid added), 1 L was used to measure total β radioactivity concentrations.

Additionally, the transparency (or Secchi disk depth) was measured when collecting water samples, and in the case that transparency was thought to have been affected by rainwater based on comparison to prior measurements, or if there was no past data to compare, the measured transparency was 50 cm or less and it was suspected that rainwater may have influenced transparency, the water was not used as samples.

- Sediment:

Bottom sediment samples of around 6 L were collected at the predetermined points at a depth of around 10 cm from the surface layer by using an Ekman-Birge grab sampler etc., and 3 L out of the 6 L was used for γ -ray spectrometry analyses.

- Soil:

Soil samples (around 5 cm in diameter) were collected at a depth of around 5 cm at five points within a 3 to 5 meter square (four vertices and the diagonal intersection point), or, when it was difficult to find an appropriate square to determine five such sampling locations, soil from five points at 3 to 5 meter intervals along a river was collected and was brought back separately. Samples thus collected at the five points were mixed in equal amounts respectively and were used for analyses.

- Ambient dose rates (soil sampling locations):

Ambient dose rates were measured by installing NaI (Tl) scintillation survey meters at a height of 1 m

from the ground surface on both banks of a river (or in the case of a lake, installing a NaI (Tl) scintillation survey meter at one point on lake side) so that the meters would face the sampling location of river water (or lake water).

(2) Groundwater

- Water:

Groundwater samples of around 160 L (hydrochloric acid added) and 2 L (nitric acid added) were collected at the predetermined wells, etc., 80 L of the 160 L sample (hydrochloric acid added) was used for γ -ray spectrometry analyses and the remaining 80 L was preserved for possible detailed analyses. 1 L of the 2 L sample (nitric acid added) was used to measure total β radioactivity concentrations.

When collecting water samples, it was confirmed that water temperature, transparency, pH, and electrical conductivity remained constant by allowing the water to pass for several minutes, and changes in the transparency, etc., thereafter were recorded as notes.

- Ambient dose rates:

Ambient dose rates were measured by installing NaI (Tl) scintillation survey meters at a height of 1 m from the ground surface outdoors near the relevant wells, etc., so that they would face the sampling location of groundwater (or the groundwater layer).

2.2 Analysis methods

For public water areas (water and sediment) and groundwater (water), total β radioactivity concentrations and γ -ray spectrometry with a germanium semiconductor detector were conducted using the methods below. As a general rule, the γ -ray spectrometry measurement covered all detectable radionuclides (including artificial radionuclides and naturally occurring radionuclides). Measurements were described to two significant digits, and the unit of measurements were "Bq/L" for water samples from public water areas and groundwater samples, and "Bq/kg (dry weight)" for sediment samples from public water areas, respectively.

The adopted analysis methods were essentially in line with the MEXT's Radioactivity Measurement Method Series, and detection limits were set around 0.001 to 0.01 Bq/L for water samples and around 1 to 30 Bq/kg for sediment samples. (However, these detection limits did not apply to radionuclides with short half-lives or those with extremely low γ -ray emission rates.)

- Measurement of total β radioactivity concentrations: The samples were concentrated and dried, and then measurements were taken using a low-background gas-flow proportional counter.
- γ -ray spectrometry measurement: After proper pretreatment, the samples were placed in a U-8 container or a 2L Marinelli beaker and measured using a germanium semiconductor detector. The following 62 types of γ -ray emitting radionuclides (18 naturally occurring radionuclides and 44 artificial radionuclides) were surveyed. The measured results of γ -ray emitting radionuclides were corrected for attenuation, and figures were reported as activity concentration after sampling.

Table 2.2-1 Surveyed γ -ray emitting radionuclides

Naturally occurring radionuclides (18 radionuclides)		Artificial radionuclides (44 radionuclides)				
Ac-228	Ra-224	Ag-108m	Co-58	I-131	Np-239	Te-129m
Be-7	Ra-226	Ag-110m	Co-60	I-132	Ru-103	Te-132
Bi-212	Th-227	Am-241	Cr-51	La-140	Ru-106	Y-91
Bi-214	Th-228	As-74	Cs-134	Mn-54	Sb-124	Y-93
K-40	Th-231	Ba-140	Cs-136	Mn-56	Sb-125	Zn-63
Pa-234m	Th-234	Bi-207	Cs-137	Mo-99	Sb-127	Zn-65
Pb-210	Tl-206	Ce-141	Fe-59	Nb-95	Sr-91	Zr-95
Pb-212	Tl-208	Ce-143	Ga-74	Nb-97	Tc-99m	Zr-97
Pb-214	U-235	Ce-144	Ge-75	Nd-147	Te-129	

3 Results

An outline of detectable radioactive materials at each monitoring location is as follows.

3.1 Detection of total β radioactivity and γ -ray emitting radionuclides

(1) Public water areas

1) Water

The results of the measurements of total β radioactivity and γ -ray emitting radionuclides in water samples from public water areas are as shown in Table 3.1-1 and Figure 3.1-1.

i) Total β radioactivity

The detection rate for total radioactivity was 92.0% with detected values ranging from not detectable to 2.8 Bq/L; they were all within the past measurement trends.

ii) γ -ray emitting radionuclides

As shown in Table 3.1-1 and Figure 3.1-1, six types of γ -ray emitting radionuclides (four naturally occurring radionuclides and two artificial radionuclides) were detected, while other types of γ -ray emitting radionuclides were not detectable at any of the locations surveyed.

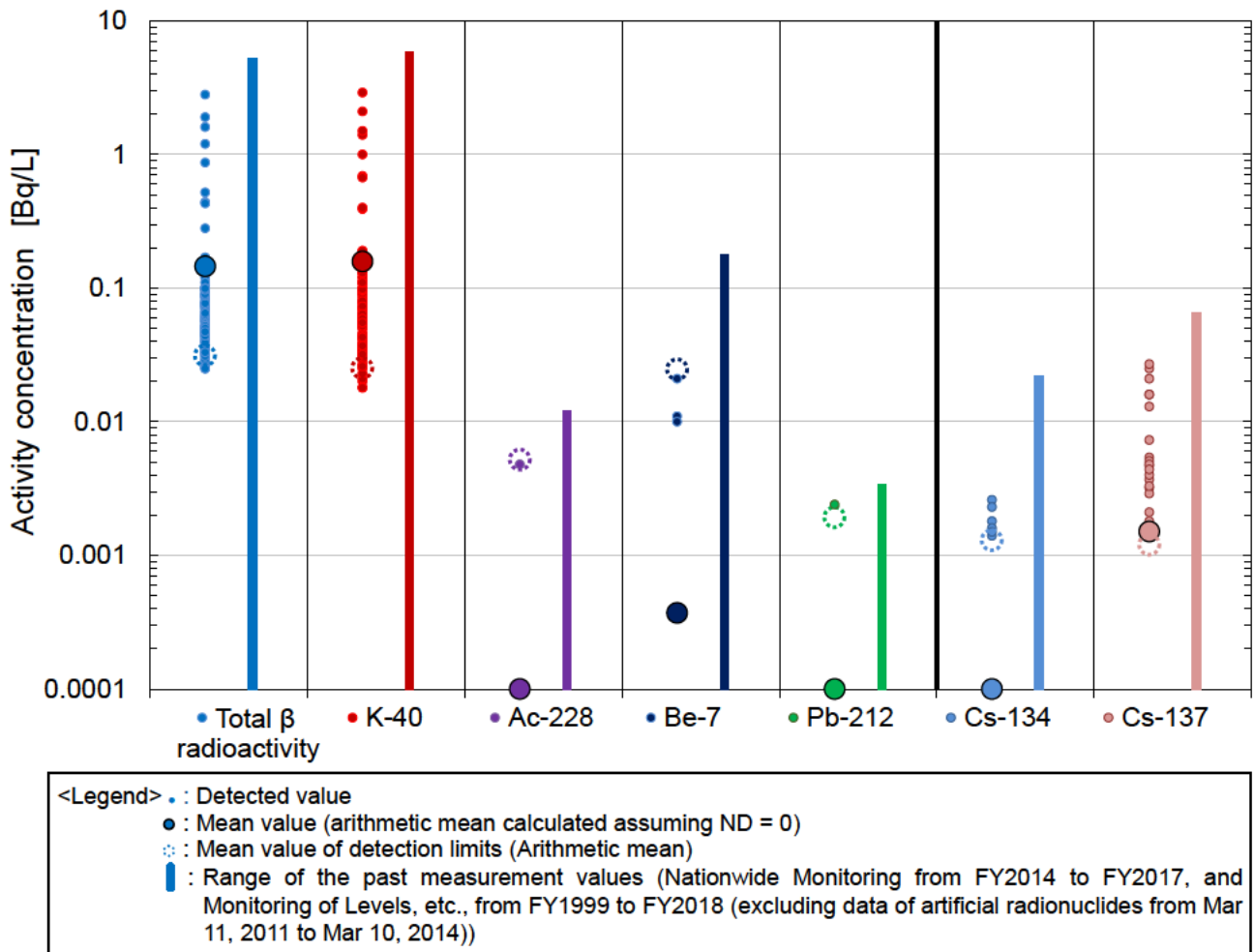
The detection rates of naturally occurring radionuclides were 3% or less, except for K-40, for which the detection rate was 95.6%. All of the measured values of naturally occurring radionuclides were within the past measurement trends.

Regarding artificial radionuclides, the detection rate was 5.3% for Cs-134 and 16.8% for Cs-137, while the nuclide concentration of Cs-134 was 0.0026 Bq/L or less, Cs-137 was 0.027 Bq/L or less: all of which were within the past measurement trends.

Table 3.1-1 Detection of total β radioactivity and γ -ray emitting radionuclides in water samples from public water areas

Radionuclides		Number of samples	Number of detections	Detection rate [%]	Measured values [Bq/L]		Maximum records [Bq/L]		
					Range	Detection limits	Nationwide monitoring (FY2014-FY2017)	Monitoring of Levels (*1)	
Total β radioactivity		113	104	92.0	ND - 2.8	0.022 - 0.22	5.2	0.24	
Y-ray emitting radionuclides	Naturally occurring	K-40	113	108	95.6	ND - 2.9	0.012 - 0.087	5.8	2.3
		Ac-228	113	1	0.9	ND - 0.0048	0.0028 - 0.020	0.012	0.0037
		Be-7	113	3	2.7	ND - 0.021	0.0074 - 0.082	0.057	0.18
		Pb-212	113	1	0.9	ND - 0.0024	0.0009 - 0.0081	0.0034	No data
	Artificial	Cs-134	113	6	5.3	ND - 0.0026	0.0008 - 0.0046	0.022	0.015
		Cs-137	113	19	16.8	ND - 0.027	0.0007 - 0.0043	0.065	0.041

(*1) Results of the Monitoring of Environmental Radioactivity Levels and the Monitoring of the Surrounding Environment conducted in Japan nationwide from FY1999 to FY2018 (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014)



(*) The vertical axis is logarithmically scaled because the magnitude of detected values varies widely depending on the type of radionuclide.

Figure 3.1-1 Detection of total β radioactivity and γ -ray emitting radionuclides in water samples from public water areas

2) Sediment

The results for total β radioactivity and γ -ray emitting radionuclides in sediment samples from public water areas are as shown in Table 3.1-2 and Figure 3.1-2.

i) Total β radioactivity

Total β radioactivity was detected at all locations surveyed, with detected values ranging from 160 to 1,400 Bq/kg: some of which exceeded the range of the past measurement records, however, they were all attributable to naturally occurring radionuclides and considered to be within the past measurement trends.

ii) γ -ray emitting radionuclides

As shown in Table 3.1-2 and Figure 3.1-2, 10 types of γ -ray emitting radionuclides (eight naturally occurring radionuclides and two artificial radionuclides) were detected, while no other types of γ -ray emitting radionuclides were detectable.

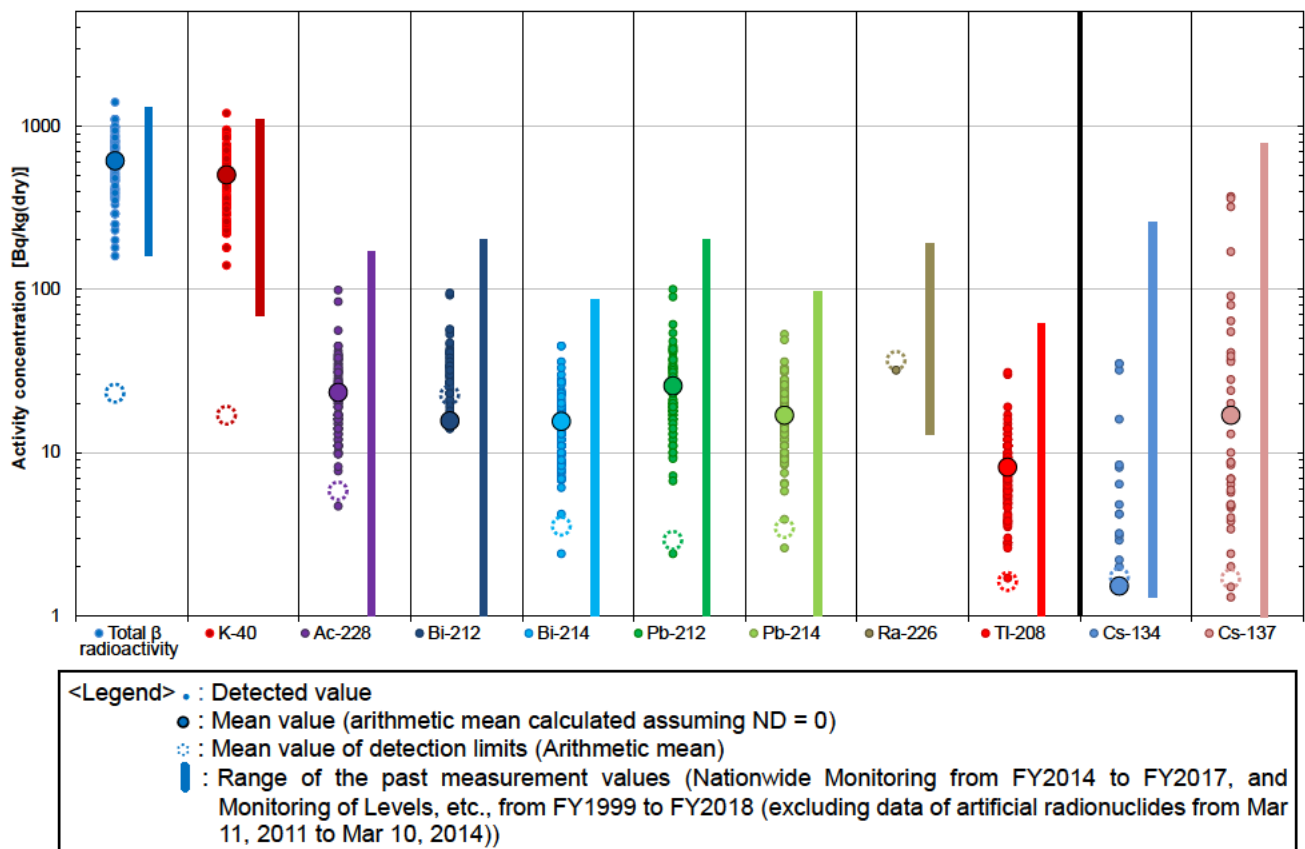
The detection rates of the six naturally occurring radionuclides other than Bi-212, and Ra-226 exceeded 95%. K-40 exceeded the range of the past measurement records at some locations; however, K-40 is generally contained in natural soils and rocks: the values were all considered to be within the past measurement trends (described later).

As for artificial radionuclides, the detection rates of Cs-134 and Cs-137 were 13.6% and 33.6% respectively, while detected values were 35 Bq/kg or less for Cs-134 and 370 Bq/kg or less for Cs-137: all of which were within the past measurement trends.

Table 3.1-2 Detection of total β radioactivity and γ -ray emitting radionuclides in sediment samples from public water areas

Radionuclides	Number of samples	Number of detections	Detection rate [%]	Measured values [Bq/kg (dry)]		Maximum records [Bq/kg(dry)]			
				Range	Detection limits	Nationwide monitoring (FY2014-FY2017)	Monitoring of Levels (*1)		
Total β radioactivity	110	110	100	160 - 1,400	14 - 36	1,300	1,300		
Y-ray emitting radionuclides	Naturally occurring	K-40	110	110	100	140 - 1,200	9.5 - 31	1,100	800
		Ac-228	110	109	99.1	ND - 99	3.2 - 9.8	170	ND
		Bi-212	110	51	46.4	ND - 95	11 - 40	200	No data
		Bi-214	110	110	100	2.4 - 45	1.9 - 7.8	87	ND
		Pb-212	110	110	100	2.4 - 100	1.6 - 6.3	200	No data
		Pb-214	110	110	100	2.6 - 53	1.7 - 8.4	96	No data
		Ra-226	110	1	0.9	ND - 32	18 - 170	190	122
		Tl-208	110	109	99.1	ND - 31	0.83 - 3.1	61	No data
	Artificial	Cs-134	110	15	13.6	ND - 35	0.89 - 3.5	260	30
		Cs-137	110	37	33.6	ND - 370	0.78 - 3.3	780	110

(*1) Results of the Monitoring of Environmental Radioactivity Levels and the Monitoring of the Surrounding Environment studies conducted in Japan nationwide from FY1999 to FY2018 (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014)



(*) Details of the detection of Cs-134 and Cs-137 are explained later.

(*) The vertical axis is logarithmically scaled because the magnitude of detected values varies widely with the type of radionuclide.

Figure 3.1-2 Detection of total β radioactivity and γ -ray emitting radionuclides in sediment samples from public water areas

(2) Groundwater

The measurement results for total β radioactivity and γ -ray emitting radionuclides in groundwater samples are as shown in Table 3.1-3 and Figure 3.1-3.

i) Total β radioactivity

The detection rate of total β radioactivity was 90.0% with detected values ranging from not detectable to 1.3 Bq/L: some of which exceeded the range of the past measurement records, however, they were all attributable to K-40 (naturally occurring radionuclide) and considered to be within the past measurement trends.

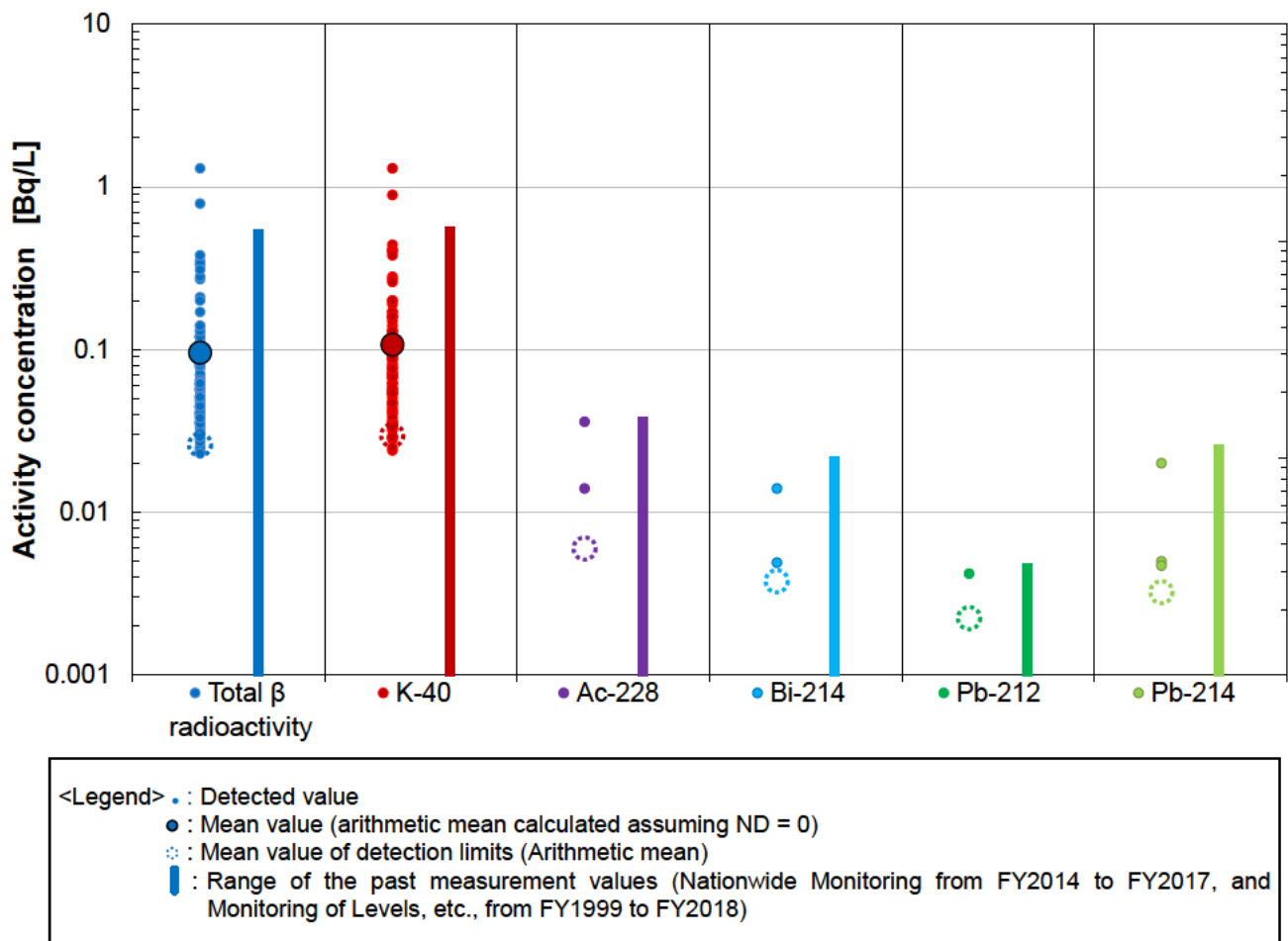
ii) γ -ray emitting radionuclides

Five types of γ -ray emitting radionuclides (all naturally occurring radionuclides), as shown in Table 3.1-3 and Figure 3.1-3, were detected, while no other types of γ -ray emitting radionuclides were detected. The detection rate was less than 3% except for the detection rate of K-40 which was 85.5%. K-40 exceeded the range of the past measurement records at some locations, however, K-40 is generally contained in natural soils, rocks, and seawater, etc., and considered to be within the past measurement trends (described later).

Table 3.1-3 Detection of total β radioactivity and γ -ray emitting radionuclides in groundwater samples

Radionuclides	Number of samples	Number of detections	Detection rate [%]	Measured values [Bq/L]		Maximum records [Bq/L]		
				Range	Detection limits	Nationwide Monitoring (FY2014 - FY2017)	Monitoring of Levels (*1)	
Total β radioactivity	110	99	90.0	ND - 1.3	0.022 - 0.071	0.54	No data	
y-ray emitting radionuclides Naturally occurring	K-40	110	94	85.5	ND - 1.3	0.013 - 0.075	0.56	0.28
	Ac-228	110	2	1.8	ND - 0.036	0.0030 - 0.015	0.038	No data
	Bi-214	110	2	1.8	ND - 0.014	0.0020 - 0.0088	0.022	No data
	Pb-212	110	1	0.9	ND - 0.004	0.0012 - 0.0064	0.0048	No data
	Pb-214	110	3	2.7	ND - 0.020	0.0018 - 0.0079	0.026	No data

(*1) Results of the Monitoring of Environmental Radioactivity Levels and the Monitoring of the Surrounding Environment conducted in Japan nationwide from FY1999 to FY2018



(*) The vertical axis is logarithmically scaled because the magnitude of detected values varies widely with the type of radionuclide.

Figure 3.1-3 Detection of total β radioactivity and γ -ray emitting radionuclides in groundwater samples

3.2 Discussion regarding detected radionuclides

(1) Detection of naturally occurring radionuclides

1) Correlation between activity concentrations of K-40 in water samples and seawater

As explained in 3.1 above, activity concentrations of K-40 detected in water samples collected in public water areas were all within the past measurement trends. All the locations where relatively high concentrations of K-40 were detected were located in the tide zone and the electrical conductivity (EC) was high (1,600 mS/m at the maximum). Therefore, seawater inflow is a concern as a cause for these high concentrations and a comparison was made using all available data to clarify the correlation between activity concentrations of K-40 and EC (see Figure 3.2-1).

As shown in Figure 3.2-1, a positive correlation was found between them.

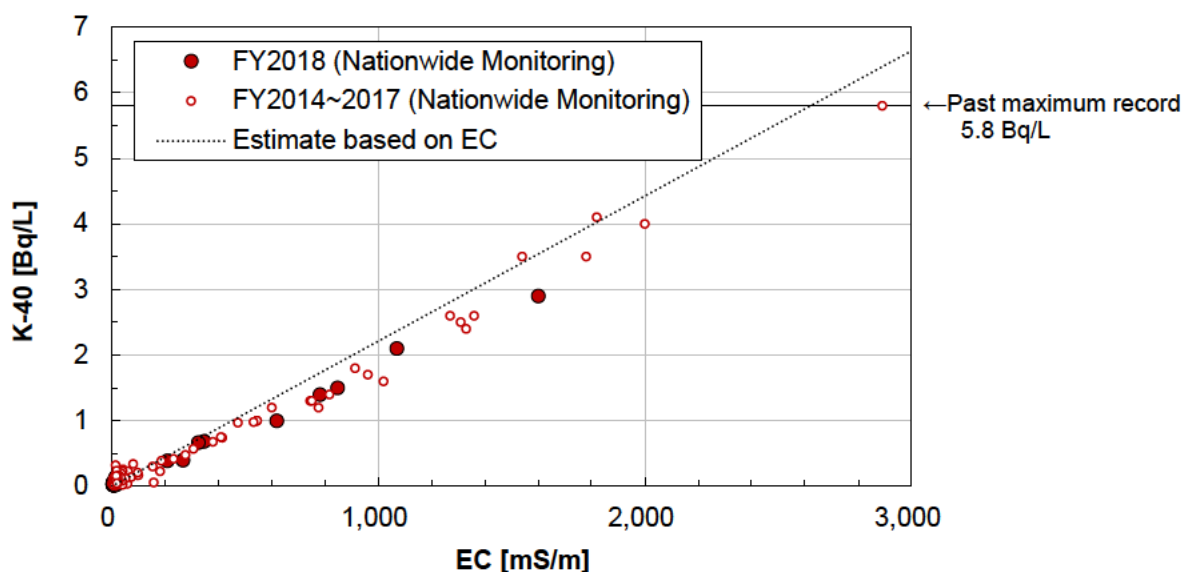


Figure 3.2-1 Correlation between K-40 concentrations and electrical conductivity (EC) in water samples from public water areas

On the other hand, according to the results of the Monitoring of Levels, conducted for 20 years from FY1999 to FY2018 (monitoring of 959 samples collected from 19 prefectures), the average concentration (arithmetic mean) of K-40 was approximately 9.9 Bq/L and the maximum concentration was 15 Bq/L (see Table 3.2-1).

Table 3.2-1 Results of the Monitoring of Levels, etc., concerning K-40 in seawater (*1)

Number of surveys	Number of detections	Detection rate [%]	Average [Bq/L]	Maximum [Bq/L]
959	924	96.4	9.9	15

(*1) Results of the Monitoring of Levels and the Monitoring of the Surrounding Environment conducted in Japan nationwide from FY1999 to FY2018

EC of seawater is generally around 4,500 mS/m, and the estimated activity concentrations of K-40 with the possible effects from seawater were obtained by using the following formula based on the measurement results of EC for the relevant river water.

$$\text{(Activity concentration of K-40 in river water)} = \text{(Average activity concentration of K-40 in seawater)} \times \frac{\text{(Measured EC in the river water)}}{\text{(Ordinary values of EC in seawater)}}$$

The estimated activity concentrations of K-40 in the river water are indicated with a dotted line (.....) in Figure 3.2-1, and the estimated values fall in line extremely well with the measured activity concentrations of K-40. Therefore, the high activity levels of K-40 obtained in the latest measurements are considered to have been caused by the intrusion of seawater.

Since the concentrations of K-40 in groundwater samples exceeded the range of the past measurement records at two locations (No. 17 and No. 66), the correlation between K-40 concentration and EC was assessed using all available data in the same manner as the case of the public water areas (see Figure 3.2-2, scales of the vertical and horizontal axes differ from those for Figure 3.2-1). Overall, no clear correlation between K-40 concentration and EC was found. However, for No. 66, it was considered to be affected by seawater judging from the environment of the collection point and the exceedingly high EC compared to other sampling locations.

For No. 17, although K-40 showed a relatively high value regardless of its low EC, it was well in line with the estimated value of K-40³ calculated from the K (stable) concentration measured for verification, and it was confirmed that there was no problem in the measurement. The K (stable) concentration was also within the range of nationwide surveys of groundwater⁴.

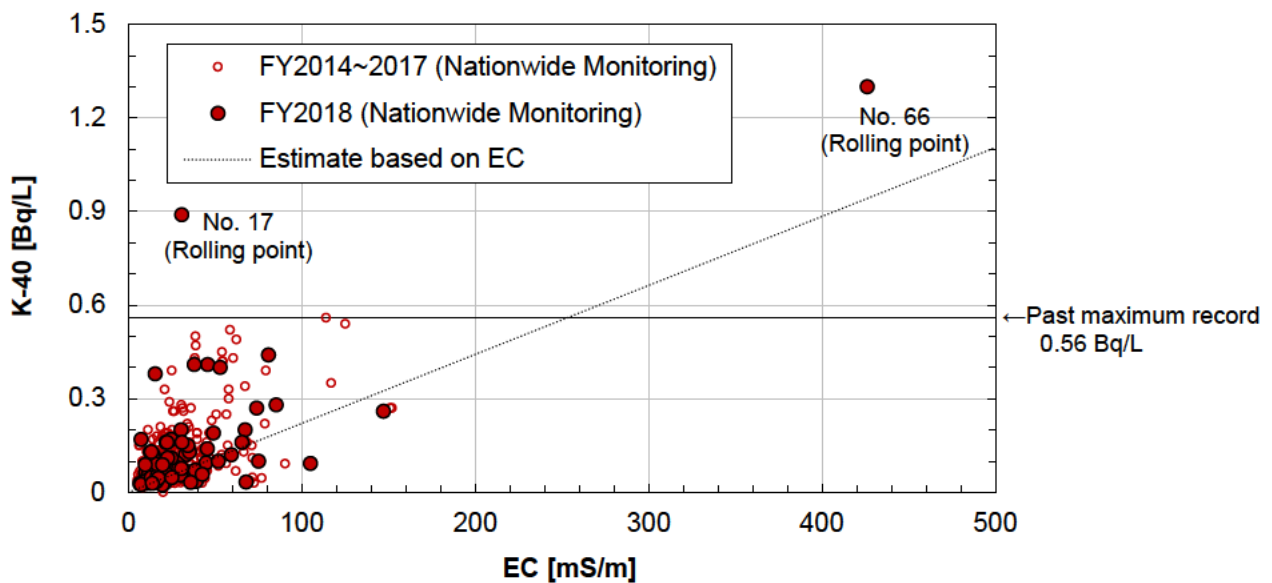


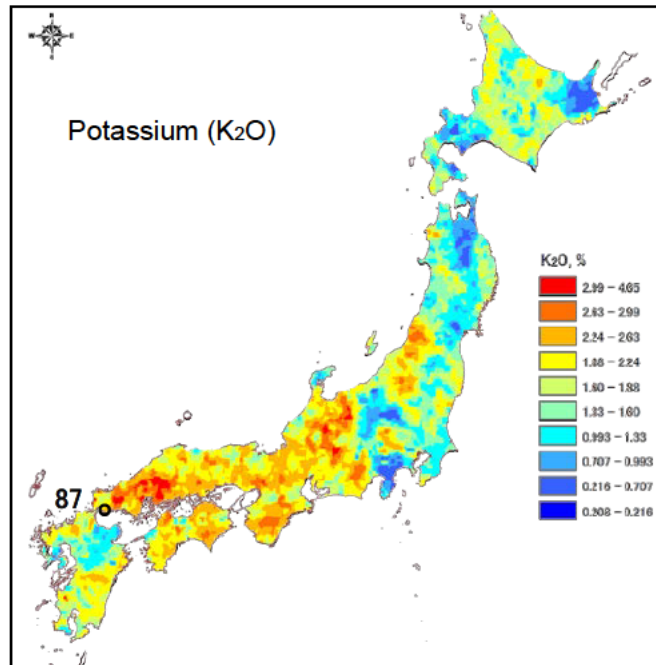
Figure 3.2-2 Correlation between the K-40 concentration and electrical conductivity (EC) in groundwater Sample

³ K-40 has a very long half-life of 1.28×10^9 years and is known to be present in 0.0117% of natural potassium. The K-40 concentration can be estimated by calculation based on its K (stable) concentration.

⁴ The K (stable) concentrations ranged from 0.17 to 33.95 mg/L in nationwide surveys of groundwater (Source: National Institute of Agro-Environmental Sciences, Material No. 20 "Survey Data on Groundwater Quality in Rural Areas (1986-1993)" by National Institute of Agro-Environmental Sciences, Ministry of Agriculture, Forestry and Fisheries (March 1997).

2) K-40 in sediments

In public water sediment, activity concentrations of K-40 exceeded the range of the past measurement records at one site (No. 87). Potassium (K_2O) is an element contained in the earth's crust. As shown in Figure 3.2-3, No. 87 is located in an area with relatively high potassium concentrations.



Reference: Website of the Geological Survey of Japan, AIST
<https://qbank.gsj.jp/geochemmap/setumei/radiation/setumei-radiation.htm>

Figure 3.2-3 Distribution of potassium (K_2O) in soil in Japan

3) Uranium and thorium series radionuclides in sediment samples

As explained in 3.1(1)(2) above, uranium and thorium series radionuclides were detected at relatively high concentration levels in sediment samples from public water areas. The detection status is shown in Table 3.2-2.

Table 3.2-2 Detection of uranium and thorium series naturally occurring radionuclides

Radionuclides		Number of samples	Number of detections	Detection rate [%]	Measured values [Bq/kg(dry)]		
					Range	Detection limit	
γ-ray emitting radionuclides	Uranium series	Ra-226	110	1	0.9	ND - 32	18 - 170
		Pb-214	110	110	100	2.6 - 53	1.7 - 8.4
		Bi-214	110	110	100	2.4 - 45	1.9 - 7.8
	Thorium Series	Ac-228	110	109	99.1	ND - 99	3.2 - 9.8
		Pb-212	110	110	100	2.4 - 100	1.6 - 6.3
		Bi-212	110	51	46.4	ND - 95	11 - 40
		Tl-208	110	109	99.1	ND - 31	0.83 - 3.1

These naturally occurring radionuclides exist widely within the earth's crust and the past monitoring has confirmed high correlations among the series.

Figure 3.2-4 and Figure 3.2-5 show the correlation among uranium series radionuclides and among thorium series radionuclides detected at the monitoring for FY2018 (These are plotted out based on radionuclides with high detection rate (uranium series: Pb-214 and thorium series: Pb-212) with instances of non-detection excluded).

Figure 3.2-4 and Figure 3.2-5 reveal high correlations among uranium series or among thorium series radionuclides.

<Note>

The tendency shown in the radionuclides of the two series are considered to be reflected in the geology of the locations at which they had been detected.

It is generally accepted that granite contains larger amounts of naturally occurring radionuclides than other kinds of rocks and that natural radiation doses correlate to some extent with uranium and thorium series radionuclides (both according to the Geological Society of Japan⁵).

For reference, Figure 3.2-6 shows the distribution map of granite in Japan, while Figure 3.2-7 shows the distribution map of natural radiation doses in Japan.

⁵ <http://www.geosociety.jp/hazard/content0058.html>

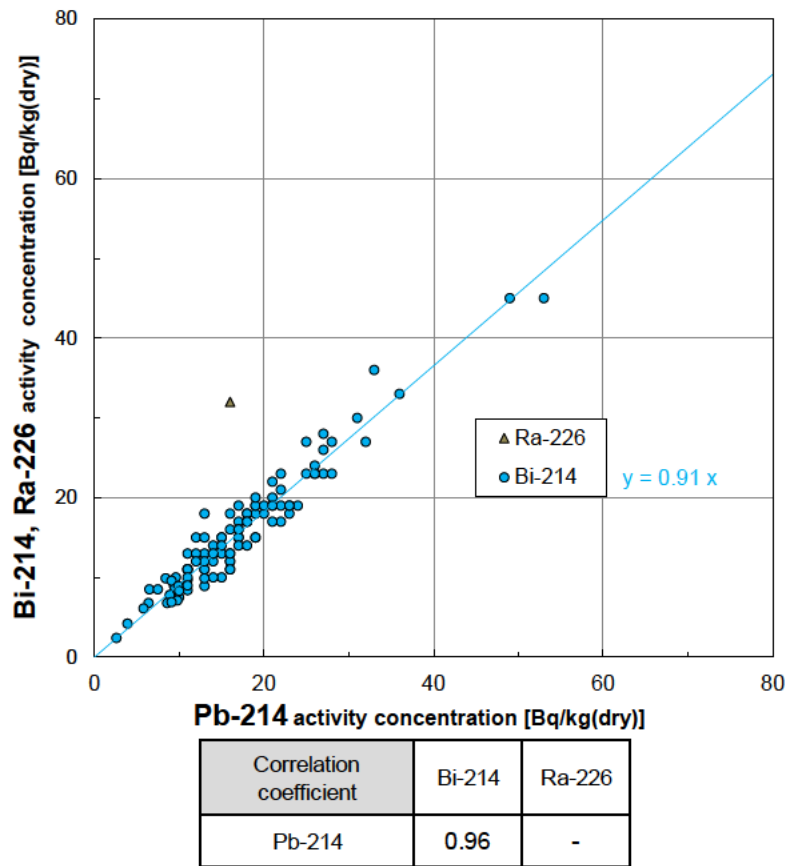


Figure 3.2-4 Correlations among uranium series radionuclides

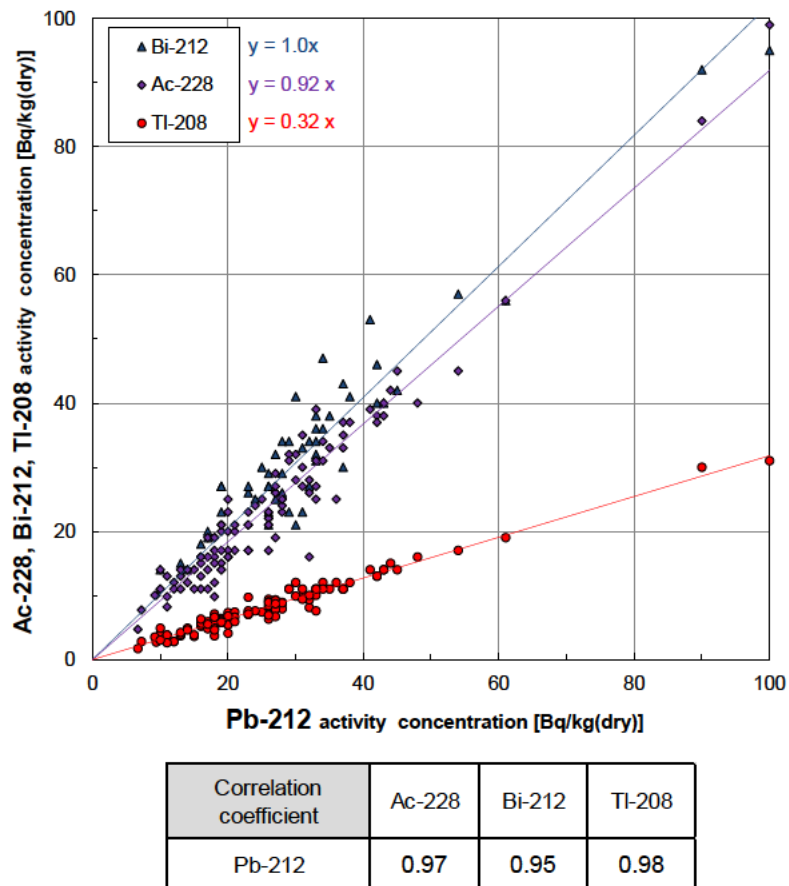
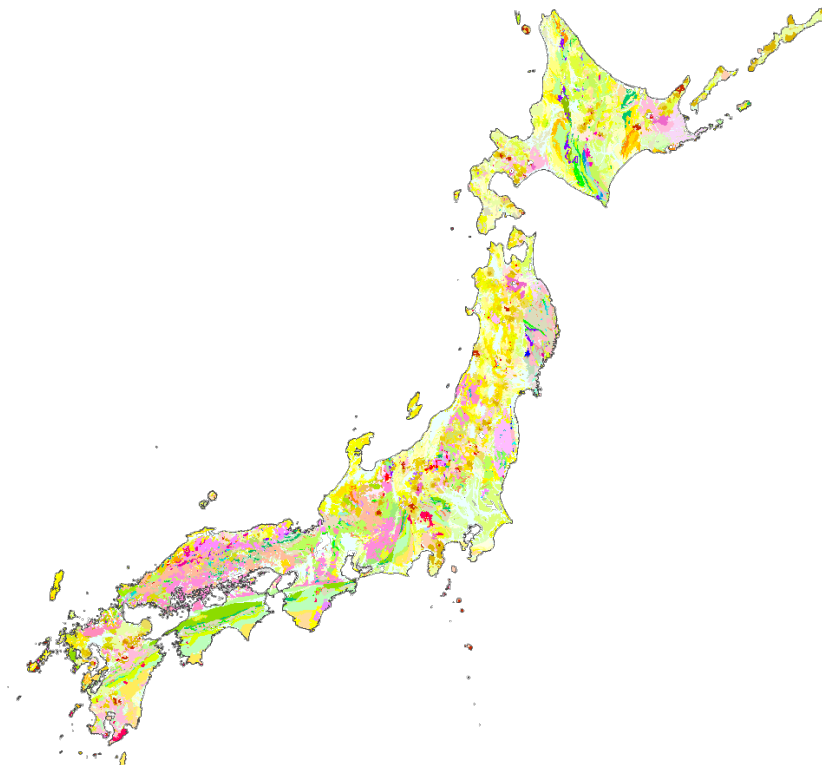


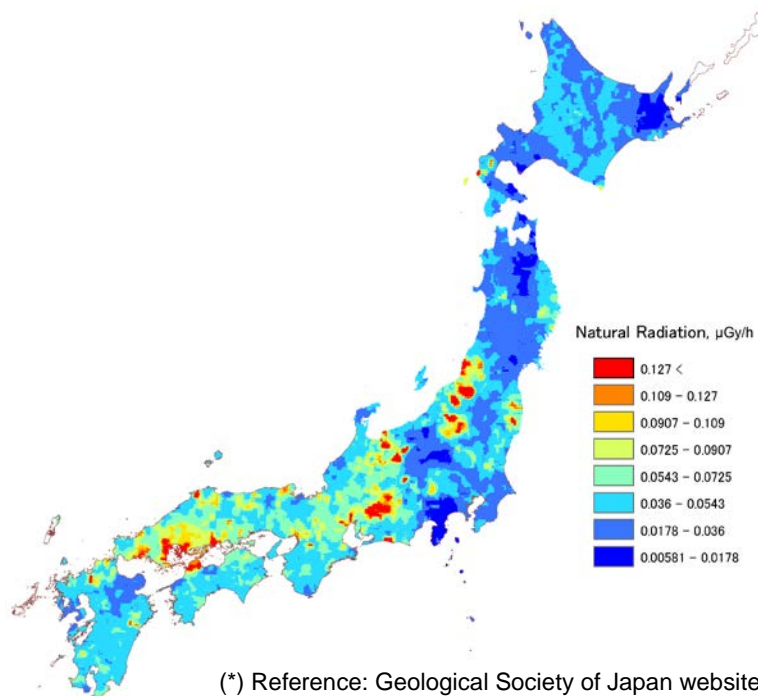
Figure 3.2-5 Correlations among thorium series radionuclides



(*) Reference: Seamless Digital Geological Map of Japan (1:200,000) ©; AIST website⁶

Figure 3.2-6 Distribution of granite in Japan

(Parts highlighted in pink in the Figure are locations where granite exists.)



(*) Reference: Geological Society of Japan website⁷

Figure 3.2-7 Natural radiation doses in Japan (Gy = Sv for γ -rays and β -rays)

⁶ <https://gbank.gsj.jp/seamless/>

⁷ <http://www.geosociety.jp/hazard/content0058.html>

(2) Detection of artificial radionuclides

1) Cs-134 and Cs-137 in water samples from public water areas

Radioactive cesium was detected in water samples from public water areas in Tohoku and Kanto blocks (19 locations in total; both Cs-134 and Cs-137 were detected at six locations; only Cs-137 was detected at 13 locations).

As for the six locations where both Cs-134 and Cs-137 were detected (all in Tohoku and Kanto blocks), concentration ratio was tested as a reference. The results showed a good correlation between them and the calculated activity concentration ratio was approximately 10.5. Assuming that detected Cs-134 and Cs-137 are those discharged due to the Fukushima NPS Accident in March 2011, this ratio fell in line extremely well with the theoretical ratio (approx. 10.5) as of September 2018 (see Figure 3.2-8). This suggests that Cs-134 and Cs-137 detected in the Tohoku and Kanto blocks were indeed derived from the Fukushima NPS Accident.

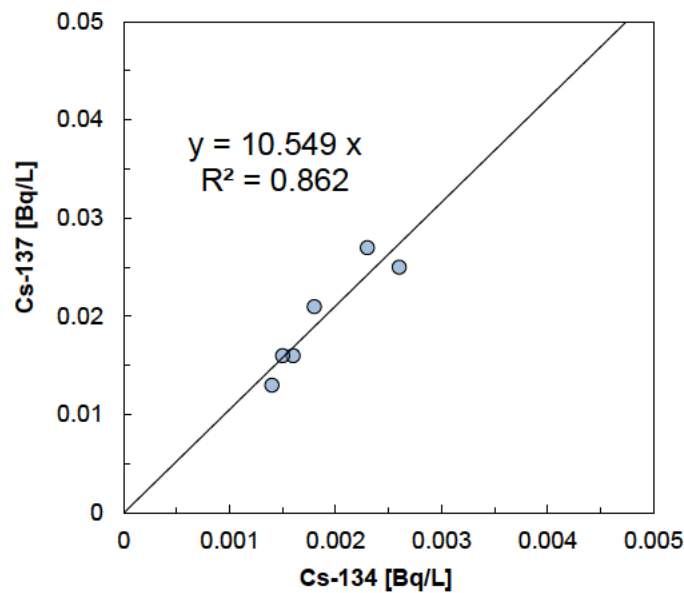


Figure 3.2-8 Concentration ratios (Cs-137/Cs-134) [Water (public water areas)]

(Reference: Changes in concentration ratios (Cs-137/Cs-134) over time, accounting for half-life periods)

Radionuclide	Half-life (year)	2011/3	2013/3	2015/3	2017/3	2018/9
Cs-134	2.0648	1	0.51	0.26	0.13	0.08
Cs-137	30.1671	1	0.96	0.91	0.87	0.84
Cs137 / Cs134		1	1.87	3.50	6.54	10.5

(*) The concentration ratio at the time of the latest monitoring (around September 2018) is estimated to be approximately 10.5 (highlighted in yellow in the table above).

2) Cs-134 and Cs-137 in sediment samples from public water areas

Radioactive cesium was detected in sediment samples from public water areas in Hokkaido, Tohoku, Kanto, Chubu, and Kinki blocks (37 locations in total; both Cs-134 and Cs-137 were detected at 15 locations (all in Tohoku and Kanto Blocks); only Cs-137 was detected at 22 locations).

For locations that have not been surveyed by Post-Earthquake Monitoring, radioactive cesium species were also detected. Therefore, to better clarify the concentration levels of the detected radioactive cesium species in such locations, the following comparisons were made:

- (i) Among the above-mentioned, for the same locations within the same prefectures where Post-Earthquake Monitoring is carried out, a comparison between data was carried out.
- (ii) For locations where Post-Earthquake Monitoring is not conducted for the same locations within the same prefectures, collected data was compared to data from nearby locations obtained via Post-Earthquake Monitoring.
- (iii) For locations where Post-Earthquake Monitoring is not conducted nearby, collected data was compared with data obtained through the Monitoring of Levels and other reports.

i) Comparison with past Post-Earthquake Monitoring results within the same prefectures

Regarding locations where Post-Earthquake Monitoring is conducted within the same prefectures (excluding locations where the Monitoring has been conducted at the same points), the measured values in the latest monitoring were compared with the past measurement records for the same locations (see Figure 3.2-9).

Measured values from the latest monitoring were found to be within the past measurement trends.

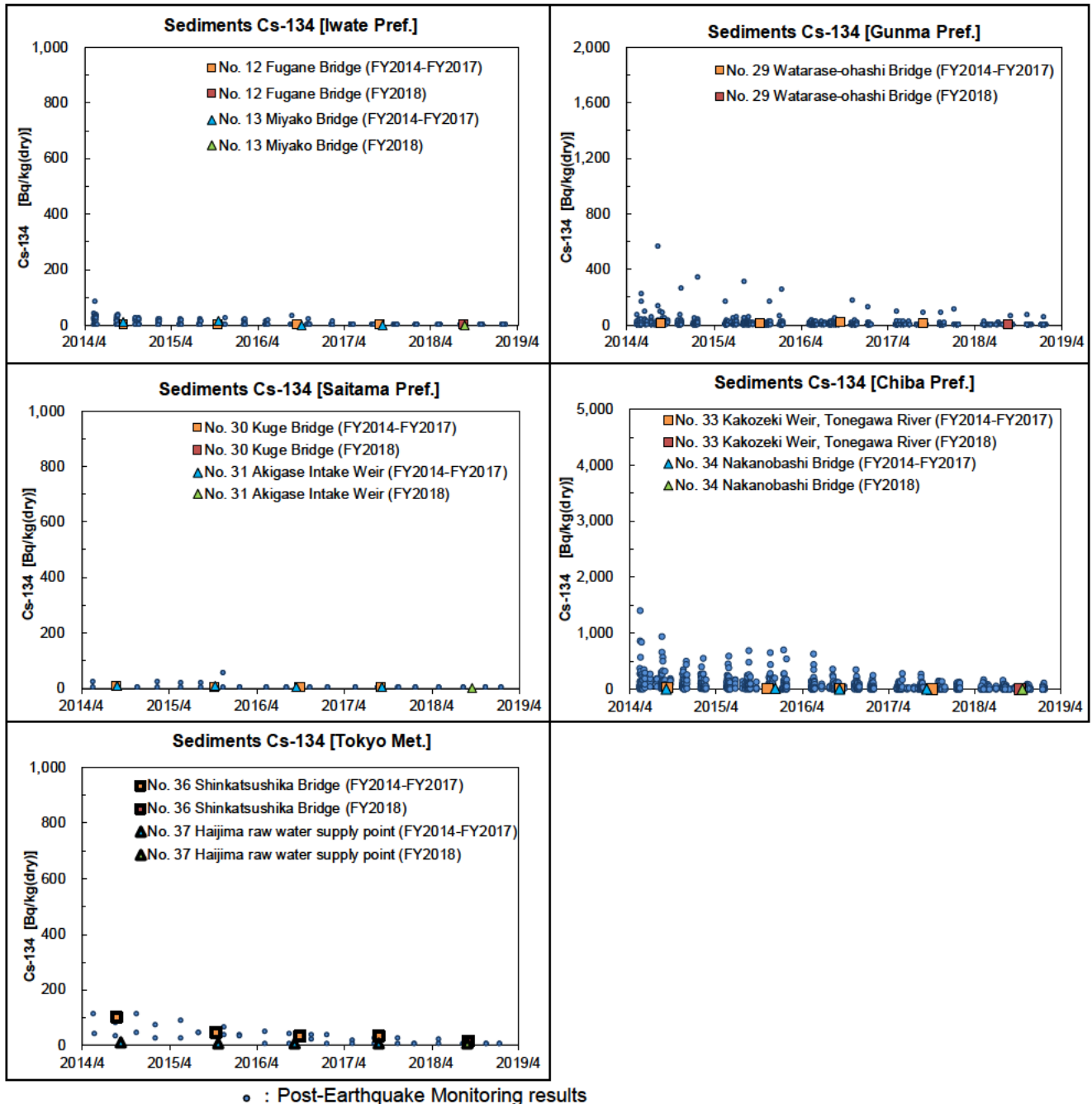
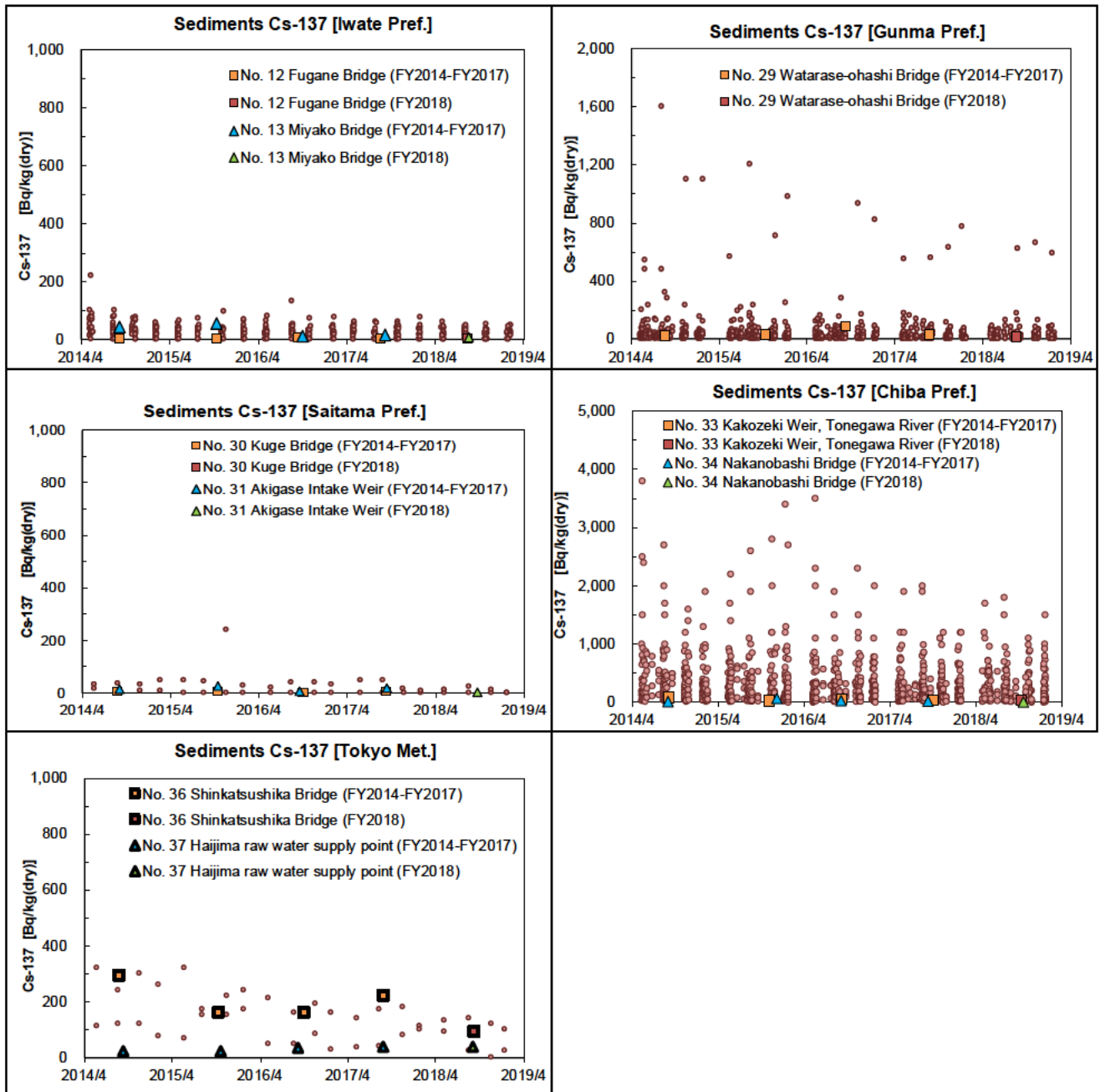


Figure 3.2-9 (1) (i) Comparison with past Post-Earthquake Monitoring results within the same prefectures [Cs-134]



○ : Post-Earthquake Monitoring results

Figure 3.2-9 (2) (i) Comparison with past Post-Earthquake Monitoring results within the same prefectures [Cs-137]

ii) Comparison with past Post-Earthquake Monitoring results for nearby locations

Regarding Location No. 40 (Rinko Tsurumigawa Bridge, Tsurumi River, Yokohama City, Kanagawa Prefecture), it was considered reasonable to make a comparison with the past data for nearby locations although Post-Earthquake Monitoring had not been conducted in Kanagawa Prefecture. Therefore, a comparison was made with the past data for Location No. 38 (Ryogoku Bridge, Sumida River, Chuo City/Sumida City, Tokyo Metropolis) and Location No. 39 (Kasai Bridge, Arakawa River, Koto City/Edogawa City, Tokyo Metropolis), both of which are located at the mouths of the Sumida River and the Arakawa River to Tokyo Bay (see Figure 3.2-10). As a result, it was found that the measured values for Location No. 40 were within the past measurement trends.

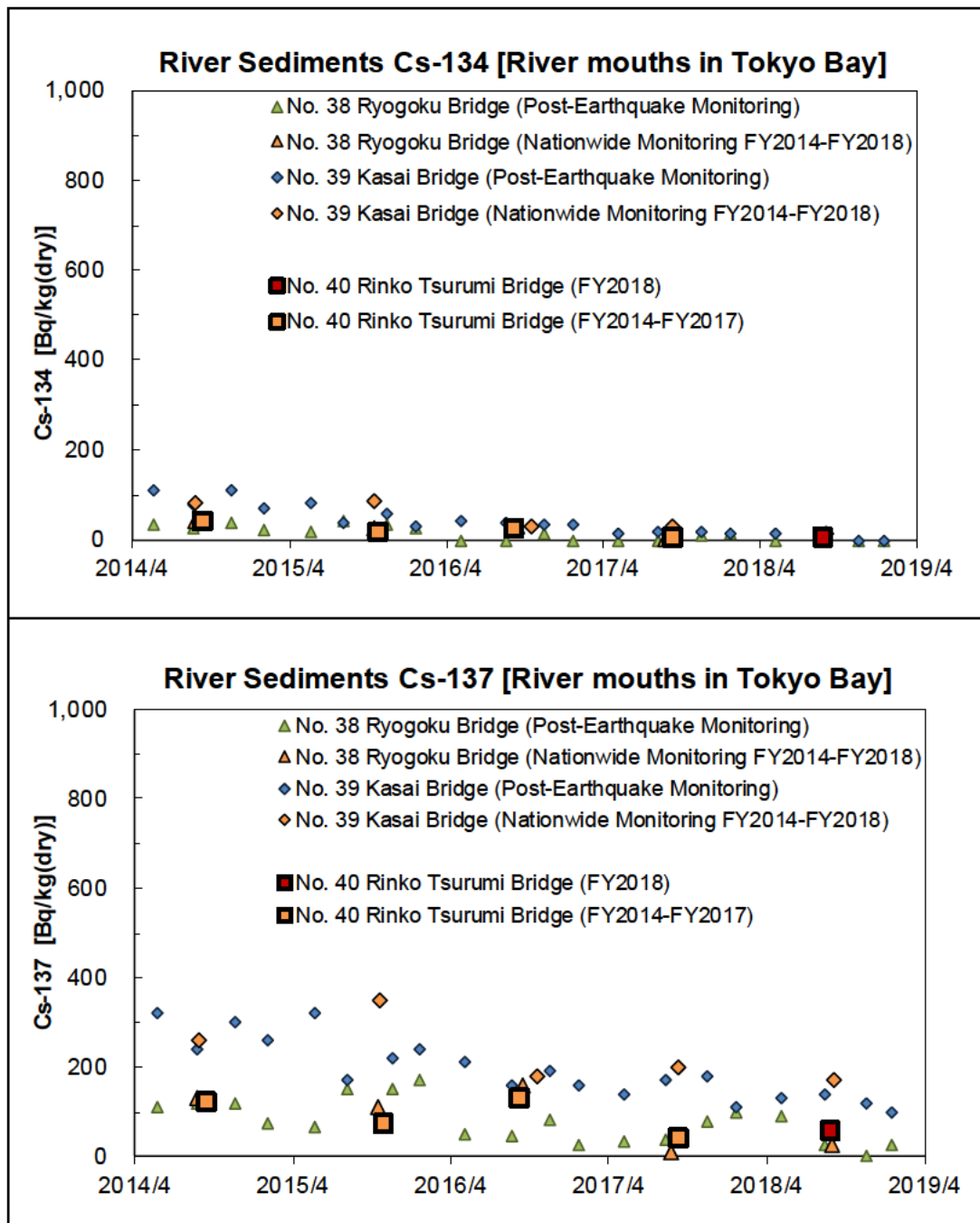
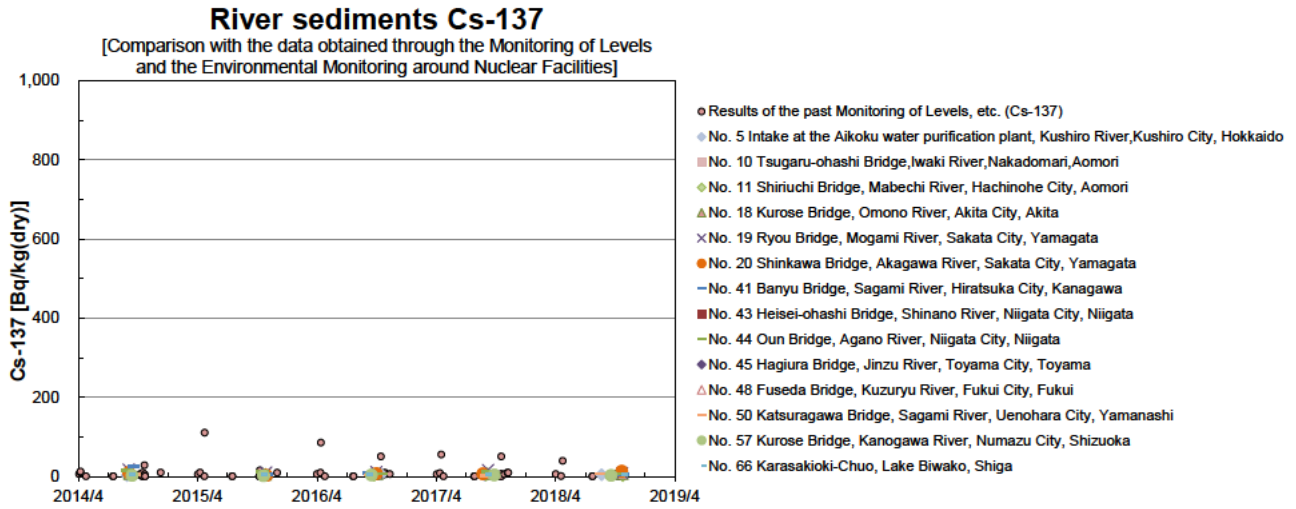


Figure 3.2-10 (ii) Comparison with past Post-Earthquake Monitoring results for nearby locations

iii) Comparison with the data obtained from the Monitoring of Levels, etc.

For locations where Post-Earthquake Monitoring has not been conducted nearby, a comparison with the results of the Monitoring of Levels was performed in order to evaluate their concentration levels (see Figure 3.2-11).

At 14 locations, only Cs-137 was detected and the measured values all fell within the past measurement trends.



(*) Locations where the detected values were found in this year are plotted in the Figure.

Figure 3.2-11 (iii) Comparison with the data obtained through the Monitoring of Levels

As a reference, concentration ratios were evaluated in the same manner as the case of the water samples for 15 locations where (all in the Tohoku and Kanto blocks) both Cs-137 and Cs-134 were detected. As a result, a good correlation was confirmed. The calculated activity concentration ratio was approximately 10.3 (Cs-137/Cs-134). Assuming that detected Cs-134 and Cs-137 are those discharged due to the Fukushima NPS Accident in March 2011, this ratio should be approximately equal to the theoretical ratio (approx. 10.5) as of September 2018 (see Figure 3.2-12). This suggests that Cs-134 and Cs-137 detected in sediment samples collected in the Tohoku and Kanto blocks were indeed derived from the Fukushima NPS Accident.

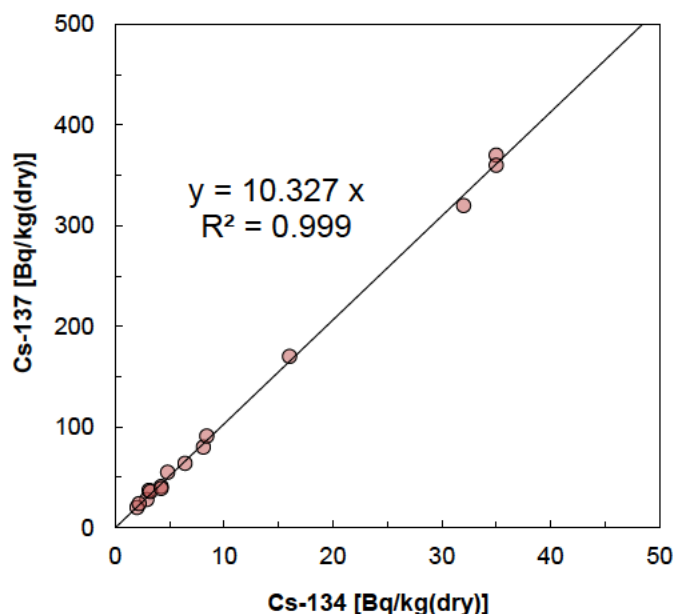


Figure 3.2-12 Concentration ratio (Cs-137/Cs-134) [Sediment (public water areas)]

(Reference: Changes in concentration ratios (Cs-137/Cs-134) over time, accounting for half-life periods)

Radionuclide	Half-life (year)	2011/3	2013/3	2015/3	2017/3	2018/9
Cs-134	2.0648	1	0.51	0.26	0.13	0.08
Cs-137	30.1671	1	0.96	0.91	0.87	0.84
Cs137 / Cs134		1	1.87	3.50	6.54	10.5

(*) The concentration ratio at the time of the latest monitoring (around September 2018) is estimated to be approximately 10.5 (highlighted in yellow in the table above).

Given these facts, Cs-134 and Cs-137 detected in sediment samples from public water areas (excluding the case in which only Cs-137 was detected) were mostly considered to be derived from the Fukushima NPS Accident, but the detected values were all within the past measurement trends.

3) Cs-134 and Cs-137 in groundwater

Cs-134 and Cs-137 were not detected in groundwater samples collected at any of the 110 locations (detection limit: approx. 0.001 to 0.002 Bq/L).

3.3 Survey results on seasonal variations

For survey results on seasonal variations of radionuclides values, at two locations⁸ (both in rivers), namely, Location No. 28 (Toneozeki Weir, Tonegawa River, Chiyoda Town, Gunma Prefecture) and Location No. 83 (Kasumi Bridge, Takahashi River, Kurashiki City, Okayama Prefecture), surveys were conducted four times during the period from May 22, 2018 to Jan 18, 2019. These two locations had been previously surveyed four times each from FY2014 to FY2017, and the current analysis includes the results from those prior years.

Radionuclides were detected as shown in Table 3.3-1 and Table 3.3-2. Figure 3.3-1 and 3.3-2 show the changes in radionuclides detected since FY2014. Table 3.3-1 and Table 3.3-2 also show the coefficients of variation⁹ (= sample standard deviation /average) indicating for the fluctuations in detected values.

The coefficients of variation in water samples ranged from 17% to 25% for total β radioactivity and K-40, and stood at 40% for Cs-137, respectively.

The coefficients of variation in sediment samples ranged from 6.4% to 27% for total β radioactivity and naturally occurring radionuclides (Ac-228, Bi-212, Bi-214, Pb-212, Pb-214, Tl-208, and K-40), and for artificial nuclides, 74% for Cs-134, 58% for Cs-137¹⁰.

The reason why the coefficients of variation of radioactive cesium in sediment samples are relatively higher than those in naturally occurring radionuclides is considered to have been associated with the fact that naturally occurring radionuclides are generally contained in minerals, while radioactive cesium is adsorbed in them. Further, Cs-134 has a half-life of approximately two years and physically attenuates faster than Cs-137 (half-life: approximately 30 years). Therefore, the coefficients of variation of Cs-134 are larger than those of Cs-137.

For reference, sediment grain size distribution and Cs-137 concentration change for Location No. 28 are shown in Figure 3.3-3.

Continuous monitoring conducted four times each year at two locations is necessary to clarify variations in the environment.

⁸ It was decided that one location each would be selected in eastern and western Japan. To make the selection, all 110 locations were first divided into two areas for convenience (Locations No. 1 to No. 55 were classified as eastern Japan and Locations No. 56 to No. 110 were classified as western Japan) and the middle number in each area was selected.

⁹ In this report: coefficient of variation = sample standard deviation divided by the average; hereinafter the same shall apply.

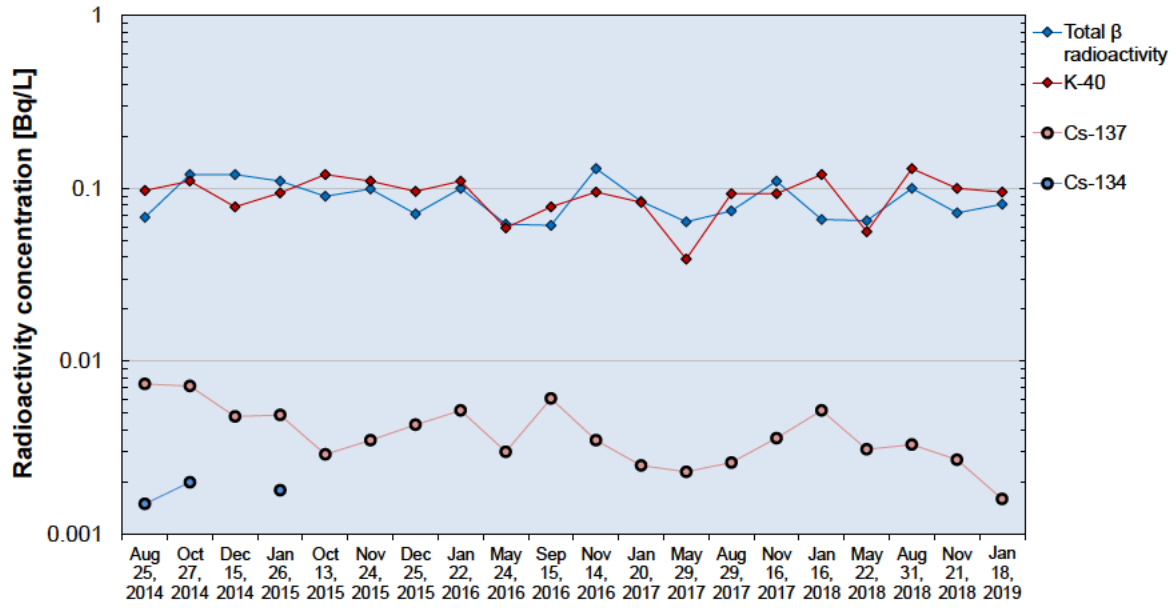
¹⁰ Regarding variations due to, among other things, the number of times of the survey conducted for radioactive materials in the environment FY2012 survey instances show 12 to 16% variations in the amount of radioactive cesium contained in riverbed sediment (nine samples collected during the same period). At River Site No. 28 where radioactive cesium was detected, a drop in water transparency probably due to sludge disturbance caused by pleasure boats or winds in the vicinity was observed. Then, the water and bottom sampling points were slightly relocated due to that those points were made off-limits, with recognizable variations in sediment grain-size distribution. Because the changes in sediment grain-size distribution might have affected the concentration of radioactive cesium, the changes in sediment grain-size distribution and Cs-137 concentration at River Site No. 28 are graphically summarized in Figure 3.3-3. This has revealed that sediment samples with high clay and silt contents tend to have higher Cs-137 concentrations. Accordingly, it was inferred that the variation in the amount of radioactive cesium in samples from River Site No. 28 had occurred due to the changes in the grain-size distribution in the sediment samples. In addition, the monitoring during the flood season recognized an increase in clay and silt ratio as well as periodic changes which would have been declining over time towards the next year's flood season. The same shall apply to Cs-137 concentration.

Table 3.3-1 Detection trends for radioactive materials at the same location [River No. 28]

No.28	Water [Bq/L]				Sediment [Bq/kg(dry)]											
	Total β radioactivity	K-40	Cs-134	Cs-137	Total β radioactivity	K-40	Ac-228	Be-7	Bi-212	Bi-214	Pb-212	Pb-214	Tl-208	Cs-134	Cs-137	
Aug 25, 2014	0.068	0.097	0.0015	0.0074	410	290	15	<24	<32	<12	18	11	5.8	19	60	
Oct 27, 2014	0.12	0.11	0.0020	0.0072	350	330	9.8	<36	<17	11	16	11	4.3	13	44	
Dec 15, 2014	0.12	0.078	<0.0010	0.0048	350	280	12	<38	<28	13	21	16	4.7	21	76	
Jan 26, 2015	0.11	0.094	0.0018	0.0049	380	280	15	<25	<23	13	16	11	5.0	17	61	
Oct 13, 2015	0.090	0.12	<0.0022	0.0029	720	290	23	<76	<46	14	28	14	6.5	51	230	
Nov 24, 2015	0.099	0.11	<0.0014	0.0035	460	370	18	<68	<30	15	18	15	4.0	25	110	
Dec 25, 2015	0.071	0.096	<0.0014	0.0043	490	320	22	<44	<21	16	16	17	5.4	26	110	
Jan 22, 2016	0.10	0.11	<0.0014	0.0052	430	320	20	<28	<23	12	18	13	6.1	21	96	
May 24, 2016	0.062	0.059	<0.0014	0.0030	410	280	15	<54	37	12	17	19	5.0	15	74	
Sep 15, 2016	0.061	0.078	<0.0014	0.0061	460	300	21	59	29	13	21	17	7.6	26	140	
Nov 14, 2016	0.13	0.095	<0.0017	0.0035	400	250	18	<66	<30	16	19	18	5.0	19	96	
Jan 20, 2017	0.084	0.083	<0.0013	0.0025	450	260	12	<29	<30	18	19	13	4.7	11	72	
May 29, 2017	0.064	0.039	<0.0011	0.0023	320	280	12	<22	<19	9.4	16	13	5.4	5.5	41	
Aug 29, 2017	0.074	0.093	<0.0014	0.0026	420	280	19	80	<27	15	19	12	5.4	15	130	
Nov 16, 2017	0.11	0.093	<0.0014	0.0036	470	330	18	<49	<22	16	18	14	6.1	9.4	85	
Jan 16, 2018	0.066	0.12	<0.0015	0.0052	370	320	14	<25	<29	12	16	13	4.3	4.4	38	
May 22, 2018	0.065	0.056	<0.0014	0.0031	360	300	12	<100	<25	11	16	9.5	3.6	2.6	31	
Aug 31, 2018	0.10	0.13	<0.0015	0.0033	370	270	17	<96	<29	11	18	13	5.9	3.1	37	
Nov 21, 2018	0.072	0.10	<0.0013	0.0027	450	270	13	<56	<24	12	20	14	5.1	5.3	62	
Jan 18, 2019	0.081	0.095	<0.0012	0.0016	420	270	16	<26	<23	11	15	11	5.6	2.9	38	
Coefficient of variation	25 %	24 %	-	40 %	20 %	9.9 %	23 %	-	-	17 %	16 %	19 %	17 %	74 %	58 %	

(*) The coefficients of variation are shown only for radionuclides detected five times or more.

Water [River No. 28]



Sediment [River No. 28]

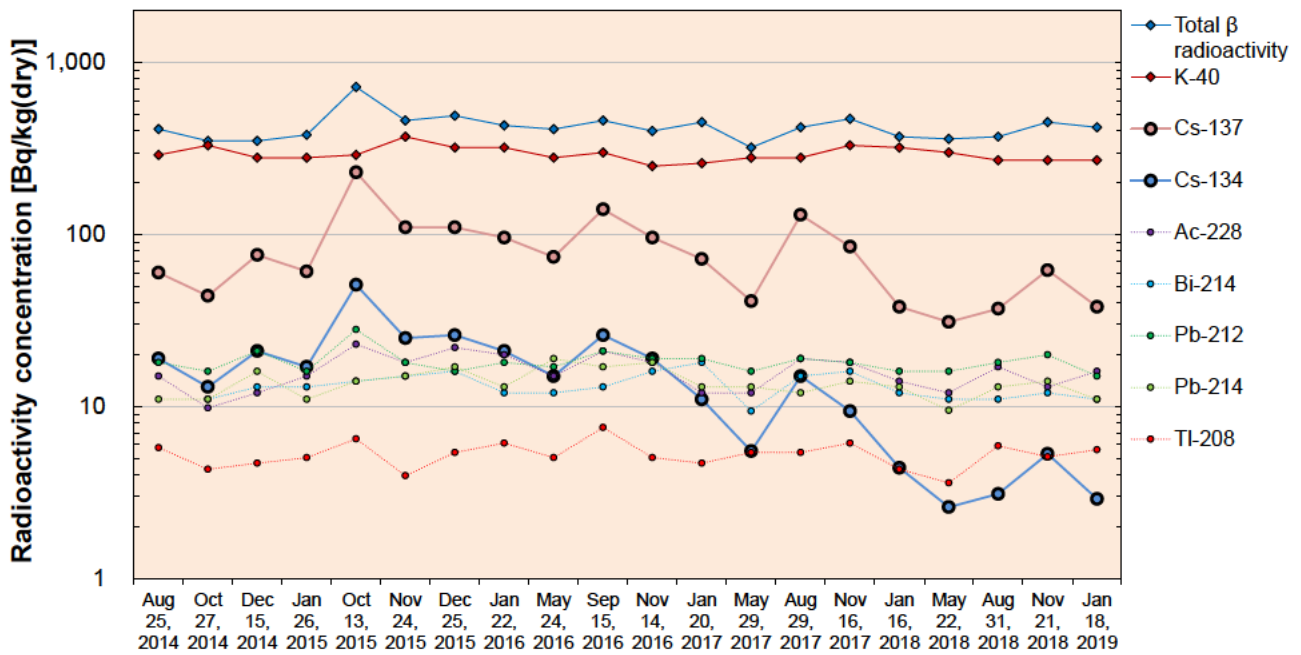


Figure 3.3-1 Changes in detection trends for radioactive materials at the same location [River No. 28]

Table 3.3-2 Detection trends for radioactive materials at the same location [River No. 83]

No.83	Water [Bq/L]				Sediment [Bq/kg(dry)]									
	Total β radioactivity	K-40	Be-7	Pb-212	Total β radioactivity	K-40	Ac-228	Bi-212	Bi-214	Pb-212	Pb-214	Ra-226	Th-234	Tl-208
Aug 30, 2014	0.046	0.034	<0.024	<0.0019	1,000	870	13	42	15	28	21	50	<30	9.0
Oct 28, 2014	0.064	0.045	0.012	<0.0021	980	830	25	34	21	28	23	<42	<41	7.2
Dec 15, 2014	0.037	<0.028	<0.0073	<0.0019	890	910	12	23	17	24	19	36	30	7.6
Jan 26, 2015	0.038	0.034	<0.0073	0.0013	920	770	19	28	17	27	15	<39	42	9.0
Oct 16, 2015	0.048	0.045	<0.024	<0.0019	1,000	920	25	28	16	28	21	<37	<31	8.3
Nov 30, 2015	0.047	0.042	<0.018	<0.0015	1,000	920	21	<33	19	26	20	<46	<47	8.6
Dec 22, 2015	0.041	0.038	<0.013	<0.0015	950	840	29	37	16	26	22	<44	<45	5.4
Jan 25, 2016	0.035	0.031	<0.0085	<0.0014	940	840	25	<34	19	27	18	<41	<47	6.8
May 30, 2016	0.039	0.050	<0.011	<0.0017	930	840	17	<35	19	24	24	<42	<160	8.3
Aug 23, 2016	0.045	0.043	<0.040	<0.0015	1,100	900	18	34	14	21	16	<38	<140	7.6
Nov 15, 2016	0.030	0.046	<0.022	<0.0015	940	840	24	<28	18	22	17	<42	<150	7.6
Jan 27, 2017	0.041	0.036	<0.0078	<0.0014	990	840	15	<29	14	23	17	<39	<140	6.1
May 29, 2017	0.047	0.049	<0.0089	<0.0013	990	850	19	27	16	20	16	<38	<140	7.9
Aug 25, 2017	<0.024	0.042	<0.029	<0.0014	960	850	19	28	15	23	19	<31	<72	6.5
Nov 27, 2017	0.037	0.029	<0.016	<0.0013	950	790	28	30	19	28	24	<36	<80	9.7
Jan 16, 2018	0.044	0.041	<0.0093	<0.0016	960	860	27	<33	22	31	18	<44	<160	7.6
May 26, 2018	0.032	0.038	<0.029	<0.0014	930	800	32	<29	17	29	20	<48	<150	8.5
Oct 16, 2018	0.041	0.051	<0.018	<0.0013	860	710	31	36	23	34	28	<170	<78	11
Nov 27, 2018	0.043	0.054	<0.012	<0.0012	850	640	30	34	17	29	21	<45	<150	9.2
Jan 17, 2019	<0.024	0.042	<0.0076	<0.0012	840	670	30	40	21	32	24	<48	<160	8.2
Coefficient of variation	18 %	17 %	-	-	6.4 %	9.3 %	27 %	17 %	15 %	14 %	17 %	-	-	16 %

(*) The coefficients of variation are shown only for radionuclides detected five times or more.

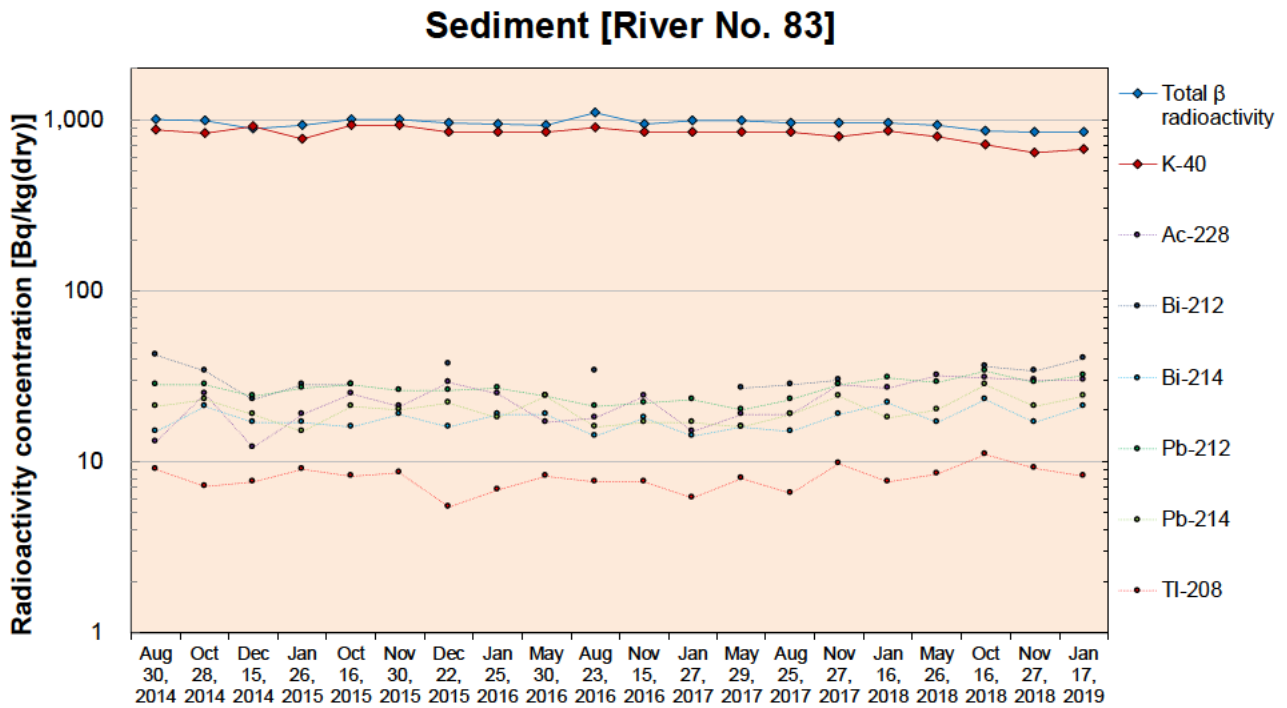
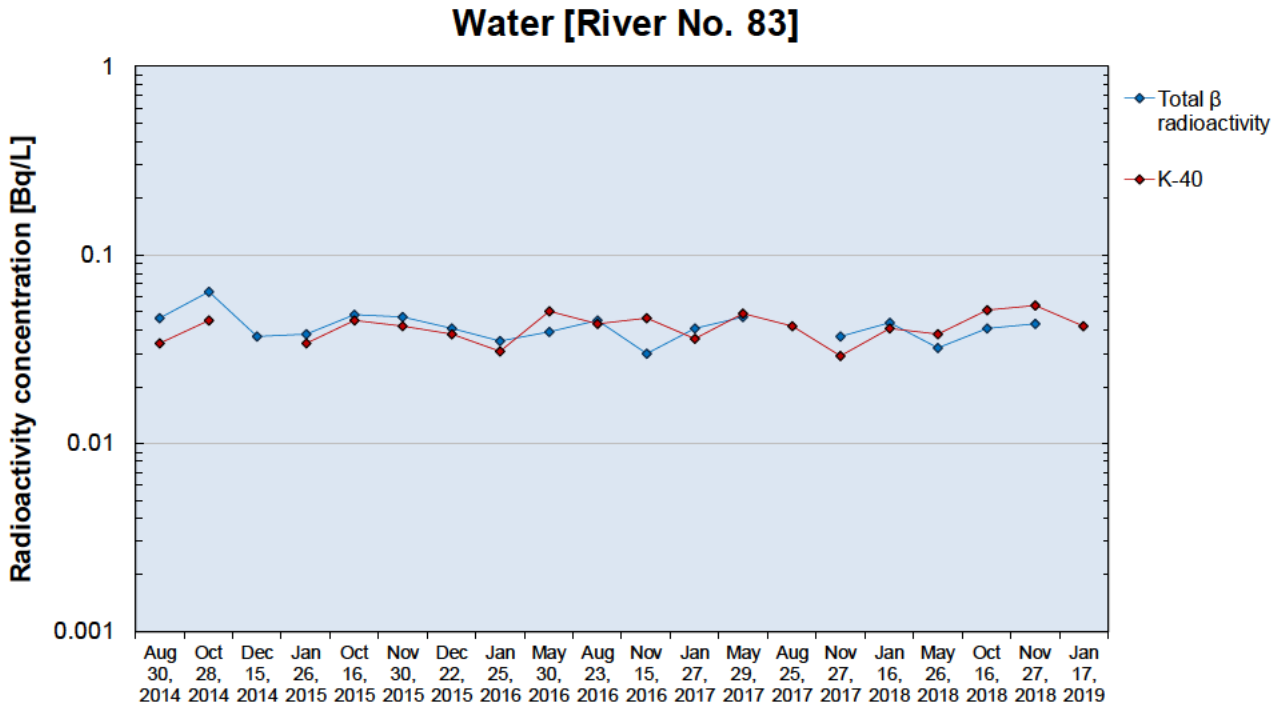


Figure 3.3-2 Changes in detection trends for radioactive materials at the same location [River No. 83]

Sediment grain size distribution and Cs-137 concentration (River No.28)

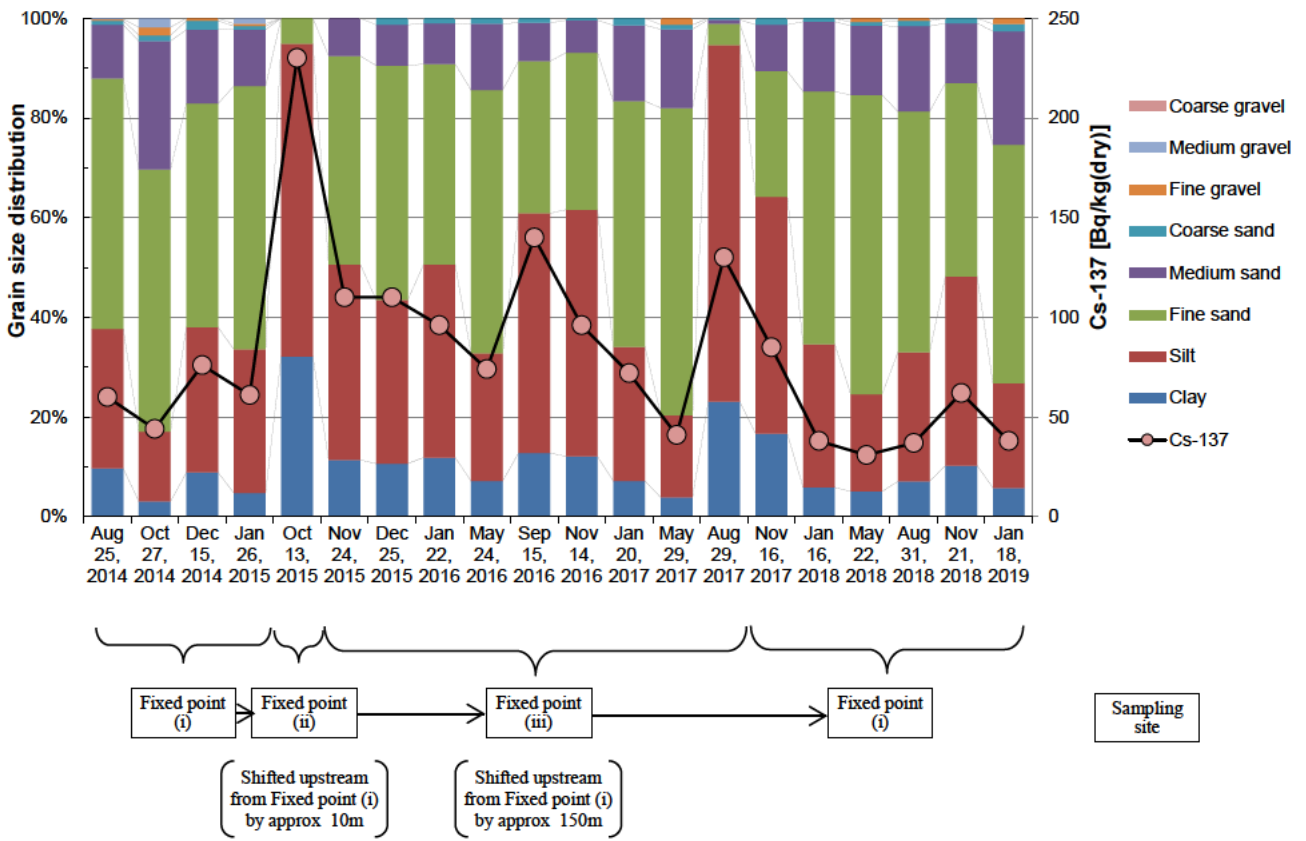


Figure 3.3-3 Changes in sediment grain size distribution and Cs-137 concentration [River No. 28]

Part 2: Radioactive Material Monitoring in the Water Environment in and around Fukushima Prefecture (FY2018)

1 Objective and Details

1.1 Objective

This monitoring was conducted in response to the Fukushima NPS Accident for the purpose of clarifying the distribution of the accident-derived radioactive materials in the water environment.

1.2 Details

(1) Locations

The survey was conducted mainly in and around Fukushima prefecture at around 600 locations for public water areas and at around 400 locations for groundwater. Specific locations are shown in Figure 1.2-1.

(2) Targets

For public water areas (rivers, lakes, and coastal areas), water and sediment were surveyed. Additionally, radioactivity in soil in the surrounding environment (riverbeds, etc.) near the sampling locations was also surveyed as a reference.

Radioactivity in groundwater was also measured.

(3) Frequencies and periods

The monitoring for public water areas was conducted two to 10 times a year (varying by location).

The monitoring for groundwater was conducted one to four times a year (varying by location).

(4) Conducted analyses

Primarily, analyses of Cs-134 and Cs-137 were conducted for the subject samples.

Additionally, analyses on Sr-89, Sr-90 and other artificial radionuclides were also conducted for some of the samples.

(5) Compilation and evaluation of results

The results of the measurement are compiled and released sequentially as preliminary reports on the Ministry of the Environment website.

This report is the compilation of the overall monitoring results, and the details of individual monitoring surveys are available on the following website.

<http://www.env.go.jp/en/water/rmms/surveys.html>

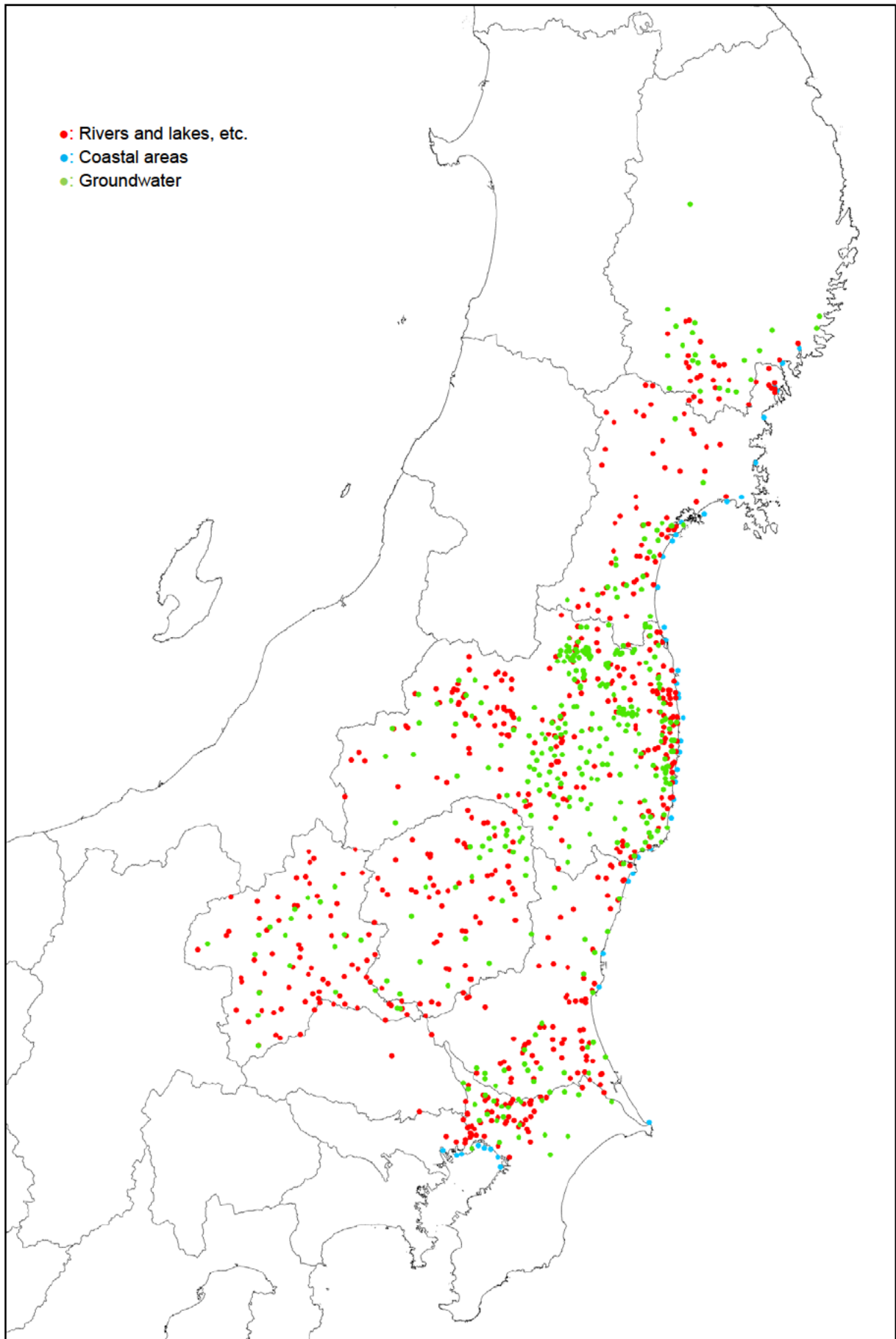


Figure 1.2-1 Map showing locations for Post-Earthquake Monitoring in FY2018

2 Survey Methods and Analysis Methods

2.1 Survey methods

Samples were collected at predetermined locations (for public water areas and groundwater) and the following analyses of radioactive materials were conducted.

Samples were collected based on the following guidelines in principle, as outlined below.

- Water Quality Survey Method (Sep 30, 1971; Notice Kansuikan No. 30 issued by the Director General of the Water Quality Preservation Bureau, Ministry of the Environment)
- Sediment Survey Method (Aug 8, 2012; Notice Kansuikansuihatsu No. 120725002 issued by the Director General of the Environmental Management Bureau, Ministry of the Environment)
- Groundwater Quality Survey Method (Sep 14, 1989; Notice Kansuikan No. 189 issued by the Director General of the Water Quality Preservation Bureau, Ministry of the Environment)
- Environmental Sample Collection Method (1983, MEXT's Radioactivity Measurement Method Series)
- Sample Pretreatment for Instrumental Analysis Using Germanium Semiconductor Detectors (1982, MEXT's Radioactivity Measurement Method Series)

2.2 Analysis methods

γ -ray spectrometry measurements using a germanium semiconductor detector were conducted for water samples and sediment samples collected from public water areas and for groundwater samples, primarily targeting Cs-134 and Cs-137.

Additionally, analyses on Sr-89, Sr-90 and other artificial radionuclides were also conducted for some of the collected samples. Detected values were indicated with basically two significant digits in the unit of "Bq/L" in the case of water samples from public water areas and groundwater samples, and in the unit of "Bq/kg (dry weight)" in the case of sediment samples from public water areas. The measurement results were corrected for attenuation, and results were reported as activity concentrations at the time sampling was completed.

Adopted analysis methods were basically in line with the MEXT's Radioactivity Measurement Method Series. Detection limits are as shown in the table below.

Table 2.2-1 Target values of detection limits for radionuclides in Post-Earthquake Monitoring

Radionuclide		Public water areas (water)	Public water areas (sediment)	Groundwater
Radioactive cesium (Cs-134 and Cs-137)		Approx. 1 Bq/L	Approx. 10 Bq/kg	Approx. 1 Bq/L
Radioactive strontium	Sr-90	Approx. 1 Bq/L	Approx. 1 Bq/kg (0.16 to 2.9 Bq/kg)	Approx. 1 Bq/L
	Sr-89	-	-	Approx. 1 Bq/L
Other artificial radionuclides (*1)		-	-	-

*1: Varies by type of radionuclides.

3 Outlines of the Results

The results of Post-Earthquake Monitoring conducted in FY2018 are as outlined below.

3.1 Detection of radioactive cesium

Radioactive cesium (the total of Cs-134 and Cs-137, the same hereinafter) was detected as follows.

(1) Public water areas (water)

In FY2018, radioactive cesium activity concentrations were not all detectable in river water samples and coastal area water samples; from not detectable to 5.1 Bq/L in lake water samples and had a detection rate of 1.5%.

Since FY2011, all prefectures have shown decreasing trends in the detection rate for river water samples (15,000 or more total samples) and lake water samples (9,500 or more total samples). In prefectures other than Fukushima Prefecture, radioactive cesium has not been detected since FY2013 (see Figure 4.1.1-1 and Figure 4.1.1-2). In addition, no survey has detected radioactive cesium in coastal area water samples (3,900 or more total samples) since FY2011.

(2) Groundwater

Radioactive cesium was not detected in any of the groundwater samples in FY2018.

Looking at the trend from FY2011 onward, radioactive cesium was detected in two samples from Fukushima Prefecture in FY2011 (detected values were 2 Bq/L and 1 Bq/L), but has not been detected in groundwater samples (7,400 or more total samples) since FY2012.

(3) Public water areas (sediment)

1) Overall trends

In FY2018, radioactive cesium activity concentrations ranged from not detectable to 7,160 Bq/kg and with a detection rate of 83.6% in river sediment samples, from not detectable to 349,000 Bq/kg and with a detection rate of 99.1% in lake sediment samples, and from not detectable to 437 Bq/kg and at a detection rate of 76.4% in coastal area sediment samples.

Additionally, radioactive cesium activity concentrations were less than 200 Bq/kg in 3/4 or more areas in rivers and coastal areas (river: approx. 77%, coastal area: approx. 76%), and were less than 3,000 Bq/kg in 3/4 or more areas in lakes (approx. 77%) throughout the year.

2) Status by location

Because radioactive cesium was detected at many locations, its statuses in respective locations were compared. The status in respective locations were compared and relative concentration levels for detected values and their changes were statistically compiled as shown in "4.1-2 (3) Detection of radioactive materials by location."

Detected concentration levels were compiled as shown in Table 3.1-1.

Locations of Categories A and B (top 10th percentile of the whole) were observed in Hamadori District, Fukushima Prefecture as well as in Nakadori and Aizu, Fukushima Prefecture and in Ibaraki, Gunma, Chiba (all these were for rivers), and Miyagi Prefectures (for rivers and coastal areas).

Table 3.1-1 Categorization of detected concentration levels for sediment samples from public water areas (FY2018) (rivers, lakes, and coastal areas)

<Rivers>

Category	Percentile (see Figure 4.1.2-7)	Range [River sediments] [Bq/kg (dry)]	Number of locations											Total	
			Iwate	Miyagi	Fukushima			baraki	Tochigi	Gunma	Chiba	Saitama	Tokyo	Number of location	Percentage
					Hamadori	Nakadori	Aizu								
A	Upper 5th percentile	591 or more	0	0	11	0	0	1	0	0	7	0	0	19	4.8
B	Upper 5th to 10th percentile	360 - 591	0	1	4	1	1	3	0	1	9	0	0	20	5.1
C	Upper 10th to 25th percentile	114 - 360	0	8	13	11	1	10	1	0	15	0	1	60	15.2
D	Upper 25th to 50th percentile	40 - 114	1	18	12	14	4	22	8	9	11	0	0	99	25.0
E	Lower 50th percentile	40 or less	21	16	13	18	20	17	47	38	5	2	1	198	50.0
Total			22	43	53	44	26	53	56	48	47	2	2	396	100.0

<Lakes>

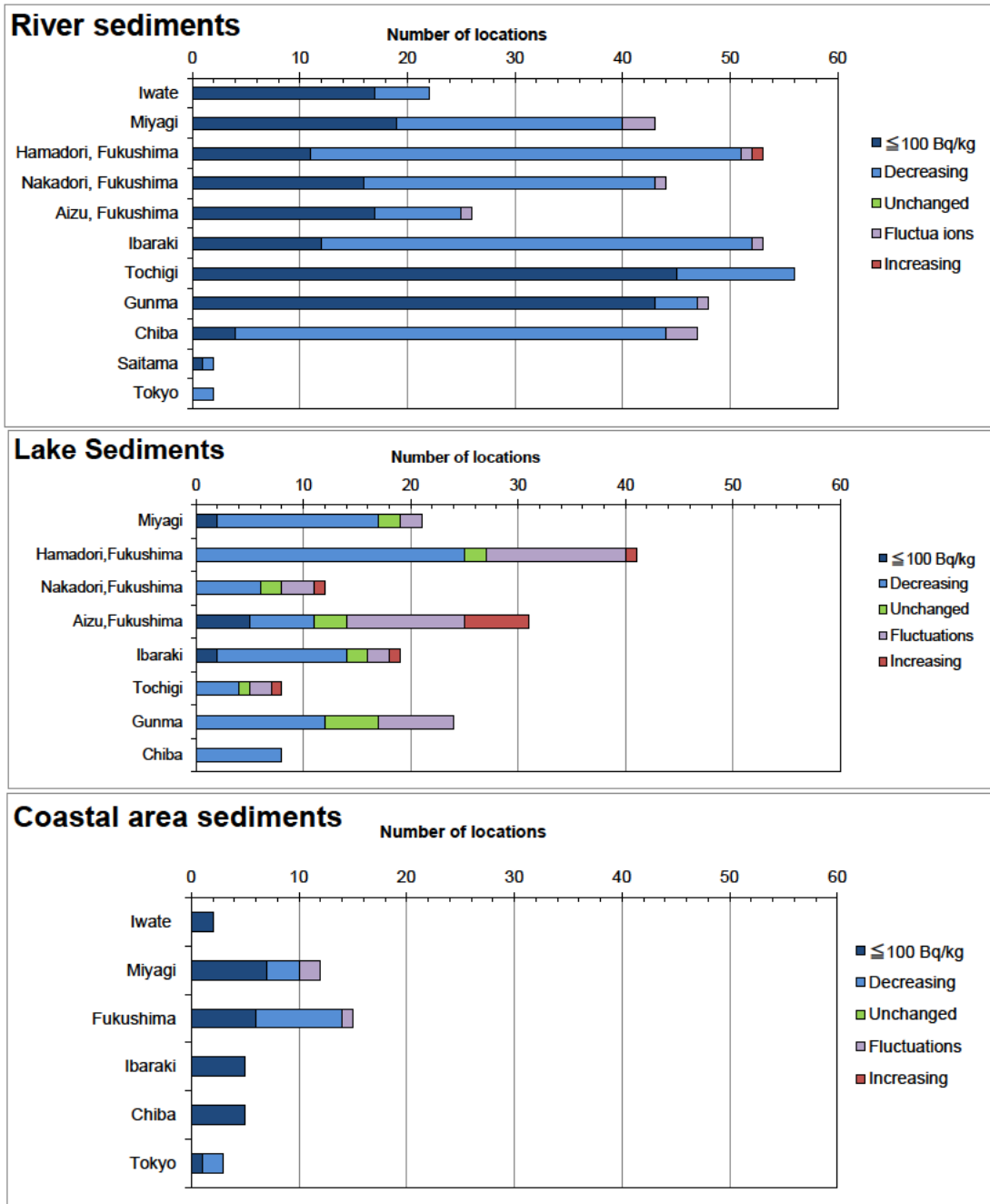
Category	Percentile (see Figure 4.1.2-7)	Range [Lake sediments] [Bq / kg (dry)]	Number of locations									Total	
			Miyagi	Fukushima			Ibaraki	Tochigi	Gunma	Chiba	Number of locations	Percentage	
				Hamadori	Nakadori	Aizu							
A	Upper 5th percentile	20,468 or more	0	8	0	0	0	0	0	0	8	4.9	
B	Upper 5th to 10th percentile	8,094 - 20,468	0	8	0	0	0	0	0	0	8	4.9	
C	Upper 10th to 25th percentile	1,677 - 8,094	0	11	4	7	1	0	1	1	25	15.2	
D	Upper 25th to 50th percentile	408 - 1,677	3	10	5	3	4	4	11	1	41	25.0	
E	Lower 50th percentile	408 or less	18	4	3	21	14	4	12	6	82	50.0	
Total			21	41	12	31	19	8	24	8	164	100.0	

<Coastal areas>

Category	Percentile (see Figure 4.1.2-7)	Range [coastal area sediments] [Bq/kg (dry)]	Number of locations							Total	
			Iwate	Miyagi	Fukushima	baraki	Chiba	Tokyo	Number of location	Percentage	
A	Upper 5th percentile	294 or more	0	1	1	0	0	0	2	4.8	
B	Upper 5th to 10th percentile	211 - 294	0	1	1	0	0	0	2	4.8	
C	Upper 10th to 25th percentile	95 - 211	0	2	2	0	0	2	6	14.3	
D	Upper 25th to 50th percentile	29 - 95	0	4	5	1	0	1	11	26.2	
E	Lower 50th percentile	29 or less	2	4	6	4	5	0	21	50.0	
Total			2	12	15	5	5	3	42	100.0	

Changes in detected concentration levels were compiled as shown in Figure 3.1-1, which shows Table 4.1.2-48 (described later) graphically.

For rivers, the average values including past years were 100 Bq/kg or less at approximately half of the monitoring locations, while more than 90% of the other locations showed decreasing trends. For lakes, the average values including past years were 100 Bq/kg or less at approximately 10% of the monitoring locations, while approximately 30% of the other locations showed fluctuations with approximately 70% of the monitoring locations showing either decreasing or unchanged trends. For coastal areas, the average values including past years were 100 Bq/kg or less at approximately 60% of the monitoring locations with over 80% of the other locations showing decreasing trends.



(*) "≤ 100 Bq/kg" shows the average values including past years were 100 Bq/kg or less.

Figure 3.1-1 Changes in detected concentration levels of radioactive materials in sediment samples from public water areas (rivers, lakes, and coastal areas)

3.2 Detection of radionuclides other than radioactive cesium

(1) Sr-89 and Sr-90

Sr-90 was surveyed from FY2011 to FY2018 for sediment samples (approximately 880 samples in total) from public water areas (rivers, lakes, and coastal areas) and for groundwater samples (385 samples in total) (see Figure 4.2-1 for the detection of Sr-90 in sediment). Additionally, from FY2016, water samples (45 samples in FY2016 and three samples in FY2017 and FY2018) were also surveyed at those locations where relatively high concentrations of Sr-90 were detected in sediment from public areas (1.0 Bq/kg or more in FY2016 and 10 Bq/kg or more after FY2017).

The results of the FY2018 survey were as follows: for public water area sediment samples, Sr-90 concentrations ranged from not detectable to 1.1 Bq/kg and had a detection rate of 52.6% in river sediment; from not detectable to 17 Bq/kg with a detection rate of 98.5% in lakes, and not detectable in coastal areas. As for water samples, Sr-90 was not detected in any public water areas or ground water locations (detection limit: approximately 1 Bq/L for water and approximately 1 Bq/kg for sediment).

Sr-89 was not detectable in any of the monitoring surveys conducted for sediment samples from public water areas (a total of 22 samples collected from rivers and lakes in FY2011) or for groundwater samples (a total of 385 samples surveyed from FY2011 to FY2018) (detection limit: approximately 1 Bq/L for water and approximately 2 Bq/kg for sediment).

(2) Other artificial radionuclides

None have been detected since FY 2013.

4 Results

4.1 Radioactive cesium

4.1 -1 Water

(1) Public water areas

1) Rivers

Detection of radioactive cesium in river water samples is as shown in Table 4.1.1-1 and Figure 4.1.1-1.

According to the results, all prefectures have shown decreasing trends in the detection rate since FY2011. In FY2018, radioactive cesium was not detected in any locations.

Detected values (the total of Cs-134 and Cs-137) have also shown decreasing trends since FY2011 (detection limit: 1 Bq/L for both Cs-134 and Cs-137 and the same applies to lakes, coastal areas and ground water).

2) Lakes

Detection of radioactive cesium in lake water samples is as shown in Table 4.1.1-2 and Figure 4.1.1-2.

According to the results all prefectures have shown decreasing trends in the detection rate since FY2012. Radioactive cesium has not been detected in any locations other than Hamadori District, Fukushima Prefecture since FY2013.

Detected values (the total of Cs-134 and Cs-137) have also shown decreasing trends since FY2012. The measured values in FY2018 ranged from not detectable to 5.1 Bq/L.

3) Coastal areas

Detection of radioactive cesium in coastal area water samples is as shown in Table 4.1.1-3.

According to the results, including past years, radioactive cesium has not been detected in any locations.

(2) Groundwater

Detection of radioactive cesium in groundwater samples is as shown in Table 4.1.1-4.

According to the results, radioactive cesium has not been detected in any locations since FY2012 including FY2018.

<Reference>

- Specification and Standards for Food, Food Additives, etc. in Accordance with the Food Sanitation Act (Drinking Water) (Ministry of Health, Labor and Welfare Public Notice No. 130, Mar 15, 2012)
Radioactive cesium (the total of Cs-134 and Cs-137): 10 Bq/kg
- Target Values for Radioactive Materials in Tap Water (Management Target for Water Supply Facilities) (March 5, 2012; 0305 Notice No. 1 from the Director of the Water Supply Division, Health Service Bureau, Ministry of Health, Labor and Welfare)
Radioactive cesium (the total of Cs-134 and Cs-137): 10 Bq/kg

Table 4.1.1-1 Detection of radioactive cesium in river water samples

Prefecture	FY2018				FY2011-2018			
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)
Iwate	79	0	0.0	ND	560	0	0.0	ND
Yamagata	0	0	-	-	10	0	0.0	ND
Miyagi	196	0	0.0	ND	1,490	3	0.2	ND - 6.3
Fukushima	818	0	0.0	ND	6,135	59	1.0	ND - 20
	Hamadori	326	0	0.0	2,493	47	1.9	ND - 20
	Nakadori	324	0	0.0	2,473	12	0.5	ND - 8.0
Aizu	168	0	0.0	ND	1,169	0	0.0	ND
Ibaraki	212	0	0.0	ND	1,614	0	0.0	ND
Tochigi	278	0	0.0	ND	2,100	1	0.0	ND - 1.0
Gunma	214	0	0.0	ND	1,585	0	0.0	ND
Saitama	8	0	0.0	ND	58	0	0.0	ND
Chiba	200	0	0.0	ND	1,484	2	0.1	ND - 1.3
Tokyo	8	0	0.0	ND	63	0	0.0	ND
Total	2,013	0	0.0	ND	15,099	65	0.4	ND - 20

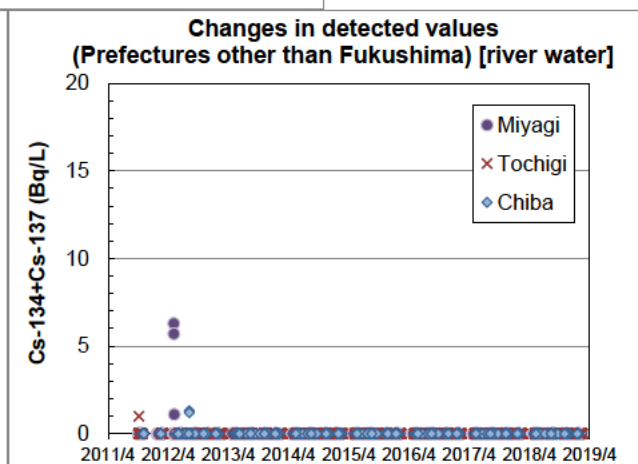
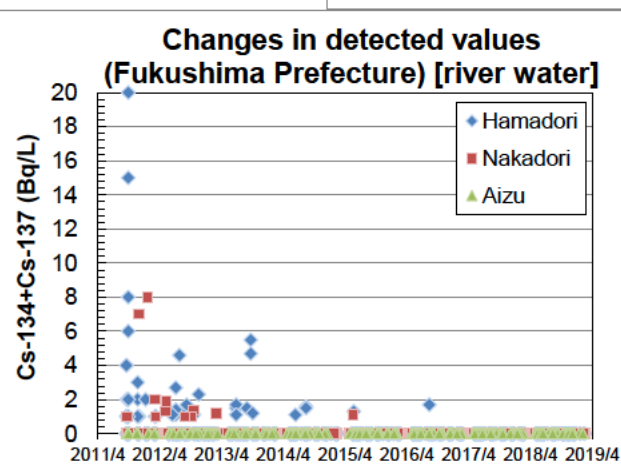
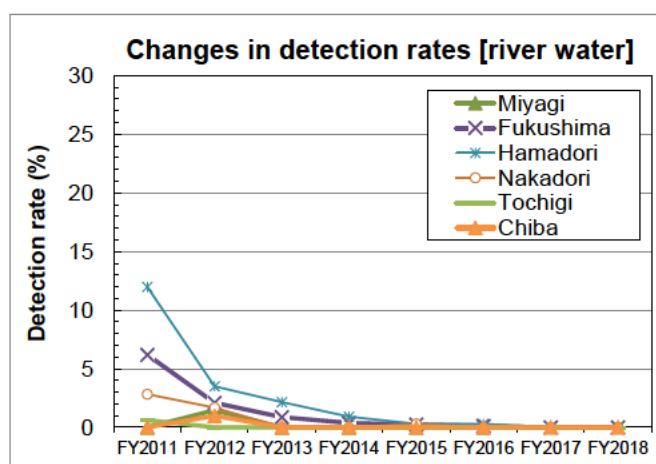


Figure 4.1-1 Detection rates of radioactive cesium in river water samples (top) and changes in detected values (lower left and lower right)

Table 4.1.1-2 Detection of radioactive cesium in lake water samples

Prefecture	FY2018				FY2011-2018				
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)	
Yamagata	0	0	-	-	4	0	0.0	ND	
Miyagi	115	0	0.0	ND	817	1	0.1	ND - 3.0	
Fukushima	841	21	2.5	ND - 5.1	5,554	248	4.5	ND - 100	
	Hamadori	367	21	5.7	ND - 5.1	2,437	239	9.8	ND - 100
	Nakadori	110	0	0.0	ND	790	5	0.6	ND - 5.0
Aizu	364	0	0.0	ND	2,327	4	0.2	ND - 5.1	
Ibaraki	144	0	0.0	ND	1,029	0	0.0	ND	
Tochigi	64	0	0.0	ND	456	0	0.0	ND	
Gunma	187	0	0.0	ND	1,324	1	0.1	ND - 1.0	
Chiba	38	0	0.0	ND	336	0	0.0	ND	
Total	1,389	21	1.5	ND - 5.1	9,520	250	2.6	ND - 100	

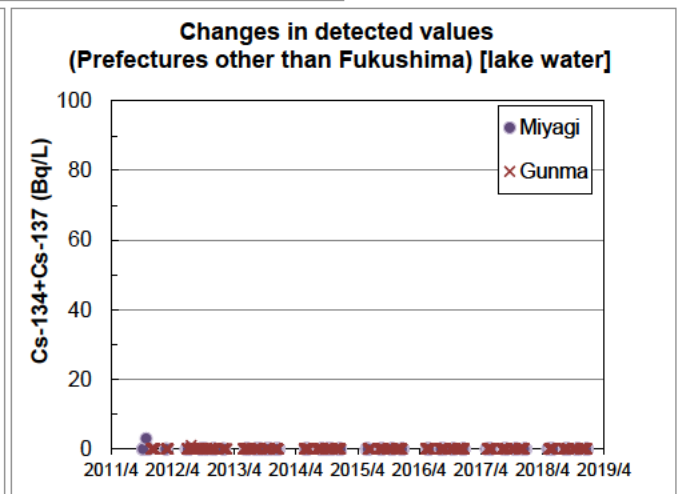
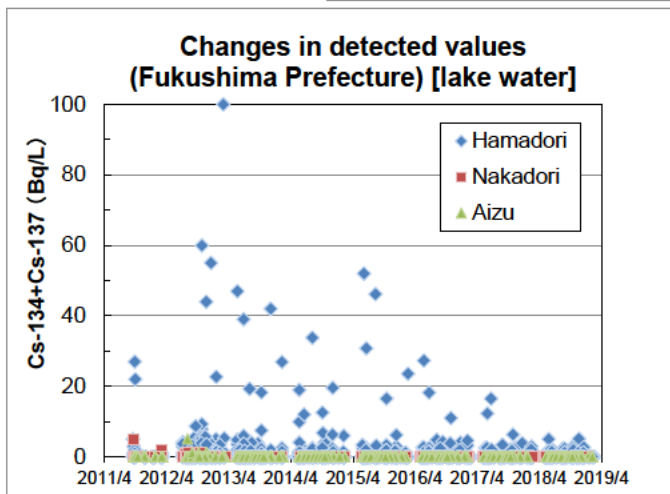
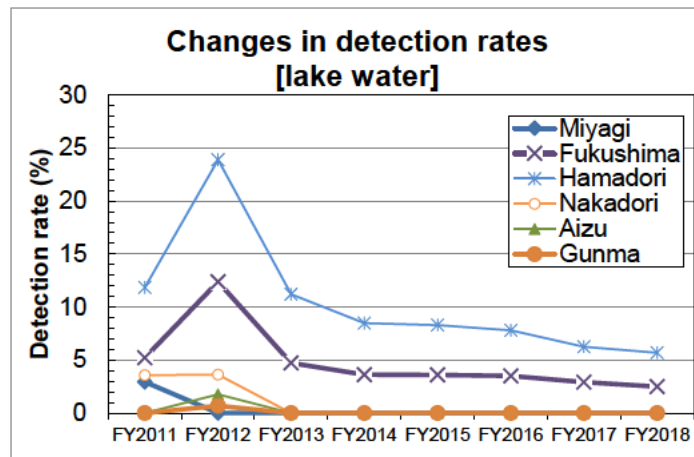


Figure 4.1.1-2 Detection rates of radioactive cesium in lake water samples (top) and changes in detected values (lower left and lower right)

Table 4.1.1-3 Detection of radioactive cesium in coastal area water samples

Prefecture	FY2018				FY2011-2018			
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)	Number of samples	Number of detections	Detection rate (B/A) (%)	Range of measured values (Bq/L)
Iwate	8	0	0.0	ND	61	0	0.0	ND
Miyagi	104	0	0.0	ND	812	0	0.0	ND
Fukushima	300	0	0.0	ND	2,105	0	0.0	ND
Ibaraki	40	0	0.0	ND	347	0	0.0	ND
Chiba	46	0	0.0	ND	338	0	0.0	ND
Tokyo	36	0	0.0	ND	254	0	0.0	ND
Total	534	0	0.0	ND	3,917	0	0.0	ND

Table 4.1.1-4 Detection of radioactive cesium in groundwater samples

Prefecture	FY2018				FY2011-2018			
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L)
Iwate	22	0	0.0	ND	240	0	0.0	ND
Miyagi	24	0	0.0	ND	289	0	0.0	ND
Yamagata	0	0	-	-	79	0	0.0	ND
Fukushima	770	0	0.0	ND	5,709	2	0.0	ND - 2.0
Ibaraki	27	0	0.0	ND	332	0	0.0	ND
Tochigi	27	0	0.0	ND	319	0	0.0	ND
Gunma	21	0	0.0	ND	227	0	0.0	ND
Chiba	23	0	0.0	ND	261	0	0.0	ND
Total	914	0	0.0	ND	7,456	2	0.0	ND - 2.0

(*) Detected in FY2011. Both Cs-134 and Cs-137 were detected at one site, and only Cs-137 was detected at another site, at a level of 1 Bq/L (detection limit: 1 Bq/L) (see the main text).

4.1-2 Sediment

Detection of radioactive cesium in sediment samples from public water areas (rivers, lakes, and coastal areas) is as outlined below.

(1) Detection status

1) Rivers

Radioactive cesium detected in river sediment samples is as shown in Table 4.1.2-1 and Figure 4.1.2-1.

According to the results, including past years, the detection rate has ranged between 37.5 and 100% and has been slightly decreasing over time in many prefectures.

On the other hand, as for detected values (the total of Cs-134 and Cs-137) shown in Figure 4.1.2-1, the number of locations with high concentration levels has decreased while the number of locations with low concentration levels has increased. When the detected values for FY2018 were observed by the concentration category, radioactive cesium was not detectable at 37 locations (approx. 9%), less than 100 Bq/kg at 207 locations (approx. 52%) and 100 to less than 200 Bq/kg at 61 locations (approx. 15%). The locations where their detected values were less than 200 Bq/kg accounted for approximately 77% of the total surveyed locations.

2) Lakes

Detection of radioactive cesium in lake sediment samples is as shown in Table 4.1.2-2 and Figure 4.1.2-2.

According to the results, including past years, the detection rate has ranged between 83.3 and 100%. In FY2018, detection rates of 90% or more were still observed in all prefectures.

Detected values (the total of Cs-134 and Cs-137) have increased at locations with lower concentrations, however, this trend is relatively moderate compared to those in rivers or coastal areas. The areas with higher concentrations still exist in many locations as in Hamadori District, Fukushima Prefecture where radioactive cesium was still detected at concentrations of 100,000 Bq/kg or more in FY2018. When the detected values for FY2018 are observed by the concentration category, radioactive cesium was not detectable at one location, less than 100 Bq/kg at 17 locations (approx. 10%), 100 to less than 1,000 Bq/kg at 81 locations (approx. 49%), and 1,000 to less than 3,000 Bq/kg at 30 locations (approx. 18%). The locations where their detected values were less than 3,000 Bq/kg accounted for approximately 79% of the total surveyed locations.

3) Coastal areas

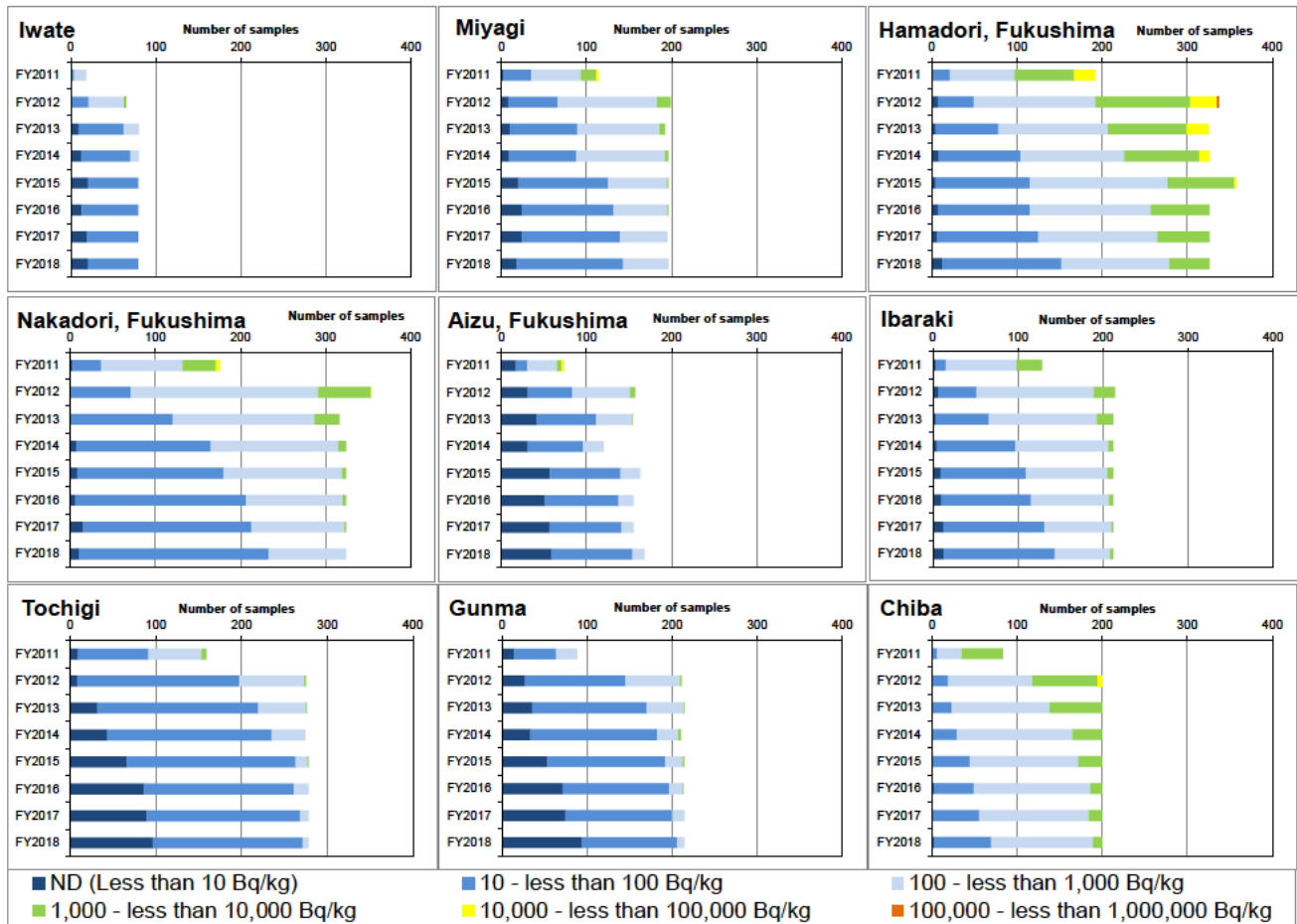
Detection of radioactive cesium in coastal area sediment samples is as shown in Table 4.1.2-3 and Figure 4.1.2-3.

According to the results, including past years, the detection rate ranged between 25.0 and 100% except for Iwate Prefecture where only a small number of samples were collected.

Coastal area locations showed lower detected values (the total of Cs-134 and Cs-137) than those in rivers or lakes. Radioactive cesium was not detected with a value of 1,000 Bq/kg or more in any prefectures since FY2016. When the detected values for FY2018 are observed by the concentration category, radioactive cesium was not detectable at 10 locations (approx. 24%), less than 100 Bq/kg at 16 locations (approx. 38%), and 100 to less than 200 Bq/kg at six locations (approx. 14%). The locations where their detected values were less than 200 Bq/kg accounted for approximately 76% of the total surveyed locations.

Table 4.1.2-1 Detection of radioactive cesium in river sediment samples

Prefecture	FY2018				FY2011-2018				
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Range of detection rate (%)
Iwate	79	59	74.7	ND - 59	560	466	83.2	ND - 1,040	74.7 - 100.0
Yamagata	0	0	-	-	10	6	60.0	ND - 132	60.0 - 60.0
Miyagi	196	178	90.8	ND - 686	1,483	1,368	92.2	ND - 11,100	87.7 - 98.2
Fukushima	818	737	90.1	ND - 7,160	6,126	5,685	92.8	ND - 165,000	90.1 - 95.5
Hamadori	326	314	96.3	ND - 7,160	2,515	2,466	98.1	ND - 165,000	96.3 - 99.5
Nakadori	324	314	96.9	ND - 822	2,466	2,417	98.0	ND - 30,000	95.4 - 100.0
Aizu	168	109	64.9	ND - 715	1,145	802	70.0	ND - 25,000	63.9 - 80.3
Ibaraki	212	199	93.9	ND - 1,410	1,614	1,554	96.3	ND - 5,800	93.9 - 98.6
Tochigi	278	182	65.5	ND - 251	2,096	1,668	79.6	ND - 4,900	65.5 - 97.1
Gunma	214	120	56.1	ND - 725	1,578	1,177	74.6	ND - 2,160	56.1 - 87.2
Saitama	8	3	37.5	ND - 26	58	40	69.0	ND - 540	37.5 - 100.0
Chiba	200	198	99.0	ND - 1,960	1,482	1,475	99.5	ND - 20,200	99.0 - 100.0
Tokyo	8	7	87.5	ND - 146	62	61	98.4	ND - 700	87.5 - 100.0
Total	2,013	1,683	83.6	ND - 7,160	15,069	13,500	89.6	ND - 165,000	37.5 - 100.0



Prefectures where only a small number of samples were collected are omitted.

*Number of locations for each category at the maximum concentration values for FY2018;

ND: 37 locations (approx. 9%), 10 to less than 100 Bq/kg: 207 locations (approx. 52%), and 100 to less than 200 Bq/kg: 61 locations (approx. 15%)

Figure 4.1.2-1 Detection of radioactive cesium in river sediment samples (changes)

Table 4.1.2-2 Detection of radioactive cesium in lake sediment samples

Prefecture	FY2018				FY2011-2018				
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Range of detection rate (%)
Yamagata	0	0	-	-	2	2	100.0	34 - 470	100.0
Miyagi	74	73	98.6	ND - 1,980	532	523	98.3	ND - 9,700	94.5 - 100.0
Fukushima	538	531	98.7	ND - 349,000	3,610	3,570	98.9	ND - 920,000	95.9 - 99.6
Hamadori	259	258	99.6	ND - 349,000	1,782	1,780	99.9	ND - 920,000	99.6 - 100.0
Nakadori	76	76	100.0	11 - 5,460	545	542	99.4	ND - 35,000	97.4 - 100.0
Aizu	203	197	97.0	ND - 7,610	1,283	1,248	97.3	ND - 15,400	88.4 - 98.9
baraki	76	76	100.0	26 - 2,190	525	523	99.6	ND - 5,400	98.7 - 100.0
Tochigi	32	32	100.0	38 - 1,079	228	226	99.1	ND - 8,700	83.3 - 100.0
Gunma	96	96	100.0	18 - 2,850	670	666	99.4	ND - 5,100	84.6 - 100.0
Chiba	32	32	100.0	121 - 2,400	240	240	100.0	66 - 8,200	100.0
Total	848	840	99.1	ND - 349,000	5,807	5,750	99.0	ND - 920,000	83.3 - 100.0



Yamagata Prefecture, where only a small number of samples were collected, was omitted.

*Number of locations for each category at the maximum concentration values for FY2018:

ND: one location, 10 to less than 100 Bq/kg: 17 locations (approx. 10%), 100 to less than 1,000 Bq/kg: 81 locations (approx. 49%), and 1,000 to less than 3,000 Bq/kg: 30 locations (approx. 18%)

Figure 4.1.2-2 Detection of radioactive cesium in lake sediment samples (changes)

Table 4.1.2-3 Detection of radioactive cesium in coastal area sediment samples

Prefecture	FY2018				FY2011-2018				
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/kg)	Range of detection rate (%)
Iwate	4	2	50.0	ND - 32	31	12	38.7	ND - 46	0.0 - 50.0
Miyagi	52	42	80.8	ND - 418	411	321	78.1	ND - 2,040	65.4 - 92.2
Fukushima	150	129	86.0	ND - 437	1,077	993	92.2	ND - 2,950	86.0 - 96.7
Ibaraki	20	5	25.0	ND - 170	179	93	52.0	ND - 230	25.0 - 96.4
Chiba	23	8	34.8	ND - 37	169	88	52.1	ND - 315	34.8 - 64.5
Tokyo	18	18	100.0	61 - 232	127	124	97.6	ND - 780	89.5 - 100.0
Total	267	204	76.4	ND - 437	1,994	1,631	81.8	ND - 2,950	0.0 - 100.0



* Number of locations for each category at the maximum concentration values for FY2018;

ND: 10 locations (approx. 24%), 10 to less than 100 Bq/kg: 16 locations (approx. 38%) and 100 to less than 200 Bq/kg: six locations (approx. 14%)

Figure 4.1.2-3 Detection of radioactive cesium in coastal area sediment samples (Changes)

(2) Changes in concentration levels

Changes in overall concentration levels were evaluated based on the following method shown below by using data obtained at locations where continuous monitoring has been conducted.

- i. Obtain the average value for each location where continuous monitoring has been conducted in order to evaluate changes in overall concentration levels of radioactive cesium each fiscal year (arithmetic average calculated by assuming ND to be zero; hereinafter referred to as the "average for each location").

The analyzation of data from FY2011 was excluded, concerning a small number of samples and locations collected compared to those in other years.

- ii. Arrange all such averages for each location (separately for samples from rivers, lakes, and coastal areas) for each fiscal year in descending order and set the following five categories depending on upper percentile ranges.

- Upper 5th percentile of the entirety
- Upper 10th percentile of the entirety
- Upper 25th percentile of the entirety
- Upper 50th percentile of the entirety
- Upper 75th percentile of the entirety

(Incidentally, a correlation between the average for each location and the maximum value by fiscal year revealed a good correlation. Therefore, considering that the evaluation of the average for each location covers that of large detected values (maximum values) that emerge occasionally, the evaluation was conducted by using only the average for each location.)

1) Rivers

Interannual changes in the percentile values of the averages for each location in river sediment samples are as shown in Figure 4.1.2-4.

Since FY2012, all percentile values have been on a decreasing trend, and in FY2018, they had declined to a level of about 20% of FY2012.

In FY2018, 95% of the total (locations no more than the upper 5th percentile) was less than 1,000 Bq/kg.

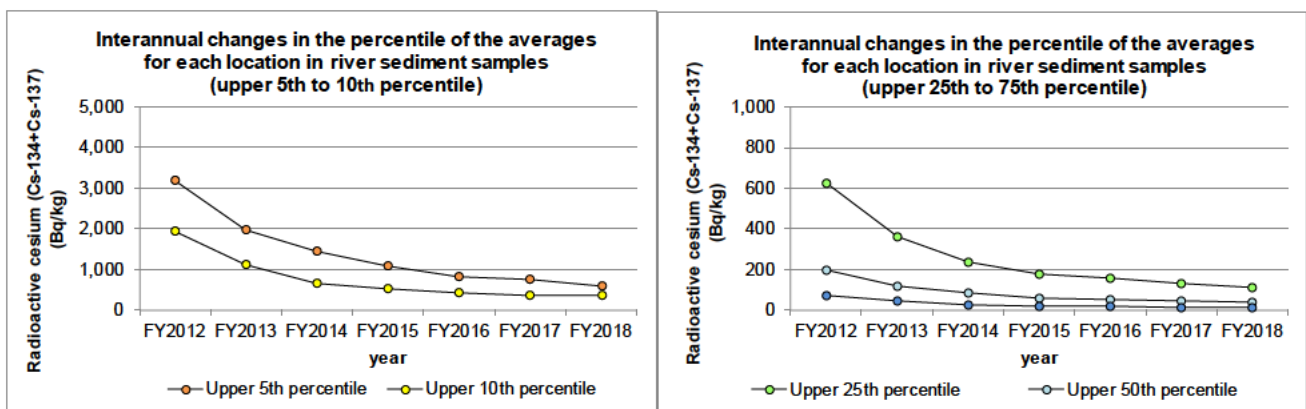


Figure 4.1.2-4 Interannual changes in the percentile values of the averages for each location in river sediment samples

2) Lakes

Interannual changes in the percentile values of the averages for each location in lake sediment samples are as shown in Figure 4.1.2-5.

Since FY2012, most of the percentile values have been on a decreasing trend, and in FY2018, they had declined to the level of about half of Y2012.

In FY2018, 90% of the total (locations no more than the top 10th percentile) was less than about 8,000 Bq/kg, and 75% of the total (locations no more than the upper 25th percentile) was less than 2,000 Bq/kg.

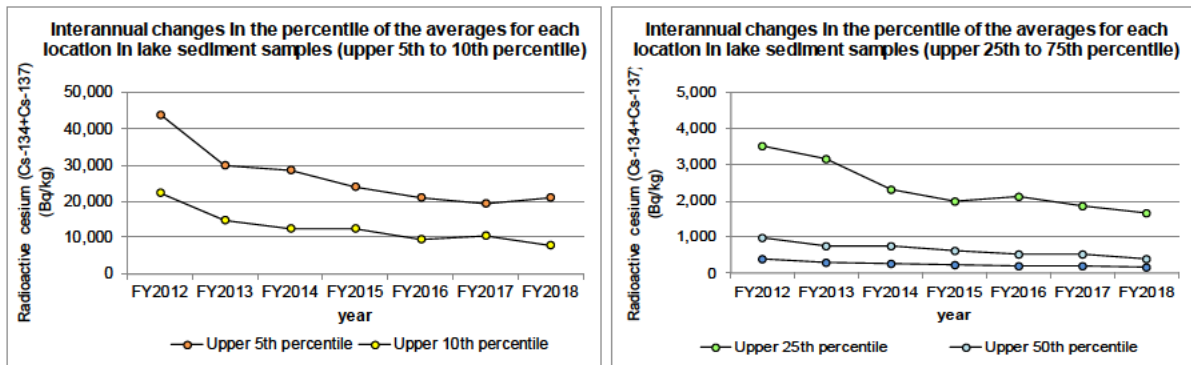


Figure 4.1.2-5 Interannual changes in the percentile values of the averages for each location in lake sediment samples

3) Coastal areas

Interannual changes in the percentile values of the averages for each location in coastal area sediment samples are as shown in Figure 4.1.2-6.

Since FY2012, the percentile values have generally been decreasing with some variations. In FY2018, they declined to about half of those in FY2012 (In coastal areas, the concentration levels were relatively lower than those in rivers or lakes, and the number of survey locations was very small. Therefore, the percentile values showed variations. Of these, the increase in the 25th percentile from FY2012 to FY2013 was due to the addition of three survey locations with relatively high concentration. Another partial increase of percentile values in FY2015 was considered to be affected by the torrential rainfall in the Kanto and Tohoku regions in September 2015. This increase was a transient trend and the percentile values have continuously seen decreasing trends since FY2016 as they used to be previously.

In FY2018, 95% of the total (locations no more than the upper 5th percentile) declined to approximately 300 Bq/kg.

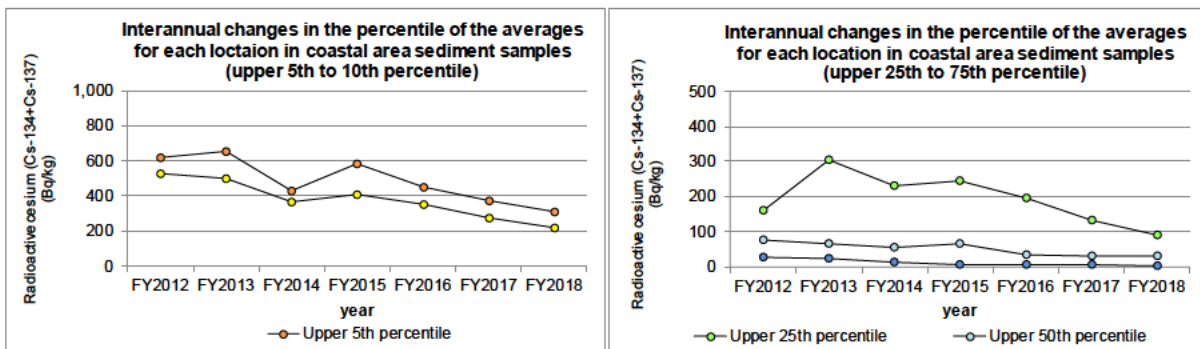


Figure 4.1.2-6 Interannual changes in the percentile values of the averages for each location in coastal area sediment samples

(3) Detection of radioactive materials in sediment by location

1) Evaluation policy

Circumstances where radioactive materials were detected were compiled in further detail by sampling location, while separately considering the property such as rivers, lakes and coastal areas.

Circumstances for each location were statistically analyzed from the following two perspectives by using all available data for each location. Locations where the survey was completed in a single fiscal year (including Yamagata Prefecture) and where the survey has not been conducted since FY2013, were excluded from the evaluation.

i) Relative detected concentration levels

- i. Obtain the average value for each location in FY2018 by using all survey results concerning concentrations of radioactive cesium (the total of Cs-134 and Cs-137) (arithmetic average calculated by assuming ND to be zero).
- ii. Arrange all such averages for each location (separately for samples from rivers, lakes, and coastal areas) in descending order and set the following five categories depending on upper percentile ranges (see Figure 4.1.2-7).
 - Category A: Upper 5th percentile of the entirety
 - Category B: Upper 5th to 10th percentile of the entirety
 - Category C: Upper 10th to 25th percentile of the entirety
 - Category D: Upper 25th to 50th percentile of the entirety
 - Category E: Upper 50th to 100th percentile of the entirety (lower 50th percentile)

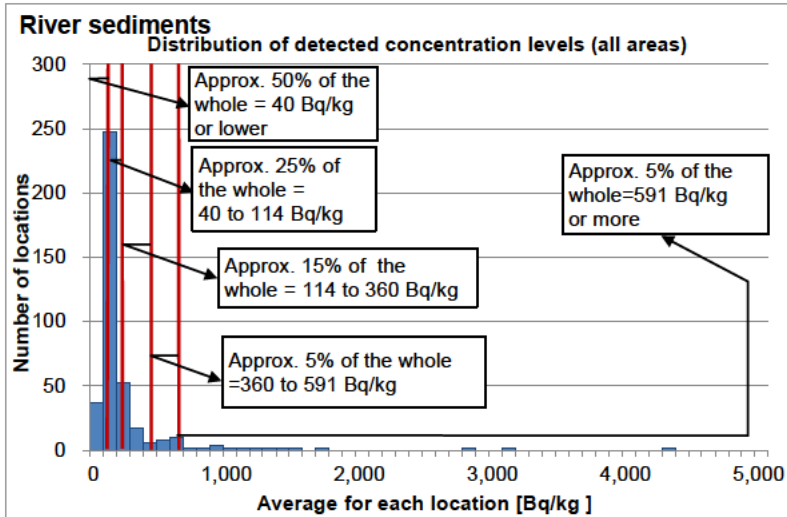
(Incidentally, a comparison between the average and the maximum value for each location in FY2018 revealed a good correlation (see lower right of Figure 4.1.2-7). Therefore, considering that the evaluation of the average for each location covers that of large detected values (maximum values) that emerge occasionally, the evaluation was conducted by using only the average for each location.)

ii) Changes in detected values

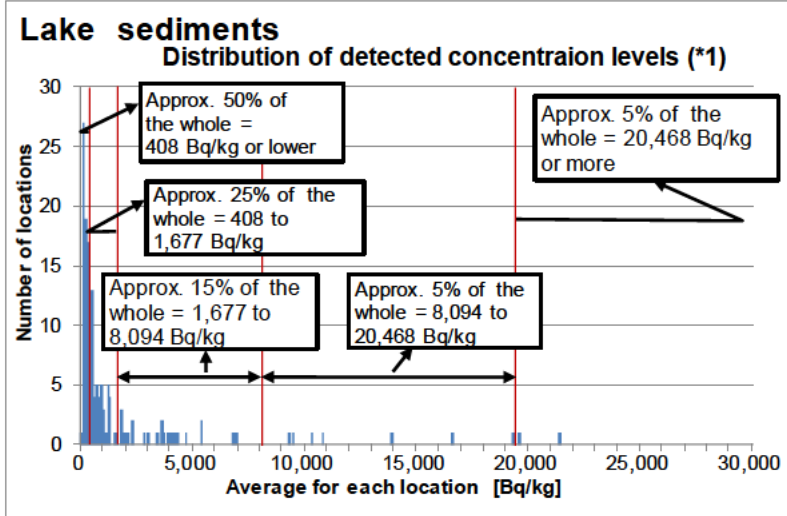
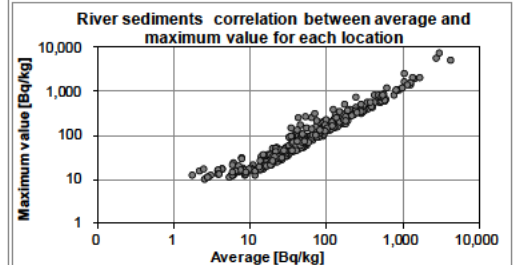
- i. Changes in detected values were categorized based on the following policy in order to evaluate their changes over the years. In addition, locations with average values of 100 Bq/kg or less, including those in past years, were excluded from evaluation on changes assuming they had no significant changes.
 - (i) Based on graphs showing changes in detected values of each location over the years, those negatively sloped are categorized as "decreasing" and those positively sloped are categorized as "increasing" respectively by visual estimation.
 - (ii) When visual estimation is difficult, a regression analysis is conducted to check the trend. Specifically, when the lower and upper 95% of the slope are both negative, it is judged as "decreasing," and when the lower and upper 95% of the slope are both positive, it is judged as "increasing."
 - (iii) When increasing or decreasing tendencies are unclear (either the lower or upper limit of 95% of the

slope is negative or the other is positive), a coefficient of variation of 0.5 is used as a reference. When the coefficient of variation is less than 0.5, it is judged as "unchanged," and when the coefficient of variation is 0.5 or higher, it is judged as "fluctuations."

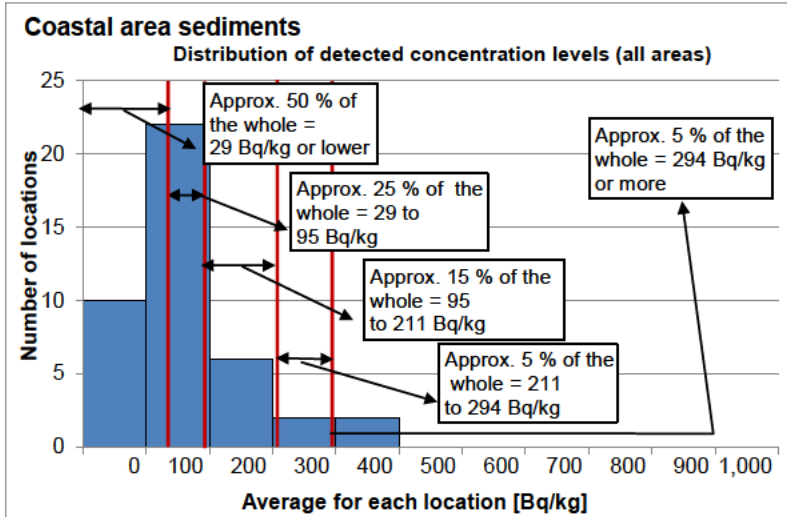
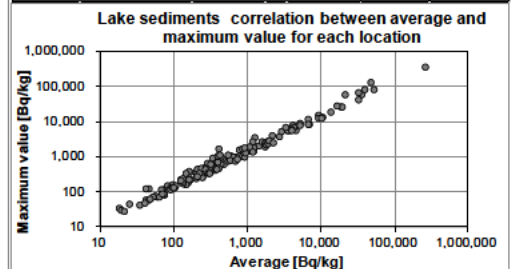
- ii. However, data may show fluctuations, depending on minor differences in sampling locations or properties of the samples, and it is considered to be too early to make judgments on changes in detected values at this point in time. Even if a certain location is categorized as an "increasing trend" based on the above-mentioned policy, whether or not the trend is increasing in a particular location requires further continuous collection of data in order to make an informed judgment.



Category	Percentile	Range [River sediments] [Bq/kg (dry)]	Number of locations	Same as on the left. [%]
A	Upper 5th percentile	591 or more	19	4.8
B	Upper 5th to 10th percentile	360 - 591	20	5.1
C	Upper 10th to 25th percentile	114 - 360	60	15.2
D	Upper 25th to 50th percentile	40 - 114	99	25.0
E	Lower 50th percentile	40 or less	198	50.0
Total			396	100.0



Category	Percentile	Range [Lake sediments] [Bq/kg (dry)]	Number of locations	Same as on the left. [%]
A	Upper 5th percentile	20,468 or more	8	4.9
B	Upper 5th to 10th percentile	8,094 - 20,468	8	4.9
C	Upper 10th to 25th percentile	1,677 - 8,094	25	15.2
D	Upper 25th to 50th percentile	408 - 1,677	41	25.0
E	Lower 50th percentile	408 or less	82	50.0
Total			164	100.0



Category	Percentile	Range [Coastal area sediments] [Bq/kg (dry)]	Number of locations	Same as on the left. [%]
A	Upper 5th percentile	294 or more	2	4.8
B	Upper 5th to 10th percentile	211 - 294	2	4.8
C	Upper 10th to 25th percentile	95 - 211	6	14.3
D	Upper 25th to 50th percentile	29 - 95	11	26.2
E	Lower 50th percentile	29 or less	21	50.0
Total			42	100.0

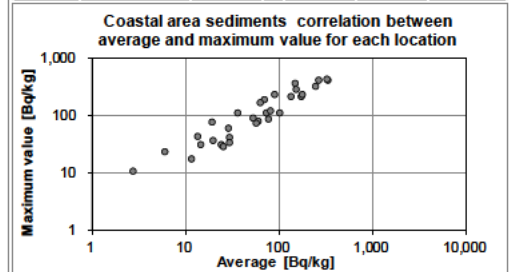


Figure 4.1.2-7 Categories based on the average for each location (left: picture showing means of categorization; upper right: results of categorization¹¹; lower right: correlation between average and maximum value for each location)
 *1: Locations where the maximum value on the horizontal axis is exceeded are not shown.

¹¹ Method of setting categorization boundary value: The boundary value of adjacent categories is the average value of the minimum value of the upper categorization and the maximum value of the lower categorization.

2) Concentration levels in sediment samples from rivers, lakes, and coastal areas and their changes by prefecture

2)-1 Rivers

i) Iwate Prefecture

In Iwate Prefecture, surveys were conducted 15 to 29 times from December 2011 to February 2019 for river sediment samples collected at 22 locations (this analysis excludes the survey results from one location where the survey was conducted only in 2011).

Regarding the concentration levels of detected values, one location was categorized as Category D and 21 locations were categorized as Category E (see Table 4.1.2-4 and Table 4.1.2-5).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 80% (17 locations), while decreasing at all five remaining locations.

Table 4.1.2-4 Categorization of detected values at respective locations (Iwate Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	1	No.22
E	Lower than upper 25th to 50th percentile (lower 50%)	21	No.1, No.2, No.3, No.4, No.5, No.6, No.7, No.8, No.9, No.10, No.11, No.12, No.13, No.14, No.15, No.16, No.17, No.18, No.19, No.20, No.21

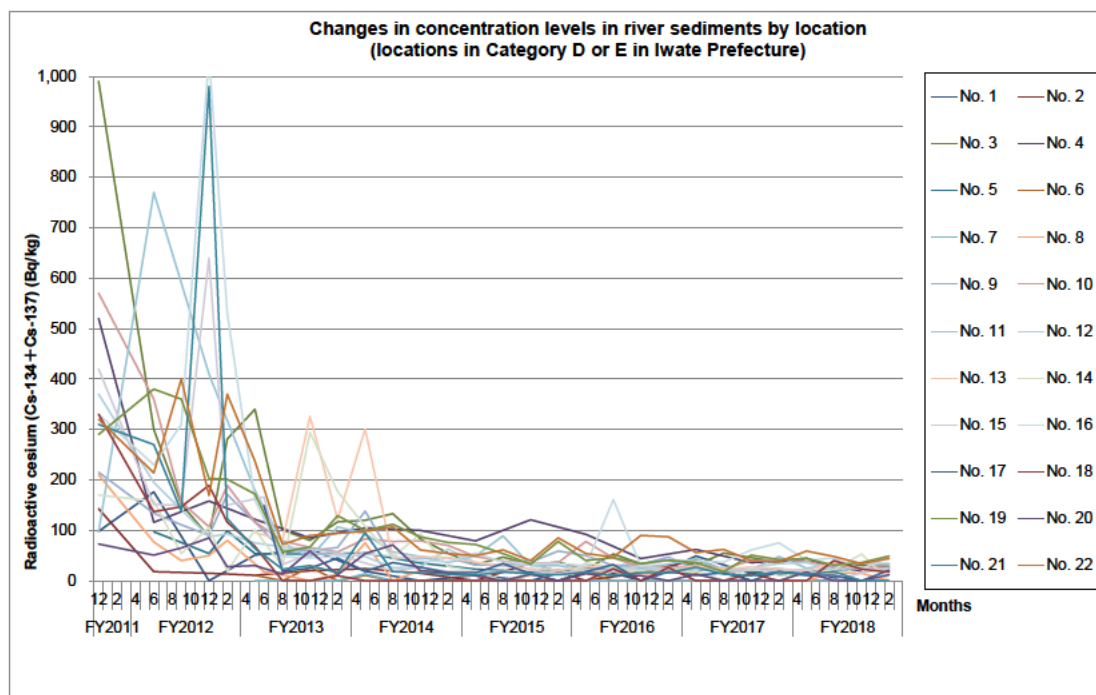


Figure 4.1.2-8 Changes in concentration levels over the years at respective locations (Iwate Prefecture: river sediment)

Table 4.1.2-5 Detection of radioactive cesium at respective locations
(Iwate Prefecture: river sediment)

No.	Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
	Water area	Loca ion	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Sakai River Lower Reaches	Sano Bridge	Ofunato City	0	12	6.0	0	176	35		1.39	—
2	Kesen River	Aneha Bridge	Rikuzentakada City	0	0	0	0	143	23		1.58	—
3	Okawa River	Prefectural border with Miyagi	Ichinoseki City	25	45	32	23	990	118		1.58	↘
4	Tsuyagawa River	Chiyogahara Bridge	Ichinoseki City	19	41	30	19	520	113		1.05	↘
5	Kurosawa River	Kawarada Bridge	Kanegasaki Town	18	24	21	17	99	43		0.65	—
6		Oago Bridge	Oshu City	0	0	0	0	27	3.0		2.38	—
7		Saijin Bridge	Oshu City	0	0	0	0	14	0.6		4.90	—
8	Kitakami River	Fuji Bridge	Oshu City	0	16	7.8	0	210	26		1.62	—
9	Shiratori River	Shiratori Bridge	Oshu City	15	28	23	15	215	62		0.80	—
10	Koromo River	Koromogawa Bridge	Hiraizumi Town	26	39	31	24	570	90		1.28	—
11	Ota River	Hitosuji Bridge	Hiraizumi Town	25	35	31	20	770	92		1.70	—
12	Iwai River Middle Reaches	Kamino Bridge	Ichinoseki City	20	36	26	20	370	60		1.20	—
13		Iwai River Lower Reaches	Kozenji Bridge	Ichinoseki City	19	37	26	12	326	61		1.34
14	Kitakami River	Chitose Bridge (Kozenji)	Ichinoseki City	0	53	22	0	294	57		1.21	—
15	Sokei River	Unada Bridge	Ichinoseki City	0	25	16	0	640	77		1.79	—
16	Sarusawa River	Kannon Bridge	Ichinoseki City	23	49	40	23	1,040	128		1.64	↘
17		Oide Bridge	Ichinoseki City	0	21	11	0	149	23		1.26	—
18	Satetsu River	Kanzaki Bridge	Ichinoseki City	0	40	20	0	330	39		1.93	—
19		Miyata Bridge	Ichinoseki City	31	49	40	18	380	101		0.96	↘
20	Kitakami River	Kitakamigawa Bridge	Ichinoseki City	0	17	7.3	0	85	23		1.11	—
21	Kinomi River	Higuchi Bridge	Ichinoseki City	0	18	7.8	0	980	80		2.37	—
22	Kinryu River	Tenjin Bridge	Ichinoseki City	34	59	46	34	400	110		0.92	↘
Total number of samples		559		0	59	21	0	1,040	64			
Number of detections		465	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)							→ : Increasing ↘ : Decreasing : Fluctuations : Unchanged — : ≤ 100 Bq/kg		
				A	B	C	D	E				

ii) Miyagi Prefecture

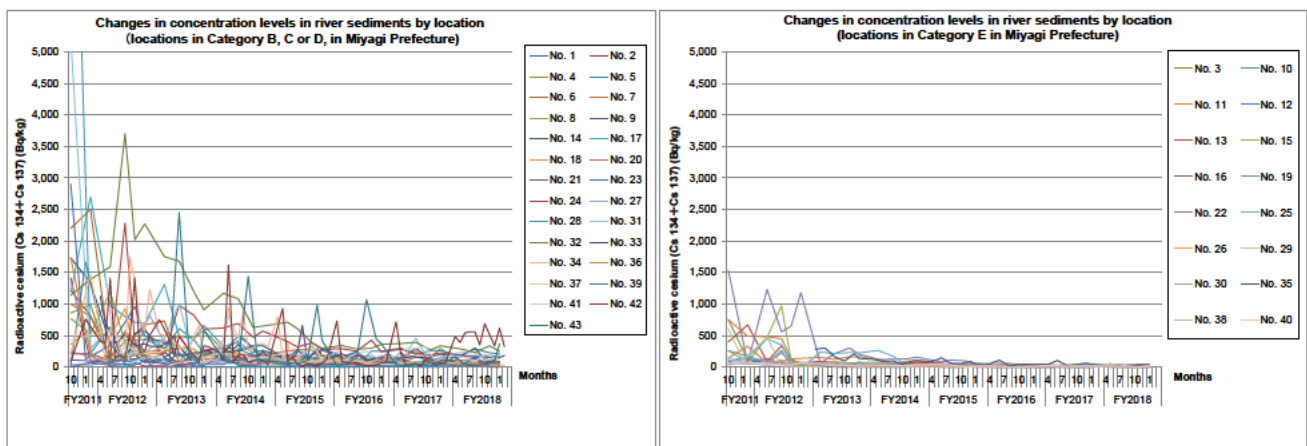
In Miyagi Prefecture, surveys were conducted 28 to 73 times from October 2011 to February 2019 for river sediment samples collected at 43 locations (this analysis excludes the survey results from 38 locations where the survey was conducted only in 2011).

Regarding the concentration levels of detected values, one location was categorized as Category B, eight locations as Category C, 18 locations as Category D, and 16 locations as Category E (see Table 4.1.2-6 and Table 4.1.2-7).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 40% (19 locations), while decreasing at 21 locations and fluctuations at three locations.

Table 4.1.2-6 Categorization of detected values at respective locations
(Miyagi Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	1	No.42
C	Upper 10th to 25th percentile	8	No.5, No.14, No.23, No.24, No.31, No.32, No.41, No.43
D	Upper 25th to 50th percentile	18	No.1, No.2, No.4, No.6, No.7, No.8, No.9, No.17, No.18, No.20, No.21, No.27, No.28, No.33, No.34, No.36, No.37, No.39
E	Lower than upper 25th to 50th percentile (lower 50%)	16	No.3, No.10, No.11, No.12, No.13, No.15, No.16, No.19, No.22, No.25, No.26, No.29, No.30, No.35, No.38, No.40



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-9 Changes in concentration levels over the years at respective locations
(Miyagi Prefecture: river sediment)

Table 4.1.2-7 Detection of radioactive cesium at respective locations
(Miyagi Prefecture: river sediment)

No.	Location			FY2018			FY2011 - 2018			Changes	Coefficient of variation	Trends (*3)		
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Shishiori River	Kinzan Bridge	Kesenuma City	51	57	54	36	211	84		0.52	—		
2		Namiita Bridge		53	74	65	28	1,220	209		1.15	↘		
3	Okawa River	Tateyama-ohashi Bridge		16	24	20	16	750	67		1.97	—		
4		Kamiyama Bridge		22	94	42	22	990	197		1.26	↘		
5		Okawa River Estuary		184	291	228	0	1,660	137		2.26	↗		
6	Omose River	Ozaki Bridge		29	97	72	29	2,500	345		1.66	↘		
7	Kasama River System	Arima River	Kurihara City	79	94	88	28	1,000	225		0.99	↘		
8		Kinryu River		Obata Bridge	51	95	78	51	1,190	244		1.00	↘	
9		Kitakami River		Tome-ohashi Bridge (Tome)	28	93	47	17	199	74		0.65	—	
10		Sanhasama River	Doman Bridge (Kurikoma Dam)	11	12	12	0	260	35		1.44	—		
11			Nhasama River	Kajiya Bridge	25	32	29	0	750	131		1.37	↘	
12		Hasama River Area	Hanayama Dam, inflow area	0	17	4.3	0	135	12		2.32	—		
13			Hasama River	Wakayanagi	22	27	26	22	670	88		1.58	—	
14			Yamayoshida Bridge	Tome City	25	299	131	25	1,730	298		1.24	↘	
15		Eai River Area	Eai River	Osaki City	Todoroki Bridge (Todoroki)	17	35	25	0	970	98		1.99	—
16			Shimizu Komon Lock		0	0	0	0	330	29		2.25	—	
17			In Furukawa District,Osaki City	Shinborisaion, entrance	100	132	110	88	2,700	449		1.21	↘	
18			Dekigawa River	Kogota Bridge	Misato Town	53	144	89	49	930	222		0.86	↘
19			Eai River	Oikawa Bridge (Tandai)	Wakuya Town / Ishinomaki Town	0	18	10	0	260	40		1.36	—
20			Kyu-Kitakami River	Kadonowaki	Ishinomaki City	53	110	77	0	240	87		0.79	—
21	Naruse River	Onobashi Bridge (Ono)	Higashi-Matsushima City	17	66	44	0	153	48		0.68	—		
22	Sunaoshi River	Tagajozeki Weir	Tagajo City	22	49	36	20	1,530	243		1.62	↘		
23		Neubutsu Bridge		150	187	162	17	2,900	336		1.56	↘		
24	Teizan-unga Canal (Kyu-sunaoshi River)	Teizan Bridge	Shiogama City / Shichigahama Town / Tagajo City	160	180	175	95	2,280	453		0.99	↘		
25	Nanakita River System	Nanakita River	Sendai City	Nanakita Bridge	18	39	29	0	450	98		1.20	—	
26		Fukuda-ohashi Bridge		0	11	2.8	0	60	10		1.56	—		
27		Umeda River		Fukuda Bridge	36	88	56	36	1,350	189		1.49	↘	
28		Nanakita River		Takasago Bridge	42	55	51	0	11,100	502		4.00	↘	
29	Natori River	Yuriage-ohashi Bridge	Sendai City / Natori City	14	51	34	0	610	64		2.16	—		
30	Masuda River	Yakushi Bridge	Natori City	0	25	15	0	220	35		1.11	—		
31		Koyama Bridge		100	230	187	0	5,200	355		2.63	↘		
32		Bishamon Bridge		235	336	278	235	3,700	898		0.88	↘		
33	Abukuma River	Hadeniwa Bridge	Marumori Town	50	184	103	50	1,120	247		0.71	↘		
34		Marumori Bridge	Marumori Town	29	84	45	27	3,400	315		1.56	↘		
35		Higashine Bridge	Kakuda City	20	43	31	20	301	84		0.81	—		
36	Shiroishi River System	Shiroishi River	Shiroishi City	Before the confluence with Kawaragosa River (Sunaoshi Bridge)	40	60	47	30	1,730	162		1.93	↘	
37		Saikawa River		Etsubo Bridge	72	131	106	45	590	166		0.79	↘	
38		Matsukawa River	Miya-ohashi Bridge	Zao Town	0	16	4.0	0	119	22		1.18	—	
39		Arakawa River	Niragami Bridge	Murata Town / Ogawara Town	0	168	45	0	222	42		1.31	—	
40		Shiroishi River	Shirahata Bridge	Shibata Town	0	24	16	0	68	25		0.72	—	
41		Abukuma River	Tsukinoki-ohashi Bridge	Kakuda City / Shibata Town	89	200	151	24	2,470	247		1.52	↘	
42			Abukuma-ohashi Bridge (Iwanuma)	Iwanuma City / Watari Town	326	686	485	0	1,860	314		1.21	↗	
43	Abukuma River Estuary (Watariohashi Bridge)		Iwanuma City / Watari Town	28	369	122	21	2,450	258		1.76	↗		
Total number of samples		1,439		0	686	92	0	11,100	201					
Number of detections		1,325		<p>*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic, calculated by assuming ND=0; Color codes show categories according to 1) (i). *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii).</p>										
				A	B	C	D	E						

iii) Fukushima Prefecture

i. Hamadori

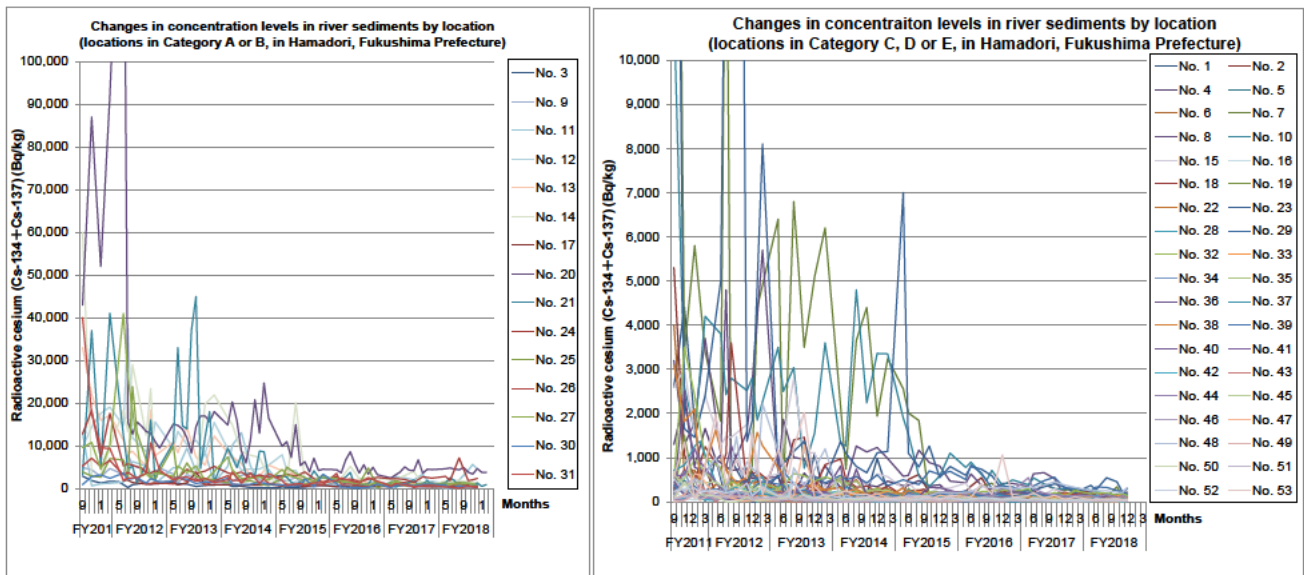
In Hamadori, Fukushima Prefecture, surveys were conducted 41 to 75 times from September 2011 to February 2019 for river sediment samples collected at 53 locations.

Regarding the concentration levels of detected values, 11 locations were categorized as Category A, four locations as Category B, 13 locations as Category C, 12 locations as Category D, and 13 locations as Category E (see Table 4.1.2-8 and Table 4.1.2-9).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 20% (11 locations), while decreasing at 40 locations, fluctuations at one location, and increasing at one location.

Table 4.1.2-8 Categorization of detected values at respective locations
(Hamadori, Fukushima Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	11	No.3, No.11, No.12, No.13, No.14, No.20, No.21, No.24, No.25, No.26, No.27
B	Upper 5th to 10th percentile	4	No.9, No.17, No.30, No.31
C	Upper 10th to 25th percentile	13	No.2, No.4, No.6, No.7, No.8, No.10, No.18, No.23, No.28, No.29, No.32, No.44, No.48
D	Upper 25th to 50th percentile	12	No.15, No.22, No.33, No.35, No.36, No.37, No.38, No.39, No.45, No.50, No.52, No.53
E	Lower than upper 25th to 50th percentile (lower 50%)	13	No.1, No.5, No.16, No.19, No.34, No.40, No.41, No.42, No.43, No.46, No.47, No.49, No.51



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-10 Changes in concentration levels over the years at respective locations
(Hamadori, Fukushima Prefecture: river sediment)

Table 4.1.2-9 Detection of radioactive cesium at respective locations
(Hamadori, Fukushima Prefecture: river sediment)

No.	Water area	Location			FY2018			FY2011 -2018			Changes	Coefficient of variation	Trends (*3)																									
		Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average																													
1	Jazgawa River	Hama-hata Bridge	Shinchi Town	0	0	0	0	4,400	337		2.38	→																										
2	Koizumi River	Koizumi Bridge	Soma City	100	150	126	100	5,300	467		1.69	→																										
3		Hyakken Bridge		510	1,032	831	46	2,900	964		0.81	↕																										
4	Udagawa River	Horisaka Bridge	Soma City	76	238	150	76	2,300	458		0.93	→																										
5		Hyakken Bridge		14	41	28	0	490	82		1.01	→																										
6	Manogawa River	Ochiai Bridge	Minamisoma City	66	195	146	34	4,000	328		1.68	→																										
7		Majima Bridge		58	338	147	58	28,000	2,377		1.96	→																										
8	Nida River	Kusano	Iitate Village	120	216	168	120	5,700	1,039		1.12	→																										
9		Komuya		280	866	553	187	7,900	1,893		0.93	→																										
10		Kidouchi Bridge		110	266	176	110	11,200	1,699		1.11	→																										
11		Saiekawa Bridge		41	5,660	2,781	41	13,100	3,111		1.04	→																										
12		Ishiwatado Bridge		1,090	1,500	1,253	890	61,000	7,103		1.34	→																										
13		Kaminouchi Bridge		730	1,049	824	682	33,000	5,600		1.12	→																										
14	Ota River	Masuda Bridge	Minamisoma City	1,310	1,960	1,652	620	60,000	7,520		1.42	→																										
15		JR Tetsudo Bridge		70	122	88	70	3,000	714		1.08	→																										
16		Maruyama Bridge		11	32	24	0	230	50		0.85	→																										
17	Odaka River	Shimokawara Bridge		326	746	523	326	3,800	853		0.69	→																										
18		Zencho Bridge		98	252	135	98	3,600	405		1.34	→																										
19		Hatsukara Bridge		0	21	5.8	0	1,500	95		2.42	→																										
20	Ukedo River	Murohara Bridge	Nami Town	3,400	4,920	4,281	2,480	165,000	14,418		1.62	→																										
21		Ukedo Bridge		384	2,540	1,041	341	45,000	6,375		1.54	→																										
22	Furumichi River	Before the confluence with Takasagawa River (Kosostinohira, Miyako Town)	Tamura City	50	122	84	32	1,410	197		1.27	→																										
23	Takase River	Keio Bridge	Nami Town	184	545	344	184	24,000	2,646		1.94	→																										
24	Maeda River	National Route 6, west	Futaba Town	1,850	7,160	3,023	1,460	18,300	4,064		0.88	→																										
25		Nakahama Bridge	Nami Town	513	1,410	1,142	132	23,900	3,224		1.22	→																										
26	Kumagawa River	National Route 6, west	Okuma Town	404	1,192	613	270	7,100	1,786		0.90	→																										
27		Mikuma Bridge		710	1,192	967	697	41,000	4,246		1.64	→																										
28	Tomioka River	Nabekura Bridge	Kawauchi Village	93	151	126	70	570	166		0.52	→																										
29		Sakaigawa Bridge		220	334	278	195	830	461		0.33	→																										
30		National Route 6, west	Tomioka Town	90	807	537	90	3,600	1,319		0.69	→																										
31		Kobama Bridge		71	537	379	71	40,000	3,391		1.88	→																										
32	Idegawa River	Motogama Bridge	Naraha Town	143	211	179	94	3,500	419		1.40	→																										
33	Kawauchi River	Before the confluence with Kidogawa River (Futamata Bridge)	Kawauchi Village	62	141	101	39	290	137		0.43	→																										
34		Nishiyama Bridge		14	58	40	14	660	87		1.20	→																										
35	Kidogawa River	Nagatoro Bridge	Naraha Town	23	103	48	22	970	195		1.01	→																										
36		Kidokawa Bridge		69	122	95	68	2,500	345		1.28	→																										
37	Asami River	Boda Bridge	Hirono Town	30	58	45	23	1,370	202		1.43	→																										
38	Ohisa River	Kageiso Bridge	Iwaki City	36	131	81	36	3,100	421		1.53	→																										
39	Kohisa River	Renjo Bridge		52	97	73	52	460	179		0.53	→																										
40	Nida River	Kasumida Bridge		23	44	28	0	460	55		1.40	→																										
41		Matsuba Bridge	36	45	40	25	1,200	168		1.41	→																											
42	Natsui River	Kitanouchi Bridge	Ono Town	0	14	8.7	0	400	46		1.81	→																										
43		Kyudayu Bridge		12	32	19	0	440	48		1.83	→																										
44		Rokujumai Bridge		78	164	119	17	546	138		0.73	→																										
45	Yoshima River	Iwanatsuri Bridge	Iwaki City	38	67	58	28	620	140		1.02	→																										
46		Before the confluence with Natsui River		23	44	35	0	480	73		1.40	→																										
47	Fujiwara River	Shima Bridge	Iwaki City	12	32	20	12	1,280	109		2.01	→																										
48		Minato-ohashi Bridge		207	323	251	20	2,220	416		0.98	→																										
49		Itozawa Bridge		14	26	20	0	278	43		1.41	→																										
50	Samegawa River	Samegawa Bridge		30	67	49	0	440	68		0.93	→																										
51	Shitaki River	Komuro Bridge		15	31	26	11	300	59		1.07	→																										
52	Binda River	Kobana Bridge		32	73	41	20	450	122		0.88	→																										
53		Binda Bridge	38	71	51	38	2,020	388		1.34	→																											
Total number of samples		2,515			0			7,160			504			0			165,000			1,769			↗	Increasing														
Number of detections		2,466			1			0			0			0			0			0			0			↘	Decreasing											
													*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry).																									
													*2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i)																									
													*3 Results of the analysis of trends at respective locations using the method explained in 1) (i)																									
													A			B			C			D			E													

ii. Nakadori

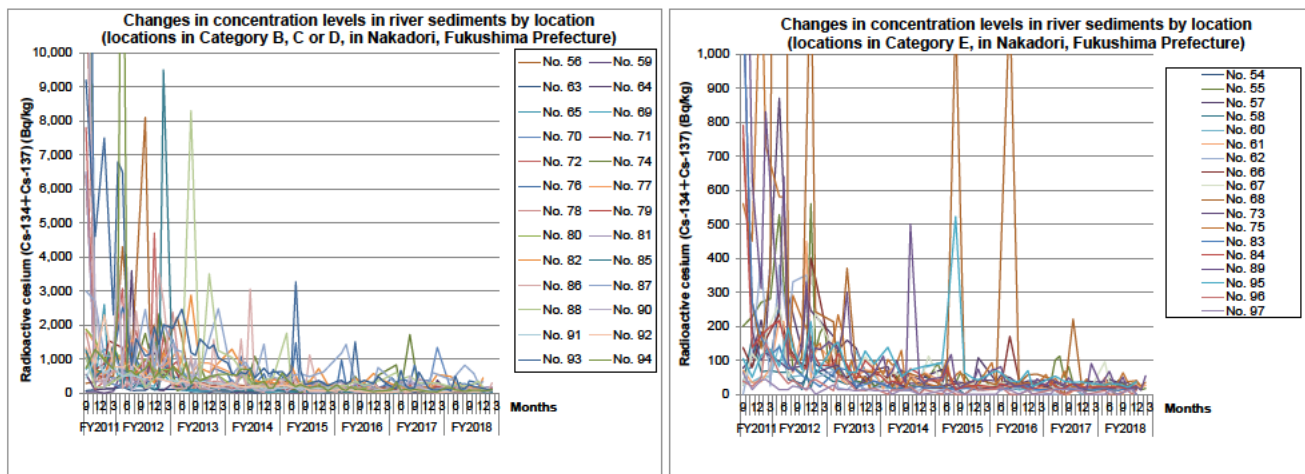
In Nakadori, Fukushima Prefecture, surveys were conducted 45 to 77 times from September 2011 to February 2019 for river sediment samples collected at 44 locations.

Regarding the concentration levels of detected values, one location was categorized as Category B, 11 locations as Category C, 14 locations as Category D, and 18 locations as Category E (see Table 4.1.2-10 and Table 4.1.2-11).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 40% (16 locations), while decreasing at 27 locations and fluctuations at one location.

Table 4.1.2-10 Categorization of detected values at respective locations
(Nakadori, Fukushima Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	1	No.87
C	Upper 10th to 25th percentile	11	No.56, No.59, No.70, No.76, No.77, No.80, No.81, No.82, No.86, No.88, No.93
D	Upper 25th to 50th percentile	14	No.63, No.64, No.65, No.69, No.71, No.72, No.74, No.78, No.79, No.85, No.90, No.91, No.92, No.94
E	Lower than upper 25th to 50th percentile (lower 50%)	18	No.54, No.55, No.57, No.58, No.60, No.61, No.62, No.66, No.67, No.68, No.73, No.75, No.83, No.84, No.89, No.95, No.96, No.97



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-11 Changes in concentration levels over the years at respective locations
(Nakadori, Fukushima Prefecture: river sediment)

Table 4.1.2-11 Detection of radioactive cesium at respective locations
(Nakadori, Fukushima Prefecture: river sediment)

No.	Location			FY2018			FY2011 - 2018			Changes	Coefficient of variation	Trends (*3)	
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average				
54	Abukuma River	Habuto Bridge	Nishigo Village	17	28	20	10	262	47		1.02	—	
55		Tamachi-ohashi Bridge	Shirakawa City	0	47	25	0	1,010	83		1.68	—	
56	Yanta River	Before the confluence with Abukuma River		91	139	116	43	8,100	649		2.09	↘	
57	Yashiro River	Yashirogawa Bridge	Tanagura Town	23	43	34	23	870	99		1.39	—	
58	Kitasu River	Yanagi Bridge	Hirata Village	14	22	18	0	165	27		1.01	—	
59	Imade River	Nekonaki Bridge	Ishikawa Town	84	170	117	0	1,450	206		1.52	↘	
60	Yashiro River	Oji Bridge		13	37	21	11	145	42		0.78	—	
61	Abukuma River	Kawanome Bridge	Tamakawa Village	0	49	21	0	450	53		1.31	—	
62		Emochi Bridge	Sukagawa City	14	41	21	0	390	56		1.83	—	
63	Shakado River	Sukagawa City water intake point		21	61	41	11	182	66		0.65	—	
64		Before the confluence with Abukuma River	24	134	63	14	3,600	160		2.75	↘		
65	Sasahara River	Shinbashi Bridge	Koriyama City	42	220	98	17	2,600	300		1.71	↘	
66	Yatagawa River	Yatagawa Bridge		12	20	16	0	400	66		1.28	—	
67	Otake River	Funehiki Bridge	Tamura City	0	95	34	0	270	62		0.93	—	
68		Before the confluence with Abukuma River	Koriyama City	16	30	25	0	6,400	317		3.06	↘	
69		Before the confluence with Babagawa River		25	100	50	18	1,290	172		1.74	↘	
70	Ouse River	Makunouchi Bridge	Koriyama City	84	281	157	84	1,340	279		0.84	↘	
71		Before the confluence with Abukuma River		75	161	112	39	13,500	455		3.40	↘	
72	Abukuma River	Akutsu Bridge	Motomiya City	44	210	73	25	7,800	497		2.60	↘	
73		After the confluence with Ishimuro River		15	21	18	15	1,210	71		2.49	—	
74	Gohyaku River	Kamisekishita Bridge	Motomiya City	53	111	82	18	22,000	867		3.73	↘	
75		Before the confluence with Abukuma River		24	63	35	18	1,320	129		1.69	↘	
76	Abukuma River	Takada Bridge	Nihonmatsu City	50	360	189	50	30,000	905		3.80	↘	
77	Kuchibuto River	Kuchibutogawa Bridge		85	200	117	65	1,880	511		0.95	↘	
78	Utsushi River	Osegawa Bridge		69	135	97	24	2,380	289		1.36	↘	
79	Mizuhara River	Getouchi Bridge		73	154	106	73	6,400	434		2.19	↘	
80	Megami River	Tsurumaki Bridge		81	235	135	81	1,870	421		0.96	↘	
81	Abukuma River	Horai Bridge		100	248	169	28	6,500	343		2.12	↘	
82	Nigori River	Before the confluence with Omori River		110	486	283	110	2,880	560		0.85	↘	
83	Arakawa River	Hinokura Bridge		0	19	13	0	1,160	63		2.74	—	
84	Sukawa River	Sukawa Bridge		Fukushima City	17	27	21	14	790	74		1.63	—
85	Arakawa River	Before the confluence with Abukuma River		19	310	69	19	9,500	290		3.82	↘	
86	Matsukawa River		32	301	154	14	15,200	718		2.69	↘		
87	Hattanda River	Hattanda Bridge	281	822	484	135	4,300	885		0.94	↘		
88	Sunikami River	Totsuna Bridge	Date City	173	356	238	94	8,300	654		1.98	↗	
89		Before the confluence with Abukuma River		12	67	36	11	2,150	137		2.03	↘	
90	Abukuma River	Taisho Bridge	Date City	33	96	65	26	14,200	566		3.07	↘	
91	Hirose River	Tatenokoshi Bridge	Kawamata Town	48	90	73	48	1,030	241		0.90	↘	
92		Jzogawara Bridge	Date City	40	66	52	17	2,300	296		1.38	↘	
93	Oguni River	Before the confluence with Hirose River		71	493	173	71	9,200	1,198		1.44	↘	
94	Hirose River	Before the confluence with Abukuma River	48	165	94	35	20,000	631		3.62	↘		
95	Kurokawa River	Tochigisakai	Shirakawa City	21	37	29	21	522	88		0.94	—	
96	Kujigawa River	Matsuoka Bridge	Tanagura Town	0	12	5.8	0	150	19		1.34	—	
97		Takachihara Bridge	Yamatsuri Town	0	14	5.8	0	63	11		1.11	—	
Total number of samples		2,466		0	822	87	0	30,000	339				
Number of detections		2,417		*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic, calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)									
				A	B	C	D	E					

iii. Aizu

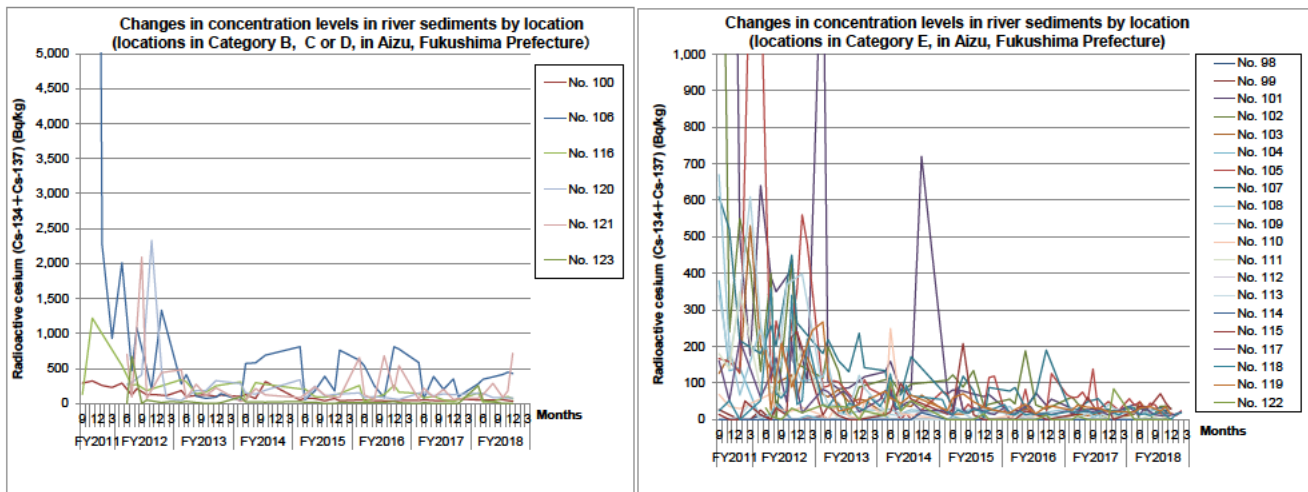
In Aizu, Fukushima Prefecture, surveys were conducted 36 to 69 times from September 2011 to February 2019 for river sediment samples collected at 26 locations.

Regarding the concentration levels of detected values, one location was categorized as Category B, one location was categorized as Category C, four locations as Category D, and 20 locations as Category E (see Table 4.1.2-12 and Table 4.1.2-13).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 70% (17 locations), while decreasing at eight locations and fluctuations at one location.

Table 4.1.2-12 Categorization of detected values at respective locations
(Aizu, Fukushima Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	1	No.106
C	Upper 10th to 25th percentile	1	No.121
D	Upper 25th to 50th percentile	4	No.100, No.116, No.120, No.123
E	Lower than upper 25th to 50th percentile (lower 50%)	20	No.98, No.99, No.101, No.102, No.103, No.104, No.105, No.107, No.108, No.109, No.110, No.111, No.112, No.113, No.114, No.115, No.117, No.118, No.119, No.122



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-12 Changes in concentration levels over the years at respective locations
(Aizu, Fukushima Prefecture: river sediment)

Table 4.1.2-13 Detection of radioactive cesium at respective locations
(Aizu, Fukushima Prefecture: river sediment)

No.	Location			FY2018			FY2011 - 2018			Changes	Coefficient of variation	Trends (*3)
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
98	Agano River	Tajima Bridge	Minamiaizu Town	0	0	0	0	50	1.5		5.22	—
99		Okawa Bridge	Aizuwakamatsu City	0	0	0	0	27	1.8		3.38	—
100	Yukawa River	Takimi Bridge		31	53	46	31	320	104		0.80	↘
101		Shinyukawa Bridge		23	41	31	20	8,700	413		3.28	↘
102		Before the confluence with Agano River		0	37	23	0	2,300	166		2.20	↘
103	Miyakawa River	Saikuna Bridge	Aizubange Town	0	49	19	0	530	62		1.42	—
104	Agano River	Miyako Bridge	Aizubange Town	0	0	0	0	380	18		3.62	—
105	Nippashi River	Minami-ohashi Bridge	Kitakata City	11	57	32	0	1,300	128		1.79	↘
106	Kyu-yukawa River	Awanomiya Bridge	Yugawa Village	279	445	381	40	25,000	1,363		3.04	↘
107	Kyu-miyakawa River	Josuke Bridge	Aizubange Town	13	31	23	0	610	131		1.04	↘
108	Tatsuki River	Ohashi	Kitakata City	16	29	24	0	670	68		1.67	—
109		Shimokawara Bridge		11	20	15	0	730	88		1.81	—
110	Nigori River	Nigorigawa Bridge		0	0	0	0	249	19		2.20	—
111		Yamazaki Bridge		0	13	3.8	0	350	38		2.17	—
112	Inagawa River	Aoyagi Bridge	Minamiaizu Town	0	0	0	0	10	0.2		6.56	—
113		Kurosawa Bridge	Tadami Town	0	0	0	0	44	1.4		5.19	—
114	Tadami River	Nishitani Bridge	Kaneyama Town	0	0	0	0	19	0.5		6.40	—
115		Fuji Bridge	Aizubange Town	23	71	40	0	241	36		1.60	—
116	Agano River	Shingo Dam	Kitakata City	17	150	72	17	1,220	192		1.06	↘
117	Sukawa River	Sukawano	Inawashiro Town	11	36	20	11	218	46		0.98	—
118	Nagase River	Kogane Bridge		0	36	18	0	360	45		1.40	—
119	Takahashi River	Shinbashi Bridge		15	36	27	15	267	61		1.05	—
120	Koguro River	Umeno Bridge		75	144	101	42	2,330	224		1.68	↘
121	Hishinuma River	Sekido District		76	715	244	28	2,090	270		1.34	↗
122	Funatsu River	Funatsu Bridge		Koriyama City	0	0	0	0	104	15		1.60
123	Haragawa River	Estuary, front	Aizuwakamatsu City	0	254	53	0	670	37		3.03	—
Total number of samples		1,145		0	715	44	0	25,000	135			
Number of detections		802		*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
				A	B	C	D	E				

iv) Ibaraki Prefecture

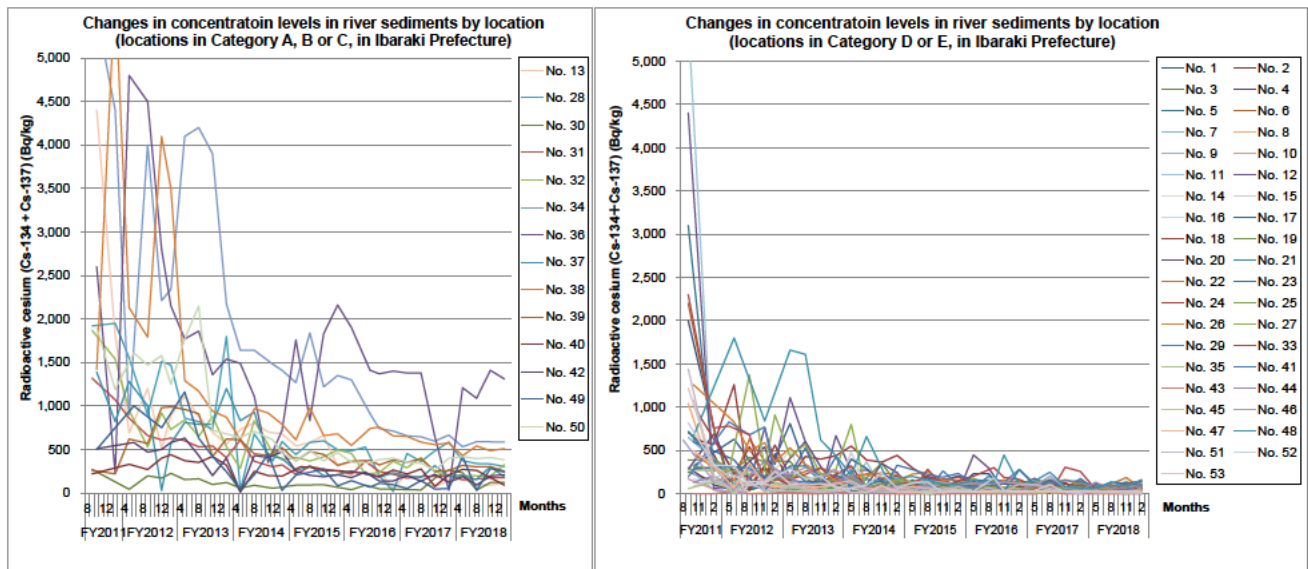
In Ibaraki Prefecture, surveys were conducted 27 to 33 times from August 2011 to February 2019 for river sediment samples collected at 53 locations (this analysis excludes the survey results from 40 locations where the survey was conducted only in 2011).

Regarding the concentration levels of detected values, one location was categorized as Category A, three locations as Category B, 10 locations as Category C, 22 locations as Category D, and 17 locations as Category E (see Table 4.1.2-14 and Table 4.1.2-15).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 20% (12 locations), while decreasing at 40 locations and fluctuations at one location.

Table 4.1.2-14 Categorization of detected values at respective locations
(Ibaraki Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	1	No.36
B	Upper 5th to 10th percentile	3	No.34, No.38, No.50
C	Upper 10th to 25th percentile	10	No.13, No.28, No.30, No.31, No.32, No.37, No.39, No.40, No.42, No.49
D	Upper 25th to 50th percentile	22	No.1, No.2, No.4, No.6, No.7, No.17, No.18, No.19, No.20, No.21, No.22, No.23, No.24, No.25, No.26, No.27, No.29, No.33, No.41, No.44, No.48, No.52
E	Lower than upper 25th to 50th percentile (lower 50%)	17	No.3, No.5, No.8, No.9, No.10, No.11, No.12, No.14, No.15, No.16, No.35, No.43, No.45, No.46, No.47, No.51, No.53



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-13 Changes in concentration levels over the years at respective locations
(Ibaraki Prefecture: river sediment)

Table 4.1.2-15 Detection of radioactive cesium at respective locations
(Ibaraki Prefecture: river sediment)

No.	Water area	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
			Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Taga River System	Salone River	Yamagoya Bridge	Kitaibaraki City	31	108	66	23	2,000	170		2.18		
2		Murayama Bridge	34		77	56	32	710	155		1.06			
3		Hanazono River	Kurabeishi		18	40	28	18	250	57		0.83		
4		Isonare Bridge	46		52	50	12	300	63		0.86			
5		Okita River	Sakae Bridge		Takahagi C ty	0	27	18	0	3,100	144		3.90	
6		Sakai Bridge	Kitaibaraki City		32	81	53	24	2,200	168		2.42		
7		Hananuki River	Shinhananuki Bridge		Takahagi C ty	22	76	50	18	650	120		1.04	
8	Kujigawa River System	Yamagata	Hitachiomiya City	11	17	14	0	1,040	65		2.89			
9		Sakaki Bridge	Hitachi City / Tokai Village	14	39	25	0	290	47		1.30			
10	Nakagawa River System	Noguchi	Hitachiomiya City / Shirosato Town	0	17	4.3	0	169	24		1.77			
11		Nakagawa River	Shimokuni	Mito City	21	76	36	12	6,500	274		3.61		
12		Katsuta Bridge	Mito City / Hitachinaka City	0	100	37	0	4,400	335		2.31			
13	Nakagawa River System	Nakamaru River	Yanagisawa Bridge	Hitachinaka City	89	158	117	53	4,400	661		1.23		
14		Hinumama River	Nagaoka Bridge	Ibaraki Town	31	42	37	20	510	118		1.08		
15	Hinumama River	Takahashi	0		18	11	0	480	44		2.29			
16	Kansei River	Kansei Bridge	13		54	33	13	167	63		0.72			
17	Hinuma River	Daiya River	Oya Bridge	Hokota City	78	99	84	48	810	191		0.94		
18		Hinuma River	Hinuma Bridge	Mito City / Oarai Town	29	86	55	29	1,260	282		0.93		
19	Kaiura River Area	Hokota River	Asahi Bridge	Hokota City	58	110	82	58	420	183		0.65		
20		Tomoe River	Shintomoegawa Bridge		34	57	43	34	660	182		1.01		
21		Taiyo River	Tazuka Bridge		58	97	76	37	720	150		0.90		
22		Takeda River	Uchijuku-ohashi Bridge	Namegata City	55	185	106	55	630	188		0.88		
23		Yamada River	Noroshi Bridge		24	57	45	24	600	139		0.87		
24		Kurakawa River	Kurakawa Bridge		51	100	65	48	1,020	160		1.13		
25		Gantsu River	JA Yokohashi Bridge		67	160	92	53	320	130		0.56		
26	Nagare River	Suhoi Bridge	Kashima City	39	100	81	39	1,280	263		1.00			
27	Kasumigaura River Area	Sonobe River	Sonobeshin Bridge	Omitama City	48	143	78	11	1,370	246		1.25		
28		Sanno River	Tokoro Bridge		304	370	337	17	1,950	725		0.75		
29		Koise River	Heiwa Bridge	Ishioka City	86	132	107	27	830	195		1.06		
30		Kajinashi River	Kamishuku Bridge	Namegata City	33	232	126	33	270	113		0.63		
31		Hshiki River	Hshiki Bridge	Kasumigaura City	152	175	166	152	1,320	411		0.70		
32		Ichinose River	Kawanaka Bridge		194	326	228	194	1,870	547		0.72		
33		Sakai River	Batai Bridge / National Route 354		31	142	86	0	2,300	275		1.57		
34		Shinkawa River	Shinten Bridge	Tsuchiura City	531	589	573	531	5,500	1,803		0.78		
35		Tonogawa River System	Sakura River	Eiri Bridge	Tsuchiura City / Tsukuba City	0	32	14	0	270	62		0.97	
36			Bizen River	Bizengawa Bridge	Tsuchiura City	1,089	1,410	1,256	31	4,800	1,613		0.64	
37	Hanamura River		Shinwa Bridge	153		305	212	29	1,390	494		0.78		
38	Seimei River		Katsuhashi Bridge	Ami Town	428	540	491	428	5,800	1,209		1.00		
39	Onogawa River		Okuhara-ohashi Bridge	Ryugasaki City / Ushiku City	250	317	292	220	990	468		0.48		
40	Shintone River		Shintone Bridge	Inashiki City	89	272	199	11	440	254		0.38		
41	Hitachigawa River Area		Yorokoshi River	Hirinouchi Bridge	Itako C ty	55	134	102	22	530	184		0.67	
42		Maekawa River	Ayame Bridge	91		209	171	16	630	294		0.58		
43	Krugawa River Area	Krugawa River	Kawashima Bridge	Ch kusei City	0	0	0	0	32	4.5		1.94		
44		Tagawa River	Takishita Bridge	Moriya City	57	130	86	11	380	101		0.82		
45		Tagawa River	Tagawa Bridge	Ch kusei City	0	12	8.3	0	1,080	69		2.85		
46	Kokai River	Kuroko Bridge	Toride City	15	51	29	13	620	147		0.82			
47		Fumimaki Bridge		27	33	31	26	500	88		1.23			
48	Kokigawa River Area	Yatagawa River	Maryama Bridge	Tsukuba City	62	160	110	61	1,800	415		1.22		
49		Nshiyata River	Sakaimatsu Bridge		32	419	243	30	1,160	293		1.01		
50		Inari River	Oguki Bridge		382	417	400	264	2,150	762		0.73		
51	Tonogawa River Area	Kurihashi Bridge	Koga City	0	41	20	0	1,440	95		2.58			
52		Tonogawa River	Fukawa	Tone Town	15	110	44	14	820	130		1.25		
53		Sawara	Inashiki City	18	30	23	11	1,220	111		1.94			
Total number of samples		1,574				0	1,410	128	0	5,800	293			
Number of detections		1,515										: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg		
<p>*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0. Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)</p>														
		A		B		C		D		E				

v) Tochigi Prefecture

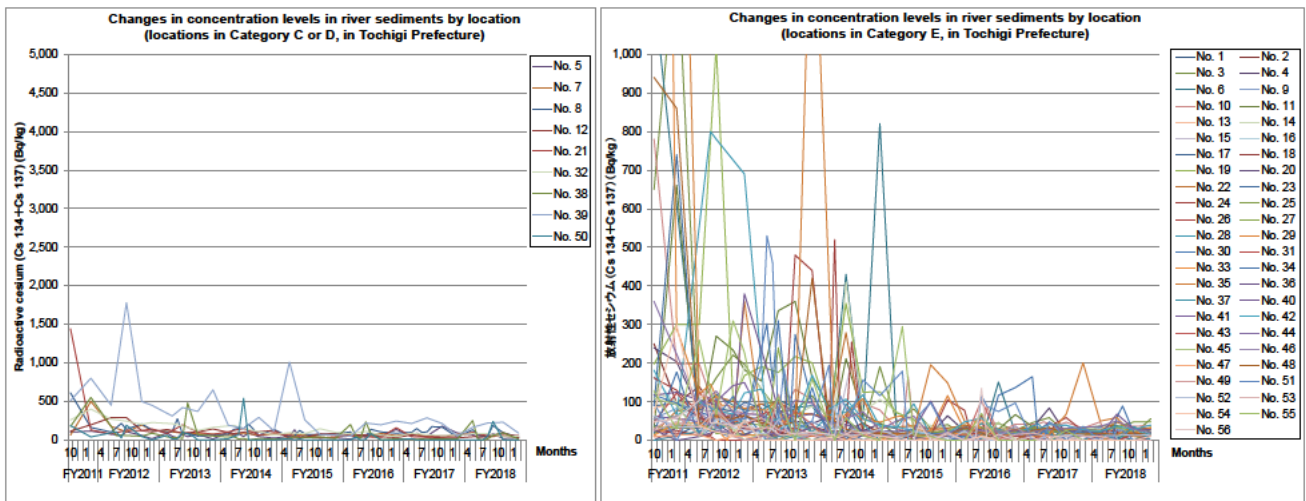
In Tochigi Prefecture, surveys were conducted 27 to 51 times from October 2011 to February 2019 at 56 locations (rivers) in public water areas (this analysis excludes the survey results from 49 locations where the survey was conducted only in 2011).

Regarding the concentration levels of detected values, one location was categorized as Category C, eight locations were categorized as Category D and 47 locations were categorized as Category E (see Table 4.1.2-16 and Table 4.1.2-17).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 80% (45 locations), while decreasing at all 11 remaining locations.

Table 4.1.2-16 Categorization of detected values at respective locations
(Tochigi Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	1	No.39
D	Upper 25th to 50th percentile	8	No.5, No.7, No.8, No.12, No.21, No.32, No.38, No.50
E	Lower than upper 25th to 50th percentile (lower 50%)	47	No.1, No.2, No.3, No.4, No.6, No.9, No.10, No.11, No.13, No.14, No.15, No.16, No.17, No.18, No.19, No.20, No.22, No.23, No.24, No.25, No.26, No.27, No.28, No.29, No.30, No.31, No.33, No.34, No.35, No.36, No.37, No.40, No.41, No.42, No.43, No.44, No.45, No.46, No.47, No.48, No.49, No.51, No.52, No.53, No.54, No.55, No.56



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-14 Changes in concentration levels over the years at respective locations
(Tochigi Prefecture: river sediment)

Table 4.1.2-17 Detection of radioactive cesium at respective locations
(Tochigi Prefecture: river sediment)

No.	Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Nakagawa River System	Nakagawa River	Kuyobashishita	11	21	15	0	96	23		1.12	—		
2			Komei Bridge	Nasushiobara City	14	26	20	11	250	44		1.10	—	
3		Takaomata River	Takaomata Bridge	Nasu Town	17	56	37	12	1,290	131		1.90	↗	
4		Yukawa River	Yukawa Bridge	Nasu Town	13	36	21	13	240	54		0.98	—	
5		Nakagawa River	Kamikuroiso	Nasushiobara City / Nasunouchi Town	19	80	47	11	178	63		0.55	—	
6		Yosasa River	Yosasa Bridge	Nasu Town	0	36	17	0	1,160	142		1.88	↗	
7		Kurokawa River	Shinden Bridge	Nasu Town	35	93	55	30	500	91		0.94	—	
8		Yosasa River	Kawada Bridge	Nasu Town	39	187	90	21	610	120		0.75	↗	
9		Nakagawa River	Kurobane	Nasu Town	15	33	23	15	102	33		0.56	—	
10		Matsuba River	Tr butary	Otawara City	18	48	34	18	780	80		1.42	—	
11		Sabigawa River	Udagawa Bridge	Otawara City	10	34	21	10	660	108		1.34	↗	
12		Momura River	Momuranaka Bridge	Otawara City	27	94	51	21	290	83		0.73	—	
13		Hokigawa River	Hokigawa River	Yunohara	0	12	5.5	0	100	30		1.09	—	
14				Sek ba Bridge	Nasushiobara City	13	50	29	13	410	71		1.07	—
15				Imai Bridge	Otawara City	0	0	0	0	204	33		1.25	—
16				Hokigawa Bridge	Otawara City	0	31	7.6	0	165	24		1.19	—
17		Nakagawa River	Shinnaka Bridge	Nakagawa Town	0	16	8.4	0	107	20		1.07	—	
18		Mumogawa River	Kosei Bridge	Nakagawa Town	0	16	7.4	0	43	13		0.78	—	
19		Arakawa River	Saikachi Bridge	Shiyoa Town	23	34	29	14	1,020	135		1.44	↗	
20		Arakawa River	Renjo Bridge	Sakura City	0	15	3.8	0	63	13		1.21	—	
21		Uchikawa River	Tanaka Bridge	Ya ta City	53	97	66	26	1,440	127		1.98	↗	
22		Uchikawa River	Asahi Bridge	Sakura City	26	47	34	18	279	57		0.88	—	
23		Arakawa River	Mukada Bridge	Nasu Karasuyama C ty	0	17	9.4	0	740	40		2.61	—	
24		Egawa River	Tr butary	Nasu Karasuyama C ty	13	37	20	0	520	67		1.69	—	
25	Kinugawa River System	Kinugawa River	Kawaji Da ichi Power Station, front	23	48	39	0	75	29		0.59	—		
26			Yunishi River	Maesawa Bridge	Nikko C ty	0	0	0	0	25	5.4		1.43	—
27			Ojika River	Tr butary	Nikko C ty	0	12	5.8	0	240	19		2.33	—
28			Kinugawa River	Kosagoe	Nikko C ty	10	35	17	10	800	113		2.00	↗
29			Itana River	Tr butary	Nikko C ty	13	33	20	12	4,900	154		4.51	↗
30			Yukawa River	Tr butary	Nikko C ty	0	0	0	0	137	22		1.88	—
31			Daiya River	Shinkyō Bridge	Nikko C ty	0	15	6.3	0	123	24		1.10	—
32			Shidobuchi River	Sujichigai Bridge	Nikko C ty	43	83	64	43	400	135		0.63	↗
33			Daiya River	Kaishin Bridge (Hargai)	Nikko C ty	0	17	2.4	0	69	12		1.28	—
34			Kinugawa River	Sanuki	Shiyoa Town	0	89	31	0	470	58		1.57	—
35			Nishi-Kinugawa River	Nishi-Kinugawa Bridge	Utsunomiya City	10	59	34	0	2,290	239		2.27	↗
36			Kinugawa River	Kinugawabashi Bridge (Hoshakui Temple)	Utsunomiya City	0	12	3.0	0	31	6.0		1.60	—
37			Kinugawa River	Daidotsumi Bridge	Mooka City	0	36	15	0	95	16		1.31	—
38			Egawa River	Tr butary	Shimotsuke City	0	251	63	0	550	71		1.55	—
39			Alakori River	Nikko City Ha I, front	Nikko C ty	89	230	176	49	1,780	353		0.99	↗
40			Alakori River	Kwadajima	Nikko C ty	13	68	35	13	380	64		1.13	—
41			Tagawa River	Ozobashi Bridge	Utsunomiya City	0	16	3.7	0	150	24		1.47	—
42			Kanagawa River	Tsukushi Bridge	Utsunomiya City	25	40	33	14	182	59		0.75	—
43			Tagawa River	Meiji Bridge	Kaminokawa Town	0	0	0	0	122	21		1.62	—
44			Tagawa River	Yanabashi Bridge	Oyama City	22	51	34	12	360	65		1.09	—
45	Omori River Area	Omori River	Kajima Bridge	0	0	0	0	109	13		2.08	—		
46			Onari Bridge	Mibu Town	0	0	0	0	75	10		1.95	—	
47			Oashi River	Akaishi Bridge	Kanuma City	0	0	0	0	53	4.7		2.26	—
48			Koyabu River	Koyabu Bridge	Kanuma City	13	20	17	0	940	99		2.32	—
49			Tamotsu Bridge	Tochigi City	0	0	0	0	119	11		2.55	—	
50			Otome-onashi Bridge	Oyama City	0	240	42	0	540	42		2.12	—	
51			Uzuma River	Uzuma Bridge	Tochigi City	0	28	7.7	0	530	78		1.34	—
52	Watarase River Area	Watarase River	Watarasegawa River Intake weir at Sorf Power Station	0	15	11	0	90	20		0.92	—		
53			Hajika Bridge	Ash kaga City	0	11	2.8	0	80	17		1.17	—	
54			Nakabashi Bridge	Ash kaga City	0	11	2.8	0	300	18		3.19	—	
55			Watarase-onashi Bridge	Tatebayashi City	0	11	5.3	0	310	61		1.56	—	
56			Shinkai Bridge	Tochigi City	0	13	3.7	0	164	24		1.44	—	
Total number of samples		2,047				0	251	24	0	4,900	61			
Number of detections		1,624												
<p>*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic, calculated by assuming ND 0. Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (i)</p>														
<p>↗ : Increasing ↘ : Decreasing ~~~ : Fluctuations — : Unchanged — : ≤ 100 Bq/kg</p>														
<p>A B C D E</p>														

vi) Gunma Prefecture

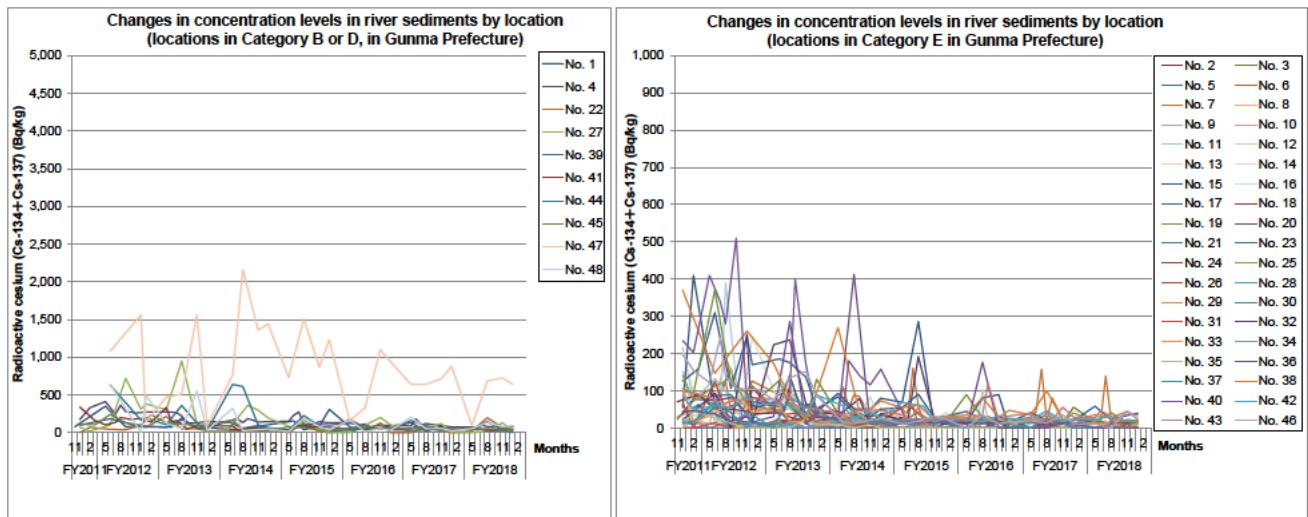
In Gunma Prefecture, surveys were conducted 16 to 51 times from November 2011 to January 2019 at 48 locations (rivers) in public water areas (this analysis excludes the survey results from eight locations where the survey was conducted only in 2011).

Regarding the concentration levels of detected values, one location was categorized as Category B, nine locations as Category D, and 38 locations as Category E (see Table 4.1.2-18 and Table 4.1.2-19).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 90% (43 locations), while decreasing at four locations and fluctuations at one location.

Table 4.1.2-18 Categorization of detected values at respective locations
(Gunma Prefecture: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	1	No.47
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	9	No.1, No.4, No.22, No.27, No.39, No.41, No.44, No.45, No.48
E	Lower than upper 25th to 50th percentile (lower 50%)	38	No.2, No.3, No.5, No.6, No.7, No.8, No.9, No.10, No.11, No.12, No.13, No.14, No.15, No.16, No.17, No.18, No.19, No.20, No.21, No.23, No.24, No.25, No.26, No.28, No.29, No.30, No.31, No.32, No.33, No.34, No.35, No.36, No.37, No.38, No.40, No.42, No.43, No.46



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-15 Changes in concentration levels over the years at respective locations
(Gunma Prefecture: river sediment)

Table 4.1.2-19 Detection of radioactive cesium at respective locations
(Gunma Prefecture: river sediment)

No.	Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)	
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average				
1	Tonegawa River Area	Tonegawa River	Hirose Bridge	32	80	51	18	350	90		0.80	—	
2		Tsukiyono Bridge	Minakami Town	11	17	15	11	115	35		0.71	—	
3		Akaya River	Kosode Bridge	10	16	14	10	113	33		0.83	—	
4		Sakura River	In Ooaza Yachi	Kawaba Village	65	96	77	65	500	165		0.57	↘
5		Kirinoki Bridge	Katashina Village	0	14	7.0	0	159	23		1.34	—	
6		Katashina River	Tonemachitakatoya	Numata City	0	23	5.9	0	58	6.9		1.80	—
7		Futae Bridge	0	140	34	0	161	54		0.77	—		
8		Agatsuma River	Shinto Bridge	Naganohara Town	0	0	0	0	187	14		2.69	—
9		Shirasuna River	Shuttatsu Bridge	Nakanojo Town	0	0	0	0	19	3.4		1.74	—
10		Agatsuma River	Downstream of Azuma Bridge	Hgashi-Agatsuma Town	0	0	0	0	22	1.8		2.65	—
11		Nakuta River	Tonoda Bridge	Takayama Village	0	16	7.8	0	215	43		1.06	—
12		Agatsuma River	Agatsuma Bridge	0	15	2.1	0	610	32		2.80	—	
13		Tonegawa River	Taisho Bridge	Shibukawa City	0	20	7.0	0	147	24		1.05	—
14	Takizawa River	Shintakizawa Bridge	Shibukawa City / Yoshioka Town	0	15	9.5	0	245	41		1.36	—	
15	Tonegawa River	Gunma-ohashi Bridge	Maebashi City	0	16	4.0	0	410	60		1.46	—	
16	Fukushima Bridge	Tamamura Town	0	0	0	0	112	25		1.19	—		
17	Nagai River	Kamigonda Bridge	Takasaki City	22	59	39	15	310	81		0.93	—	
18	Karasu River	Karasugawa Bridge		0	16	11	0	88	24		0.89	—	
19	Usui River	Nakase Bridge	Annaka City	16	41	23	0	370	56		1.28	—	
20		Hanataka Bridge	Takasaki City	12	19	15	0	82	23		1.10	—	
21	Kabura River	Tadakawa Bridge	Shimonita Town	0	0	0	0	56	6.2		1.96	—	
22		Kaburagawa Bridge	Takasaki City / Fujioka City	21	196	89	0	214	56		1.07	—	
23	Ogawa River	Kinzan Bridge	Kanra Town	0	17	4.3	0	90	21		1.11	—	
24	Nanmoku River	Ozawa Bridge	Nanmoku Village	0	13	6.0	0	68	7.1		1.92	—	
25	Someya River	Yakushi Bridge	Shinto Village	10	17	13	10	142	38		0.94	—	
26	Inogawa River	Kamakura Bridge	Takasaki City	0	10	2.5	0	125	17		1.55	—	
27	Karasu River	Iwakura Bridge	Takasaki City / Tamamura Town	0	130	41	0	950	163		1.33	↘	
28	Kanna River	Shinkaname Bridge	Ueno Village	0	0	0	0	37	5.4		1.99	—	
29	Kanna River	Morito Bridge	Kanna Town	0	0	0	0	13	0.7		4.24	—	
30	Kanna River	Tobukyo Bridge	Fujioka City / Kamikawa Town	0	0	0	0	43	3.2		3.31	—	
31	Kanna River	Kannagawa Bridge	Kamisato Town	0	0	0	0	107	18		1.61	—	
32	Tonegawa River	Bando-ohashi Bridge	Honjo City	0	0	0	0	252	49		1.53	—	
33	Tonegawa River Area	Akagishirakawa River	In Shimohosoi Town	0	13	8.8	0	108	26		0.96	—	
34		Momonoki River	Utsuboi Bridge	Maebashi City	0	0	0	0	75	10		1.56	—
35		Arato River	Okuhara Bridge	0	0	0	0	48	4.0		2.56	—	
36		Kasukawa River	Hozumi Bridge	0	0	0	0	413	43		2.13	—	
37		Hirose River	Nakajima Bridge	Isesaki City	0	0	0	0	83	21		1.03	—
38		Hayakawa River	Hayakawa Bridge	24	45	33	21	370	84		1.05	—	
39		Maejima Bridge	Ota City	22	70	43	22	183	75		0.58	—	
40		Tonegawa River	Tone-ozeki Weir	Chiyoda Town / Gyoda City	0	12	1.7	0	640	91		1.50	—
41		Koguro River	Kayano Bridge	Kiryu City	30	51	41	26	340	89		0.77	—
42		Watarase River	Takatsudo	Midori City	18	30	24	16	89	43		0.53	—
43	Intake for Akaiwayosui water channel		Kiryu City	22	47	34	15	121	49		0.50	—	
44	Tatara River	Ejiri Bridge	Oura Town	0	145	55	0	640	152		1.24	↘	
45	Kiryu River	Kannon Bridge	Kiryu City	36	46	42	25	240	83		0.67	—	
46		Sakai Bridge	Kiryu City / Ashikaga City	0	47	21	0	243	64		0.99	—	
47	Tsuruuda River	Lake Jonuma	Tatebayashi City	91	725	535	91	2,160	852		0.61	↗	
48	Yatagawa River	Togoda Bridge	Meiwa Town / Itakura Town	55	130	89	0	640	133		1.29	↘	
Total number of samples		1,570				0	725	29	0	2,160	62		
Number of detections		1,171											

*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry).
 *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i)
 *3 Results of the analysis of trends at respective locations using the method explained in 1) (i)

↗ : Increasing
 ↘ : Decreasing
 ~ : Fluctuations
 — : Unchanged
 ≤ : ≤ 100 Bq/kg

vii) Chiba and Saitama Prefectures and Tokyo Metropolis

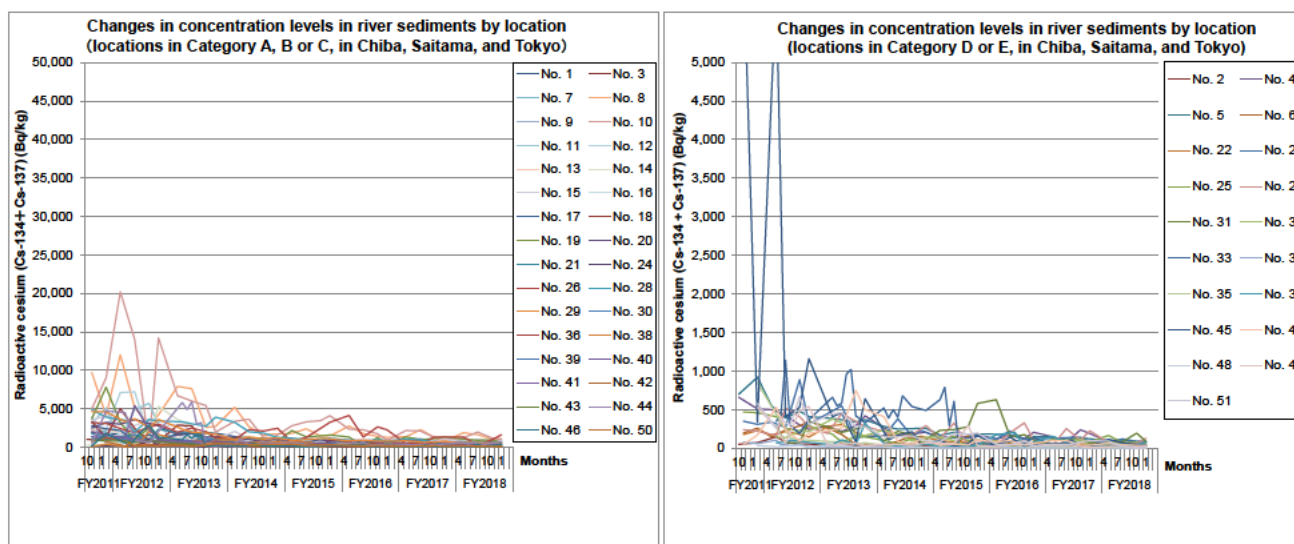
In Chiba and Saitama Prefectures and Tokyo Metropolis, surveys were conducted 28 to 50 times from October 2011 to January 2019 at 51 locations (rivers) in public water areas (47 locations in Chiba Prefecture, two locations in Saitama Prefecture, and two locations in Tokyo Metropolis).

Regarding the concentration levels of detected values, seven locations were categorized as Category A, nine locations as Category B, 16 locations as Category C, 11 locations as Category D, and eight locations as Category E (see Table 4.1.2-20 and Table 4.1.2-21).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 10% (five locations), while decreasing at 43 locations and fluctuations at three locations.

Table 4.1.2-20 Categorization of detected values at respective locations
(Chiba and Saitama Prefectures and Tokyo Metropolis: river sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	7	No.1, No.8, No.10, No.15, No.19, No.26, No.28
B	Upper 5th to 10th percentile	9	No.7, No.11, No.12, No.14, No.17, No.18, No.20, No.29, No.44
C	Upper 10th to 25th percentile	16	No.3, No.9, No.13, No.16, No.21, No.24, No.30, No.36, No.38, No.39, No.40, No.41, No.42, No.43, No.46, No.50
D	Upper 25th to 50th percentile	11	No.4, No.5, No.22, No.23, No.25, No.27, No.31, No.32, No.37, No.45, No.47
E	Lower than upper 25th to 50th percentile (lower 50%)	8	No.2, No.6, No.33, No.34, No.35, No.48, No.49, No.51



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-16 Changes in concentration levels over the years at respective locations
(Chiba and Saitama Prefectures and Tokyo Metropolis: river sediment)

Table 4.1.2-21 Detection of radioactive cesium at respective locations
(Chiba and Saitama Prefectures and Tokyo Metropolis: river sediment)

No.	Location				FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
	Prefecture	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Chiba Prefecture	Tonegawa River System	Shogen River	Fukama-ohashi Bridge	Inzai City / Sakae Town	740	797	766	590	1,910	1,136		0.36		
2			Shinbei Bridge			21	24	23	0	149	38		0.76		
3			Nagato River	Intake at Maeshinden Water Purification Plant			261	307	283	171	1,230	437		0.57	
4				Nagato Bridge	Sakae Town		62	90	79	62	660	229		0.63	
5				Fujimi Bridge			85	105	93	85	920	273		0.71	
6			Ryudai River	Ryumatsuno Bridge			31	46	40	25	350	107		0.86	
7			Nekona River	Shinkawa Floodgate			280	466	377	69	2,300	782		0.65	
8		Feeder rivers of Lake Teganuma	Ohori River	Kitakashiwa Bridge	Kashiwa City	1,067	1,870	1,413	747	12,000	3,184		0.87		
9				Sanno Bridge, under	Kamagaya City	185	357	267	185	3,900	720		1.03		
10			Otsu River	Kaminuma Bridge			997	1,960	1,343	380	20,200	4,171		1.10	
11				Someiotoshi	Someishinbashi Bridge	Kashiwa City	270	544	419	24	5,700	1,230		1.24	
12			Kanayamaotoshi	Downstream of Karuzawasakai Bridge	Kamagaya City / Shiroy City	328	616	472	305	7,200	1,159		1.47		
13			Nauchi Bridge	Shiroy City			238	355	307	129	2,400	737		0.79	
14			Kamenari River	Kamenari Bridge			58	787	422	58	5,300	775		1.47	
15		Feeder rivers of Lake Inbanuma	Igasuuro Channel	Downstream of Igasuuro Channel	Kamagaya City	671	1,041	843	671	4,100	1,541		0.87		
16				Futae River	Tomigaya Bridge	Funabashi City / Shiroy City	245	340	297	245	3,300	819		0.90	
17			Kanzaki River	Kanzaki Bridge	Yachiyo City / Inzai City	316	560	425	97	2,800	806		0.87		
18			Kanno River	Kanno Bridge			411	553	504	58	5,000	975		1.17	
19			Inba Discharge Channel (upperreaches)	Yachiyo Bridge	Yachiyo City	617	1,046	880	106	7,800	1,489		0.97		
20			Teguri River	Mumei Bridge	Sakura City	419	594	523	419	3,600	1,324		0.71		
21			Moroto River	Moroto Bridge	Inzai City	71	240	168	71	2,330	671		1.00		
22			Kashima River	Iwatomi Bridge			43	58	50	43	307	124		0.61	
23			Takasaki River	Ryuto Bridge	Sakura City	81	121	94	81	890	223		0.77		
24			Kashima River	Kashima Bridge			12	269	162	0	1,080	197		1.02	
25			Inbasuuro Channel	Tsurumaki Bridge	Inzai City	66	165	95	20	470	149		0.79		
26			Edogawa River System	Toneunga Canal	Unga Bridge	Nagareyama City / Noda City	281	1,610	1,046	281	4,130	1,904		0.50	
27		Edogawa River			Nagareyama Bridge	Nagareyama City / Misato City	24	130	72	24	520	204		0.63	
28		Sakagawa River		Benten Bridge			524	655	599	524	4,900	1,870		0.70	
29		Shinsaka River		Sakane Bridge	Matsudo City	515	627	582	515	4,800	1,578		0.77		
30		Edogawa River		Shinkatsushika Bridge		Matsudo City / Katsushika City	94	170	142	94	1,360	543		0.88	
31					Ichikawa Bridge	Ichikawa City / Edogawa City	81	196	111	33	629	196		0.73	
32				Vicinity of Keiyo Road			17	62	42	17	380	122		0.75	
33				Gyotokukadozeki Weir (upperreaches)			21	28	24	21	1,140	300		1.00	
34		Shingyotokubashi Bridge				0	15	7	0	104	24		0.94		
35		Edogawa Floodgate, down				17	21	19	15	850	73		2.12		
36		Kyu-Edogawa River		8 km Point to the estuary		Ichikawa City / Edogawa City	45	217	145	30	368	148		0.68	
37					Imai Bridge			18	81	52	18	323	76		0.86
38		Urayasu Bridge		Urayasu City / Edogawa City	160	276	211	29	2,050	514		0.77			
39		Mamagawa River		Nemoto Floodgate			120	152	136	120	1,100	359		0.80	
40		Kokubu River		Suwada Bridge	Ichikawa City	243	316	273	223	5,400	783		1.31		
41		Haruki River		Before the confluence with Kokubu River			163	215	187	134	1,380	437		0.82	
42		Hasen-okashiwa River		Downstream of Nakazawashinbashi Bridge	Kamagaya City / Ichikawa City	55	201	159	55	1,220	299		0.80		
43		Okashiwa River		Sengen Bridge			109	155	126	109	970	289		0.92	
44		Mamagawa River		Mitomae Bridge	Ichikawa City	395	718	515	34	5,900	1,070		1.45		
45		Ebigawa River		Yachiyo Bridge	Funabashi City	45	116	70	21	6,400	601		2.57		
46	Inba Discharge Channel (lowerreaches)	Shinhanamigawa Bridge	Chiba City	60	385	201	60	2,900	472		1.30				
47	Miyako River	Miyako Bridge			38	63	45	37	750	156		1.12			
48	Saitama Prefecture	Arakawa River System	Arakawa River Middle Reaches	Onari Bridge	Konosu City	0	0	0	0	38	9.2		1.43		
49			Arakawa River Lower Reaches	Sasame Bridge	Toda City	0	26	14	0	540	105		1.49		
50	Tokyo Metropolis	Sumida River	Kasai Bridge	Koto City / Edogawa City	100	146	127	75	700	261		0.53			
51			Ryogoku Bridge	Chuo City	0	91	35	0	670	202		0.88			
Total number of samples		1,602		0		1,980	298	0	20,200	700	: Increasing : Decreasing : Unchanged : ≤ 100 Bq/kg				
Number of detections		1,576										*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)			
												A B C D E			

2)-2 Lakes

i) Miyagi Prefecture

In Miyagi Prefecture, surveys were conducted 15 to 29 times from October 2011 to December 2018 for lake sediment samples collected at 21 locations.

Regarding the concentration levels of detected values, three locations were categorized as Category D and 18 locations were categorized as Category E (see Table 4.1.2-22 and Table 4.1.2-23).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 10% (two locations), while decreasing at 15 locations, unchanged at two locations, and fluctuations at two locations.

Table 4.1.2-22 Categorization of detected values at respective locations
(Miyagi Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	3	No. 9, No. 16, No. 17
E	Upper 50th to 100th percentile(lower 50%)	18	No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, No. 7, No. 8, No. 10, No. 11, No. 12, No. 13, No. 14, No. 15, No. 18, No. 19, No. 20, No. 21

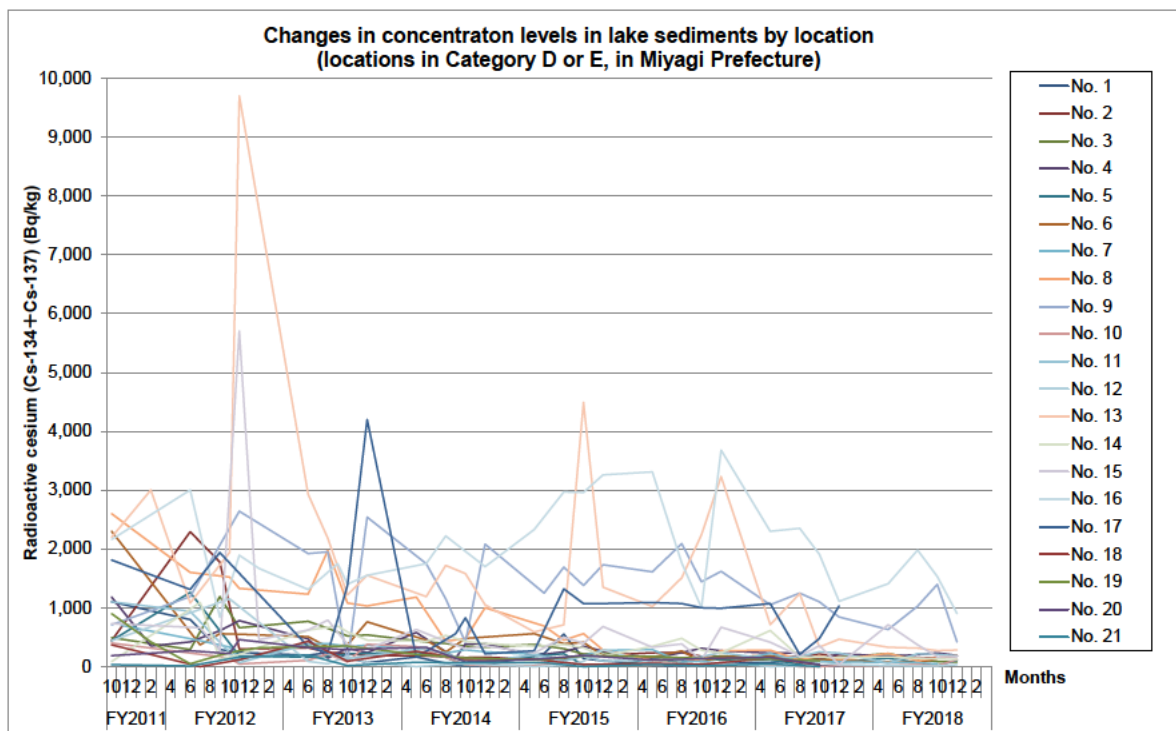


Figure 4.1.2-17 Changes in concentration levels over the years at respective locations
(Miyagi Prefecture: lake sediment)

Table 4.1.2-23 Detection of radioactive cesium at respective locations
(Miyagi Prefecture: lake sediment)

Location				FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
No.	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Kitakami River System	Kurikoma Dam	Dam site	Kurihara City	11	45	25	10	1,100	170		1.49		
2		Hanayama Dam	Dam site		140	180	158	123	2,290	330		1.49		
3		Narugo Dam	Dam site	Osaki City	80	223	127	80	1,190	345		0.74		
4		Lake Naganuma	Dam site		180	235	201	133	1,180	332		0.67		
5		Shukunosawa tameike Pond	Pond exit	Kurihara City	16	142	84	10	1,260	174		1.36		
6	Naruse River System	Futatsuishi Dam	Dam site	Kami Town	69	130	92	69	2,300	393		1.12		
7		Urushizawa Dam	Dam site		46	69	60	46	700	232		0.67		
8		Minamikawa Dam	Dam site	Taiwa Town	100	224	166	100	2,600	692		0.96		
9	Sunaoshi River System	Sonoseki Dam	Dam site	Rifu Town	420	1,397	868	88	2,640	1,369		0.46		
10	Nanakita River System	Nanakita Dam	Dam site	Sendai City	13	120	46	0	400	92		1.25		
11		Marutazawatameike Pond	Pond exit		56	219	167	56	1,100	235		1.02		
12		Natori River System	Okura Dam		Dam site	12	33	18	0	1,150	111		2.09	
13		Lake Amanuma	Lake exit		271	328	299	271	9,700	1,739		1.06		
14	Natori River System	Kamafusa Dam	Dam site	Kawasaki Town	120	165	139	85	1,090	352		0.65		
15	Abukuma River System	Kawarago Dam	Dam site	Shiroishi City	165	709	354	36	5,700	598		1.68		
16		Shichikashuku Dam	Dam site	Shichikashuku Town	904	1,980	1,456	840	3,680	1,999		0.38		
17	Lake Bagyunuma	Lake exit	Shiroishi City	780	1,035	886	160	4,200	1,007		0.79			
18	Abukuma River System	Murata Dam	Dam site	Murata Town	28	41	35	0	430	125		1.03		
19	Kitakami River System	Lake Izunuma	Lake exit	Tome City	140	160	150	48	900	240		0.80		
20	Natori River System	Tarumizu Dam	Dam site	Natori City	103	162	133	34	460	198		0.56		
21	Naruse River System	Miyatoko Dam	Dam site	Taiwa Town	0	13	6.5	0	195	49		1.20		
Total number of samples		532				0	1,980	285	0	9,700	554	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg		
Number of detections		523				*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
					A	B	C	D	E					

ii) Fukushima Prefecture

i. Hamadori

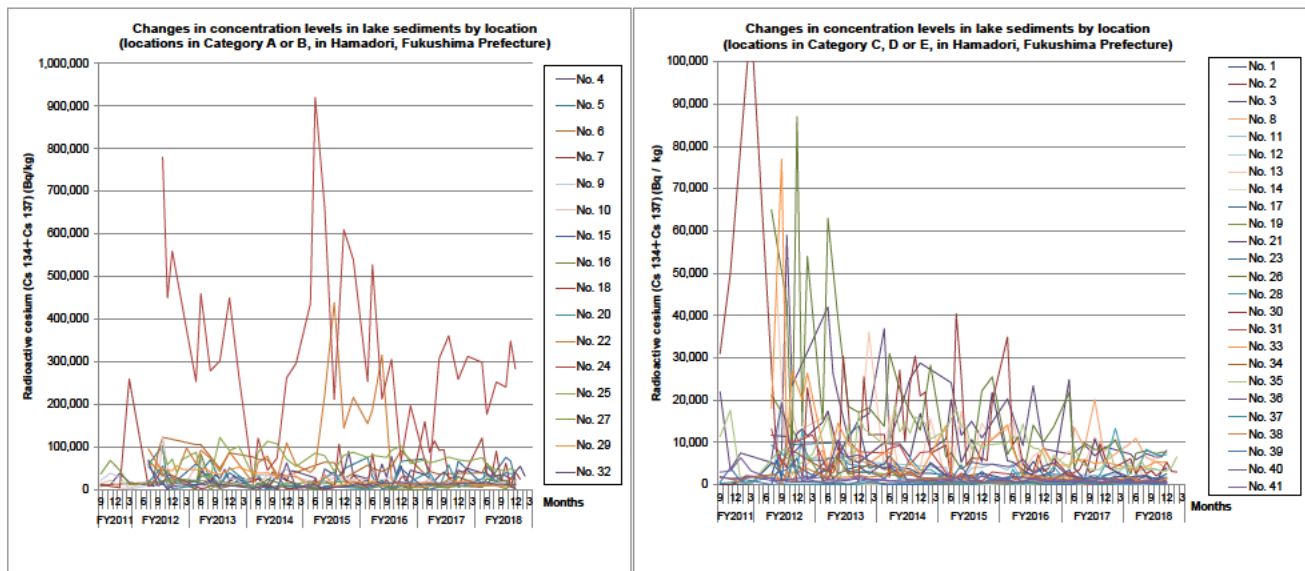
In Hamadori, Fukushima Prefecture, surveys were conducted 31 to 74 times from September 2011 to February 2019 for lake sediment samples collected at 41 locations.

Regarding the concentration levels of detected values, eight locations were categorized as Category A, eight locations as Category B, 11 locations as Category C, 10 locations as Category D, and four locations as Category E (see Table 4.1.2-24 and Table 4.1.2-25).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were not observed, while decreasing at 25 locations, unchanged at two locations, fluctuations at 13 locations, and increasing at one location.

Table 4.1.2-24 Categorization of detected values at respective locations
(Hamadori, Fukushima Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	8	No. 4, No. 5, No. 6, No. 15, No. 18, No. 20, No. 24, No. 25
B	Upper 5th to 10th percentile	8	No. 7, No. 9, No. 10, No. 16, No. 22, No. 27, No. 29, No. 32
C	Upper 10th to 25th percentile	11	No. 1, No. 3, No. 8, No. 11, No. 13, No. 21, No. 26, No. 28, No. 30, No. 33, No. 35
D	Upper 25th to 50th percentile	10	No. 2, No. 17, No. 23, No. 31, No. 34, No. 36, No. 38, No. 39, No. 40, No. 41
E	Upper 50th to 100th percentile (lower 50%)	4	No. 12, No. 14, No. 19, No. 37



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-18 Changes in concentration levels over the years at respective locations
(Hamadori, Fukushima Prefecture: lake sediment)

Table 4.1.2-25 Detection of radioactive cesium at respective locations
(Hamadori, Fukushima Prefecture: lake sediment)

No.	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
	Water area	Location	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Soso (farm pond)	Takei	Shinchi Town	1,530	1,890	1,755	129	6,300	2,452		0.58		
2		Uchizawa	Soma City	393	926	715	45	2,140	580		0.71		
3	Matsugabo Dam (Lake Utagawa)			5,890	8,150	6,958	3,600	59,000	15,994		0.72		
4	Mano Dam			25,100	55,400	36,270	42	90,000	31,073		0.52		
5	Soso (farm pond)	Ainosawa		2,640	55,400	21,347	334	103,000	27,502		0.92		
6	Ganbe Dam Reservoir		Iitate Village	18,500	62,800	33,000	8,200	123,000	56,137		0.53		
7	Soso (farm pond)	Fugane Dam		3,930	14,300	9,460	1,930	41,000	15,066		0.66		
8		Sasatoge		3,180	10,950	6,747	384	20,200	4,205		1.02		
9	Takanokura Dam Reservoir			13,300	24,300	19,233	960	39,000	21,558		0.41		
10	Yokokawa Dam Reservoir			11,970	25,400	19,590	1,240	125,000	24,683		0.83		
11	Soso (farm pond)	Tarayachi	Minamisoma City	3,300	5,400	3,808	420	20,500	3,866		0.93		
12		Takehiyachi		23	58	42	0	1,340	420		0.99		
13		Ryugasaku		1,540	7,500	4,173	900	47,000	9,785		0.96		
14		Uwatahira	Kawamata Town	0	346	195	0	5,100	596		1.83		
15		Koakuto	Namie Town	10,800	76,300	39,533	1,380	76,300	22,629		0.98		
16		Yosouchi	Iitate Village	7,040	26,500	16,577	520	84,000	15,469		1.17		
17		Myobusaku No. 2	Minamisoma City	740	2,600	1,600	294	14,000	3,240		0.90		
18	Ogaki Dam		Namie Town	6,760	121,000	48,562	740	260,000	32,761		1.38		
19	Soso (farm pond)	Uenokawa	Katsurao Village	130	484	275	114	21,200	1,544		2.34		
20		Heigoi	Iitate Village	21,000	40,400	32,950	1,910	58,800	22,953		0.76		
21		Mekurasawa No. 2	Namie Town	209	3,990	2,227	209	24,800	8,267		0.72		
22		Joroku		7,370	13,100	10,727	6,100	439,000	74,007		1.25		
23	Furumichigawa Power Plant Dam		Tamura City	446	1,750	1,182	87	11,000	2,726		1.19		
24	Soso (farm pond)	Sawairi No. 1	Futaba Town	177,000	349,000	267,167	20,500	920,000	321,108		0.63		
25		Suzunai No. 4	Okuma Town	44,900	75,500	53,550	27,700	123,000	72,220		0.32		
26		Nishihaguro	Futaba Town	2,540	8,090	6,807	1,880	87,000	18,952		0.99		
27	Sakashita Dam		Okuma Town	2,070	12,100	9,230	350	69,000	16,013		0.70		
28	Soso (farm pond)	Atamamori 2		217	8,390	5,305	54	13,300	3,938		0.85		
29		Yonomori	Tomiooka Town	8,540	11,890	10,240	8,200	62,000	27,277		0.62		
30	Takikawa Dam		Kawauchi Village	2,080	6,150	3,584	630	110,000	12,752		1.42		
31	Soso (farm pond)	Takinosawa	Tomiooka Town	99	1,650	414	92	13,200	4,002		0.97		
32		Kamisigeoka No. 1	Naraha Town	9,760	17,600	13,860	590	67,000	14,247		0.90		
33		Shimosigeoka		3,520	5,510	4,632	650	77,000	9,364		1.31		
34	Komachi Dam		Ono Town	368	1,190	885	142	8,200	2,278		0.81		
35	Kido Dam		Naraha Town	3,170	6,590	4,285	290	18,700	8,597		0.56		
36	Soso (farm pond)	Otsutsumi		763	1,420	1,131	763	19,300	4,201		0.89		
37	Iwaki (farm pond)	Shinike	Iwaki City	19	197	135	18	1,780	278		1.11		
38	Kodama Dam Reservoir (Lake Kodama)				344	1,960	1,170	213	4,000	1,558		0.58	
39	Iwaki (farm pond)	Kanoritsutsumi shita			278	790	490	28	5,000	998		1.21	
40	Takashiba Dam Reservoir (Lake Takashiba)				460	990	600	460	1,940	902		0.37	
41	Shitoki Dam Reservoir				458	879	655	458	6,400	1,443		0.67	
Total number of samples		1,782			0	349,000	17,453	0	920,000	21,927			
Number of detections		1,780	<p>*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)</p>										
			A	B	C	D	E						

ii. Nakadori

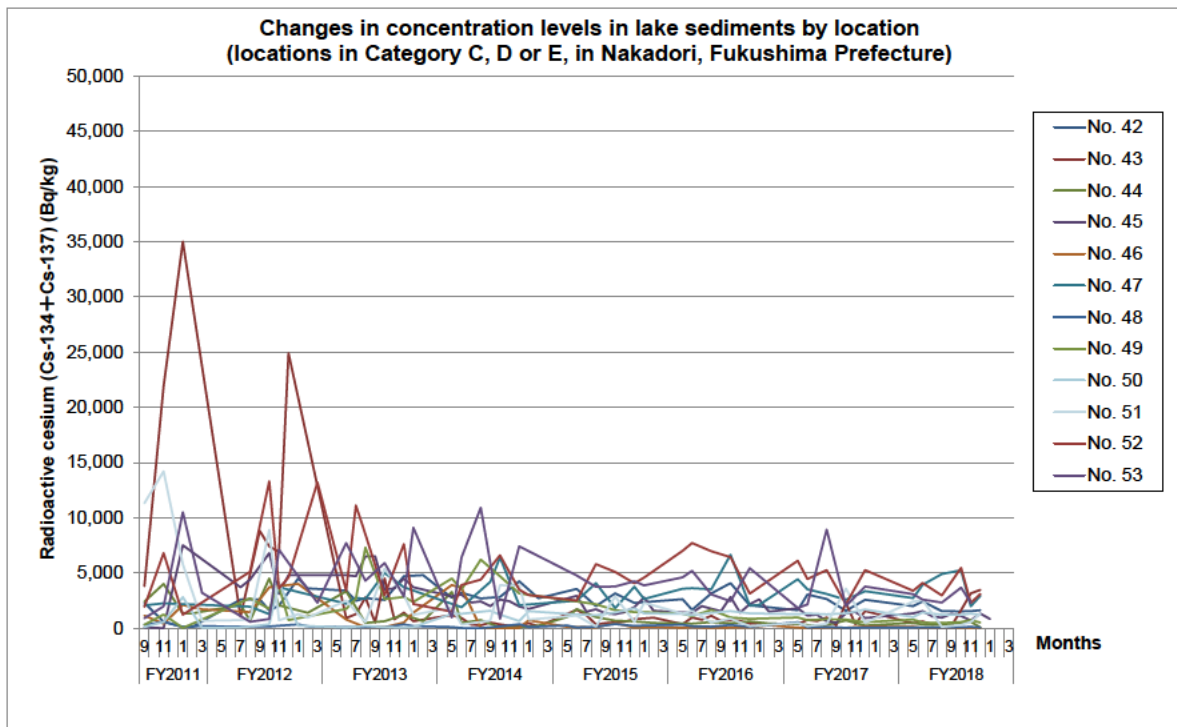
In Nakadori, Fukushima Prefecture, surveys were conducted 38 to 63 times from September 2011 to February 2019 for lake sediment samples collected at 12 locations.

Regarding the concentration levels of detected values, four locations were categorized as Category C, five locations as Category D, and three locations as Category E (see Table 4.1.2-26 and Table 4.1.2-27).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were not observed, while decreasing at six locations, unchanged at two locations, fluctuations at three locations, increasing at one location.

Table 4.1.2-26 Categorization of detected values at respective locations
(Nakadori, Fukushima Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	4	No. 42, No. 47, No. 52, No. 53
D	Upper 25th to 50th percentile	5	No. 43, No. 45, No. 49, No. 50, No. 51
E	Upper 50th to 100th percentile (lower 50%)	3	No. 44, No. 46, No. 48



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-19 Changes in concentration levels over the years at respective locations
(Nakadori, Fukushima Prefecture: lake sediment)

Table 4.1.2-27 Detection of radioactive cesium at respective locations
(Nakadori, Fukushima Prefecture: lake sediment)

Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
No.	Water area	Location	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
42	Surikamigawa Dam Reservoir	Fukushima City	1,520	2,420	1,772	104	4,800	2,540		0.43	
43	Lake Handanuma (farm pond)	Kori Town	217	3,470	1,282	176	35,000	2,654		2.29	
44	Oike Pond (farm pond)	Motomiya City	62	569	365	62	5,700	1,063		1.13	
45	Miharu Dam	Miharu Town	701	1,530	1,126	0	7,500	2,401		0.69	
46	Hounokusa (farm pond)	Koriyama City	11	116	42	0	4,000	675		1.72	
47	Lake Hatori	Tenei Village	1,980	5,240	3,613	1,270	6,640	3,193		0.40	
48	Hirodaira (farm pond)	Sukagawa City	50	110	73	0	570	167		0.77	
49	Sengosawa Dam Reservoir	Ishikawa Town	474	781	594	17	7,300	1,922		0.85	
50	Watariike Pond (farm pond)	Yabuki Town	1,004	1,420	1,225	17	4,100	1,062		0.74	
51	Izumikawa (farm pond)	Shirakawa City	111	2,530	1,199	111	14,200	2,198		1.34	
52	Hokkawa Dam	Nishigo Village	2,290	5,460	3,545	1,210	13,300	4,966		0.56	
53	Lake Nanko	Shirakawa City	2,310	3,670	2,792	580	10,900	4,249		0.64	
Total number of samples		545	11	5,460	1,433	0	35,000	2,245	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg		
Number of detections		542	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
			A	B	C	D	E				

iii. Aizu

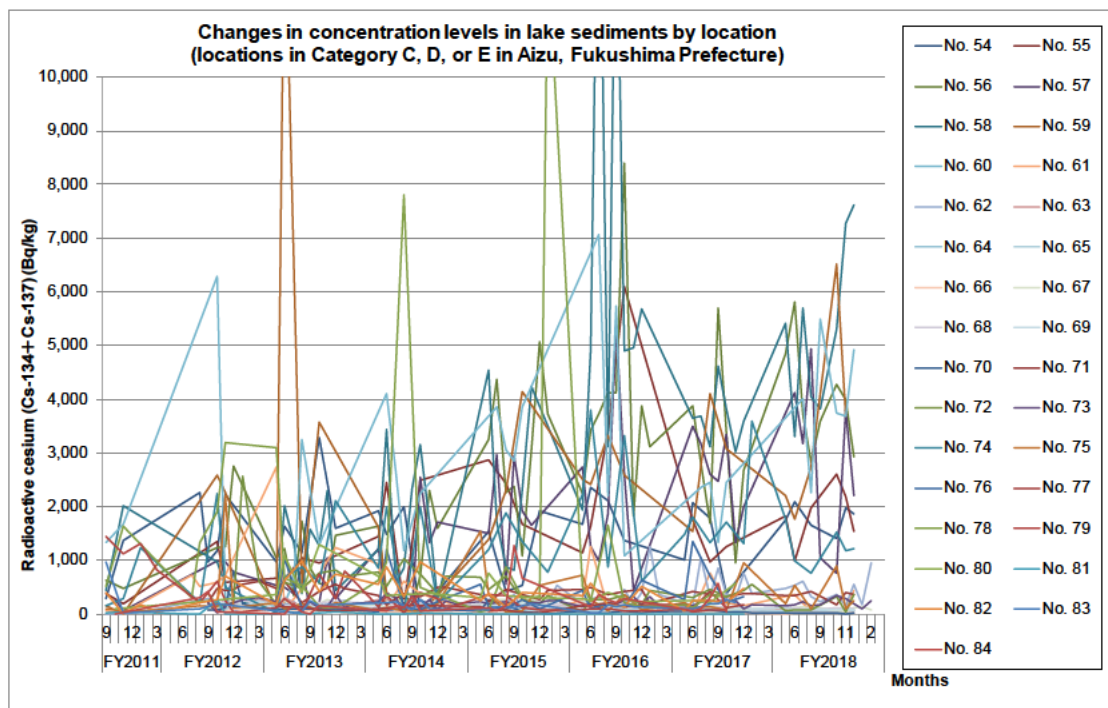
In Aizu, Fukushima Prefecture, surveys were conducted 28 to 68 times from September 2011 to February 2019 for lake sediment samples collected at 31 locations.

Regarding the concentration levels of detected values, seven locations were categorized as Category C, three locations were categorized as Category D and 21 locations were categorized as Category E (see Table 4.1.2-28 and Table 4.1.2-29).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 20% (five locations), while decreasing at six locations, unchanged at three locations, fluctuations at 11 locations, and increasing at six locations.

Table 4.1.2-28 Categorization of detected values at respective locations
(Aizu, Fukushima Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	7	No. 54, No. 55, No. 56, No. 57, No. 58, No. 59, No. 60
D	Upper 25th to 50th percentile	3	No. 62, No. 74, No. 78
E	Upper 50th to 100th percentile (lower 50%)	21	No. 61, No. 63, No. 64, No. 65, No. 66, No. 67, No. 68, No. 69, No. 70, No. 71, No. 72, No. 73, No. 75, No. 76, No. 77, No. 79, No. 80, No. 81, No. 82, No. 83, No. 84



Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-20 Changes in concentration levels over the years at respective locations
(Aizu, Fukushima Prefecture: lake sediment)

Table 4.1.2-29 Detection of radioactive cesium at respective locations
(Aizu, Fukushima Prefecture: lake sediment)

Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
No.	Water area	Location	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
54	Nicchu Dam	Kitakata City	1,410	2,090	1,790	43	3,280	1,524		0.50			
55	Lake Sohara	Kitashiobara Village	1,001	2,600	1,857	130	6,100	1,700		0.70			
56	Lake Hibara		2,840	5,810	4,000	192	8,400	2,554		0.70			
57	Lake Onogawa		761	4,950	2,981	57	5,370	1,721		0.81			
58	Lake Akimoto	Inawashiro Town	3,300	7,610	5,309	177	15,400	3,284		0.91			
59	Lake Bishamonnuma	Kitashiobara Village	1,770	6,510	3,380	0	13,400	2,488		1.04			
60	Lake Oguninuma		2,270	5,500	4,023	198	10,200	3,029		0.69			
61	Aizu (farm pond)	Lake Onuma	Nishiaizu Town	37	437	220	0	2,740	417		1.25		
62	Lake Inawashiro	Center	Aizuwakamatsu City	160	962	439	0	1,260	275		0.90		
63		Takahashi River Estuary	Inawashiro Town	56	105	71	56	300	138		0.49		
64		Oguro River Estuary		33	56	46	33	245	90		0.49		
65		Tenjinhama Beach		47	75	57	39	208	93		0.46		
66		Hishinuma River Estuary		13	29	19	12	108	40		0.63		
67		Intake of Asakasosui		56	134	104	56	440	170		0.44		
68		Hamajihama Beach		Koriyama City	75	130	104	75	242	162		0.26	
69		Funatsu Port			77	110	92	77	382	160		0.42	
70		Offshore of Funatsu River Estuary	13		28	21	13	800	92		1.42		
71		Seishogahama Beach	183		429	348	174	620	397		0.28		
72		Haragawa River Estuary	Aizuwakamatsu City	47	370	161	45	2,560	464		0.90		
73		Koishigahama Floodgate	Inawashiro Town	95	339	207	22	389	204		0.38		
74		Higashiyama Dam Reservoir	Aizuwakamatsu City	770	1,770	1,244	18	3,800	1,315		0.71		
75		Lake Numazawa	Center	Kaneyama Town	93	889	346	45	2,210	304		1.45	
76	Midpoint between the center of the lake and off the estuary		91		628	291	37	1,350	336		1.03		
77	Offshore of Maenosawa River Estuary		43		230	134	15	430	135		0.57		
78	Aizu (farm pond)	Aizumisato Town	78	1,530	796	41	12,300	1,273		1.85			
79	Okawa Dam Reservoir	Aizuwakamatsu City	35	71	53	14	1,450	277		1.29			
80	Tagokura Reservoir	Tadami Town	200	324	268	90	1,290	395		0.68			
81	Minamiaizu (farm pond)		Fukui	0	0	0	0	270	15		3.18		
82	Tajima Dam Reservoir (Lake Funehana)	Minamiaizu Town	160	330	244	0	1,000	366		0.69			
83	Okutadami Reservoir	Tadami Town	33	110	69	18	980	152		1.01			
84	Lake Ozenuma	Hinoemata Village	86	1,040	404	0	1,380	288		1.15			
Total number of samples		1,283		0	7,610	979	0	15,400	764	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg			
Number of detections		1,248		*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)									
				A	B	C	D	E					

iii) Ibaraki Prefecture

In Ibaraki Prefecture, surveys were conducted 21 to 30 times from September 2011 to February 2019 for lake sediment samples collected at 19 locations.

Regarding the concentration levels of detected values, one location was categorized as Category C, four locations as Category D, and 14 locations as Category E (see Table 4.1.2-30 and Table 4.1.2-31).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 10% (two locations), while decreasing at 12 locations, unchanged at two locations, fluctuations at two locations, and increasing at one location.

Table 4.1.2-30 Categorization of detected values at respective locations
(Ibaraki Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	1	No. 13
D	Upper 25th to 50th percentile	4	No. 12, No. 14, No. 15, No. 16
E	Upper 50th to 100th percentile (lower 50%)	14	No. 1, No. 2, No. 3, No. 4, No. 5, No. 6, No. 7, No. 8, No. 9, No. 10, No. 11, No. 17, No. 18, No. 19

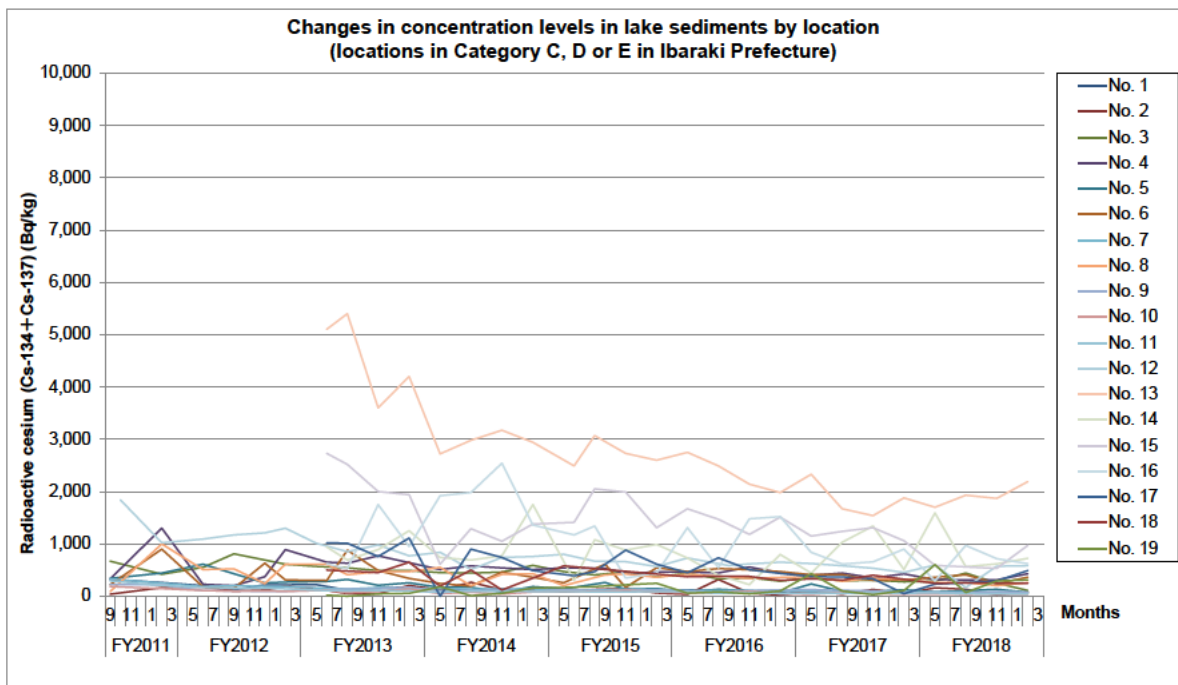














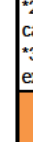

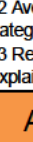

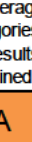

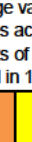

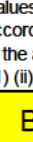

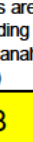

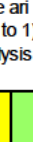

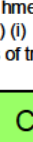

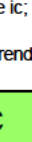

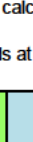

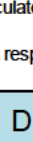

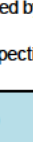








Figure 4.1.2-21 Changes in concentration levels over the years at respective locations
(Ibaraki Prefecture: lake sediment)

Table 4.1.2-31 Detection of radioactive cesium at respective locations
(Ibaraki Prefecture: lake sediment)

No.	Loca ion		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)	
	Water area	Loca ion	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average				
1	Hinuma	Hiroura	Ibaraki Town	58	71	65	54	320	126		0.52	
2		Miyamae		26	160	99	23	319	113		0.62	
3		Oyazawa		110	441	272	110	810	441		0.34	
4	Lake Kasumigaura	Offshore of Tamatsukuri	Namegata City	310	430	342	201	1,300	500		0.43	
5		Offshore of Kakeuma	Ami Town	74	132	98	62	610	200		0.65	
6		Center	Miho Village	240	410	343	151	900	400		0.46	
7	Lake Kitaura	Offshore of Aso	Inashiki City	70	80	76	70	330	135		0.42	
8		Offshore of Kamaya	Namegata City	200	260	245	90	1,000	391		0.43	
9		Jingu Bridge	Itako City	62	87	74	53	220	112		0.34	
10	Lake Sotonasakaura	36		46	42	34	184	80		0.45		
11	Hitachitone River	kisu	Kamisu City	43	60	49	43	290	97		0.56	
12	Lake Ushikunuma	Center of Lake Ushikunuma	Ryugasaki City	166	595	479	166	1,840	783		0.41	
13	Mizunuma Dam	Center	Kitaibaraki City	1,700	2,190	1,923	1,540	5,400	2,728		0.37	
14	Koyama Dam		Takahagi City	563	1,590	874	220	1,750	830		0.46	
15	Hananuki Dam		530	969	662	530	2,730	1,397		0.42		
16	Jyuou Dam		Hitachi City	290	969	649	290	2,540	1,058		0.55	
17	Ryuji Dam		Hitachiota City	230	490	318	0	1,110	537		0.56	
18	Fujigawa Dam		Shirosato Town	246	256	251	117	650	363		0.36	
19	Iida Dam		Kasama City	69	603	318	0	603	148		0.98	
Total number of samples			525		26	2,190	378	0	5,400	514	 : Increasing  : Decreasing  : Fluctuations  : Unchanged  : ≤ 100 Bq/kg	
Number of detections		523	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)									
				A	B	C	D	E				

iv) Tochigi Prefecture

In Tochigi Prefecture, surveys were conducted 26 to 30 times from October 2011 to December 2018 for lake sediment samples collected at eight locations.

Regarding the concentration levels of detected values, four locations were categorized as Category D, and four locations as Category E (see Table 4.1.2-32 and Table 4.1.2-33).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were not observed, while decreasing at four locations, unchanged at one location, fluctuations at two locations, and increasing at one location.

Table 4.1.2-32 Categorization of detected values at respective locations
(Tochigi Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	4	No. 1, No. 3, No. 6, No. 7
E	Upper 50th to 100th percentile (lower 50%)	4	No. 2, No. 4, No. 5, No. 8

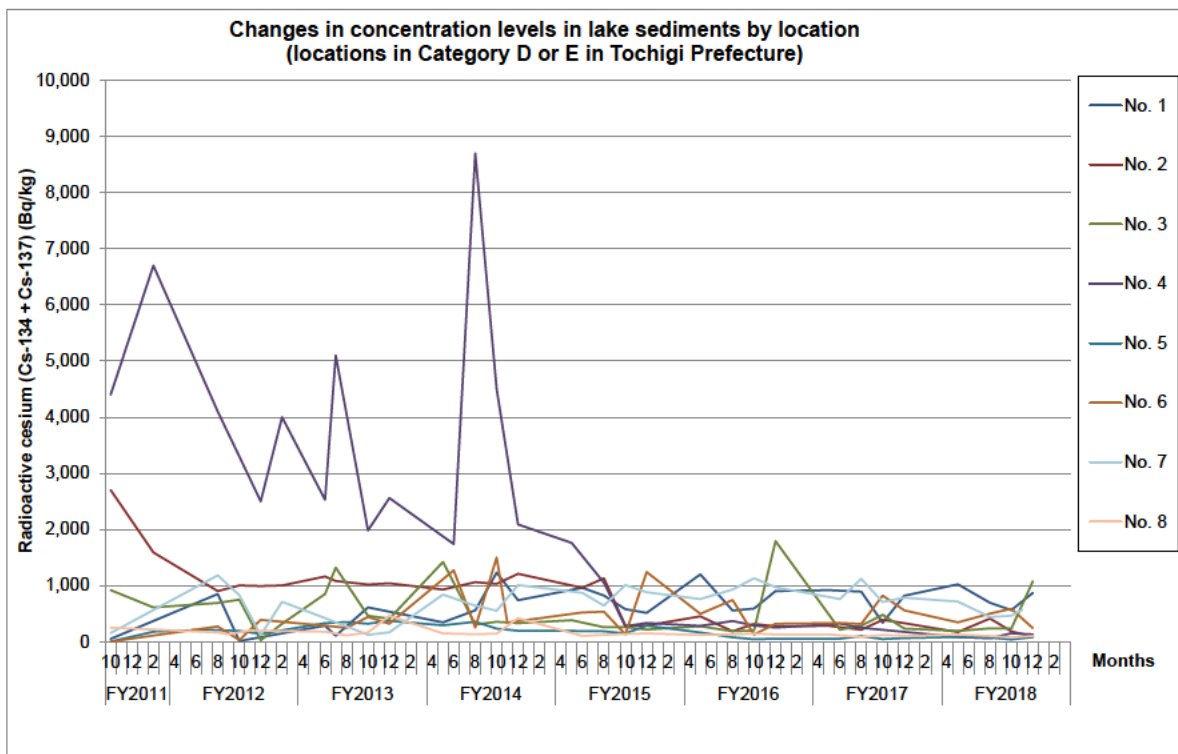


Figure 4.1.2-22 Changes in concentration levels over the years at respective locations
(Tochigi Prefecture: lake sediment)

Table 4.1.2-33 Detection of radioactive cesium at respective locations
(Tochigi Prefecture: lake sediment)

No.	Location			FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)	
	Water area	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average				
1	Nakagawa River System	Miyama Dam Reservoir	Center	Nasushiobara City	561	1,023	787	11	1,230	654		0.50	
2		Shiobara Dam Reservoir	Center		84	413	213	84	2,700	756		0.74	
3	Kinugawa River System	Kawaji Dam Reservoir	Center	Nikko City	190	1,079	434	25	1,790	509		0.83	
4		kari Dam Reservoir	Center		61	150	107	61	8,700	2,136		1.06	
5		Kawamata Dam Reservoir	Center		38	85	70	0	370	167		0.66	
6		Lake Yuno	Center		240	585	417	0	1,500	470		0.77	
7		Lake Chuzenji	Center		440	713	546	115	1,180	681		0.46	
8	Watarase River System	Watarase Reservoir	Center	Tochigi City	77	126	101	77	460	156		0.56	
Total number of samples		228		38		1,079	334	0	8,700	688	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg		
Number of detections		226		*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)									
				A	B	C	D	E					

v) Gunma Prefecture

In Gunma Prefecture, surveys were conducted 24 to 30 times from November 2011 to December 2018 for lake sediment samples collected at 24 locations.

Regarding the concentration levels of detected values, one location was categorized as Category C, 11 locations as Category D, and 12 locations as Category E (see Table 4.1.2-34 and Table 4.1.2-35).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were not observed, while decreasing at 12 locations, unchanged at five locations, and fluctuations at seven locations.

Table 4.1.2-34 Categorization of detected values at respective locations
(Gunma Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	1	No. 2
D	Upper 25th to 50th percentile	11	No. 1, No. 3, No. 5, No. 6, No. 7, No. 9, No. 10, No. 15, No. 17, No. 20, No. 22
E	Upper 50th to 100th percentile (lower 50%)	12	No. 4, No. 8, No. 11, No. 12, No. 13, No. 14, No. 16, No. 18, No. 19, No. 21, No. 23, No. 24

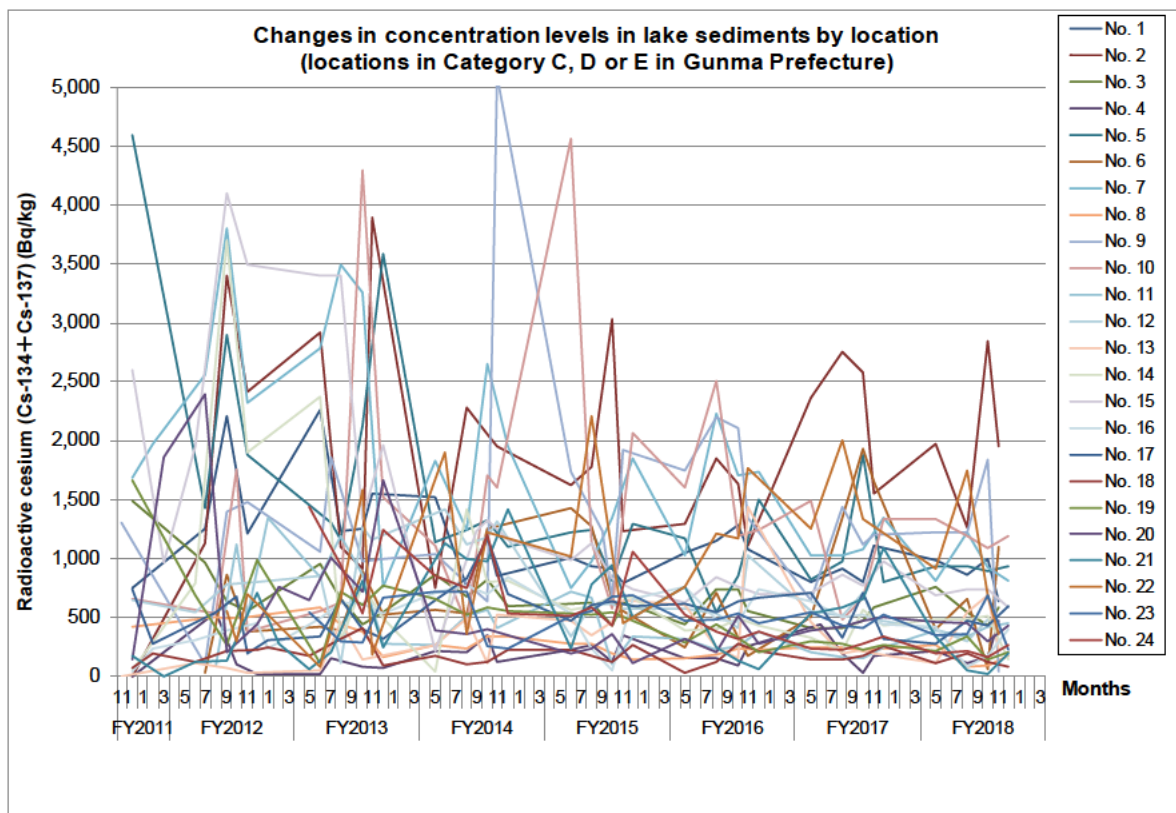


Figure 4.1.2-23 Changes in concentration levels over the years at respective locations
(Gunma Prefecture: lake sediment)

Table 4.1.2-35 Detection of radioactive cesium at respective locations
(Gunma Prefecture: lake sediment)

No.	Water area	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)		
		Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average					
1	Tonegawa River	Lake Okutone (Yagisawa Dam)	Center	Minakami Town	635	998	870	635	2,260	1,120		0.35		
2		Lake Naramata (Naramata Dam)	Center		1,260	2,850	2,008	0	3,900	1,916		0.46		
3		Lake Dogen (Sudagai Dam)	Center		432	761	583	409	1,490	651		0.35		
4		Lake Marunuma (Marunuma Dam)	Center	Katashina Village	110	470	240	0	540	189		0.73		
5		Lake Fujiwara (Fujiwara Dam)	Center	Minakami Town	893	938	925	548	4,600	1,451		0.62		
6		Lake Tanbara (Tanbara Dam)	Center	Numata City	66	1,095	553	33	1,930	726		0.69		
7		Lake Akaya (Aimata Dam)	Center	Minakami Town	808	1,220	943	750	3,800	1,732		0.50		
8		Lake Sonohara (Sonohara Dam)	Center	Numata City	87	271	155	87	590	283		0.46		
9		Lake Akagionuma	Center	Maebashi City	43	1,840	1,081	43	5,100	1,373		0.66		
10	Agatsuma River Area	Lake Okushima (Shimagawa Dam)	Center	Nakanajo Town	1,085	1,340	1,202	380	4,570	1,389		0.73		
11		Lake Shimako (Nakanajo Dam)	Center		339	449	402	94	1,350	478		0.69		
12		Lake Tashiro (Kazawa Dam)	Center	Tsumagoi Village	300	485	403	110	1,420	706		0.48		
13	Karasu River	Lake Haruna	Center	Takasaki City / Higashi-Agatsuma Town	110	690	393	0	1,440	344		0.87		
14		Lake Kirizumi (Kirizumi Dam)	Center	Annaka City	140	509	402	38	3,700	744		1.04		
15		Lake Usui (Sakamoto Dam)	Center		588	738	687	215	4,100	1,374		0.75		
16		Lake Arafune (Dodairagawa Dam)	Center		Shimonita Town	85	421	270	37	840	469		0.47	
17		Lake Oshio (Oshio Dam)	Center	Tomioka City	275	601	446	196	1,170	548		0.38		
18		Lake Kanna (Shimokubo Dam)	Center	Fujioka City / Kamikawa Town	78	199	127	26	410	179		0.46		
19		Lake Hebikami (Shiozawa Dam)	Center	Kanna Town	144	336	228	111	1,670	482		0.66		
20		Watarase River Area	Lake Kusaki (Kusaki Dam)	Center	Midori City	296	462	409	115	2,400	567		0.92	
21	Lake Umeda (Kiryugawa Dam)		Center	Kiryu City	18	337	150	0	1,420	480		0.83		
22	Nakatsu River	Lake Nozori (Nozori Dam)	Center	Nakanajo Town	362	1,750	928	82	2,210	1,019		0.59		
23	Watarase River Area	Lake Jonuma	Center	Tatebayashi City	230	690	407	230	720	486		0.33		
24		Lake Tataranuma	Center		160	270	213	160	1,440	567		0.65		
Total number of samples		670					18	2,850	584	0	5,100	803	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg	
Number of detections		666					*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)							
							A	B	C	D	E			

vi) Chiba Prefecture

In Chiba Prefecture, surveys were conducted 30 times from November 2011 to February 2019 for lake sediment samples collected at eight locations.

Regarding the concentration levels of detected values, one location was categorized as Category C, one location as Category D, and six locations as Category E (see Table 4.1.2-36 and Table 4.1.2-37).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were not observed, while decreasing at all eight locations.

Table 4.1.2-36 Categorization of detected values at respective locations
(Chiba Prefecture: lake sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	1	No. 4
D	Upper 25th to 50th percentile	1	No. 3
E	Upper 50th to 100th percentile (lower 50%)	6	No. 1, No. 2, No. 5, No. 6, No. 7, No. 8

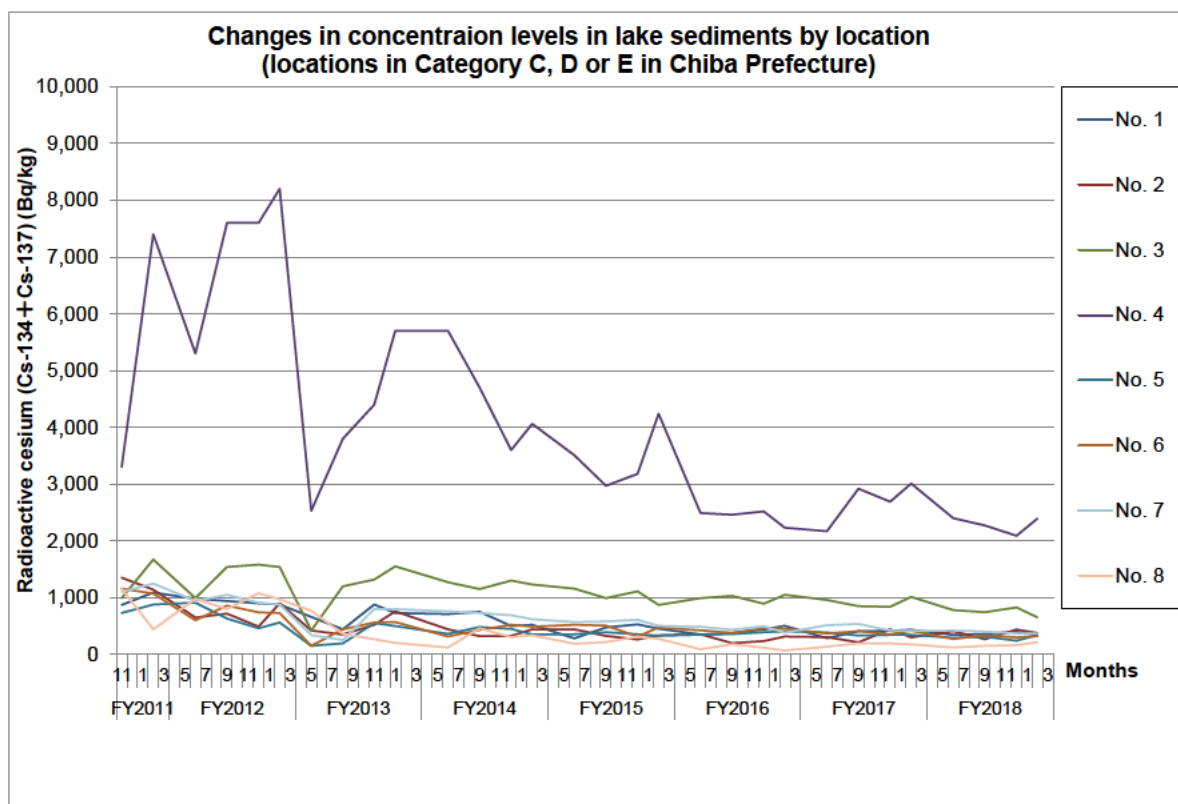


















Figure 4.1.2-24 Changes in concentration levels over the years at respective locations
(Chiba Prefecture: lake sediment)

Table 4.1.2-37 Detection of radioactive cesium at respective locations
(Chiba Prefecture: lake sediment)

No.	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)	
	Location	Municipality	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average				
1	Lake Teganuma	Fusashita	Inzai City	339	400	361	283	1,090	575		0.41	
2		Shimoteganuma Chuo	Inzai City	268	439	373	197	1,350	468		0.57	
3		Teganuma Chuo	Abiko City / Kashiwa City	652	828	750	420	1,670	1,083		0.27	
4		Nedoshita	Abiko City / Kashiwa City	2,090	2,400	2,288	2,090	8,200	3,914		0.47	
5	Lake Inbanuma	Kita-Inbanuma Chuo	Inzai City / Narita City	240	341	296	151	910	424		0.41	
6		Ipponmatsushita	Inzai City	272	335	307	152	1,160	498		0.45	
7		Lower area of Josuido water intake	Sakura City	370	419	391	251	1,250	621		0.41	
8		Asobashi Bridge	Yachiyo City	121	218	163	66	1,160	368		0.87	
Total number of samples	240		121	2,400	616	66	8,200	994				
Number of detections	240		<p>*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)</p>									
			A	B	C	D	E					

2)-3 Coastal areas

i) Iwate Prefecture

In Iwate Prefecture, surveys were conducted 15 times from January 2012 to November 2018 for coastal area sediment samples collected at two locations (this analysis excludes the survey results from one location where the survey was conducted only in FY2011).

Regarding the concentration levels of detected values, both locations were categorized as Category E (see Table 4.1.2-38 and Table 4.1.2-39).

As for the trends of detected values, mean values were 100 Bq/kg or less including past years at both two locations.

Table 4.1.2-38 Categorization of detected values at respective locations
(Iwate Prefecture: coastal area sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	0	(None)
E	Upper 50th to 100th percentile (lower 50%)	2	No. 1, No. 2

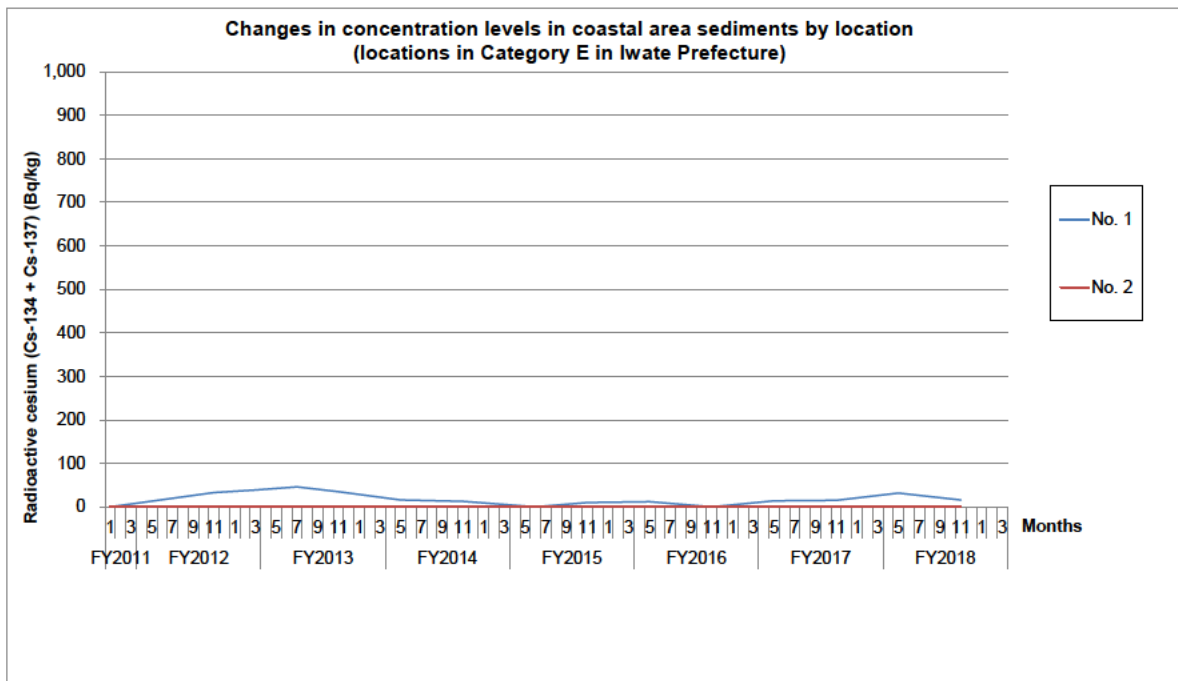




Figure 4.1.2-25 Changes in concentration levels over the years at respective locations
(Iwate Prefecture: coastal area sediment)

Table 4.1.2-39 Detection of radioactive cesium at respective locations
(Iwate Prefecture: coastal area sediment)

Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
No.	Location	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Ofunato Bay (A)	16	32	24	0	46	19		0.79	—
2	Hirota Bay	0	0	0	0	0	0		-	—
Total number of samples	30	0	32	12.0	0	46	9.4	↗ : Increasing ↘ : Decreasing ▲▼ : Fluctuations ↔ : Unchanged — : ≤ 100 Bq/kg		
Number of detections	12	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
		A	B	C	D	E				

ii) Miyagi Prefecture

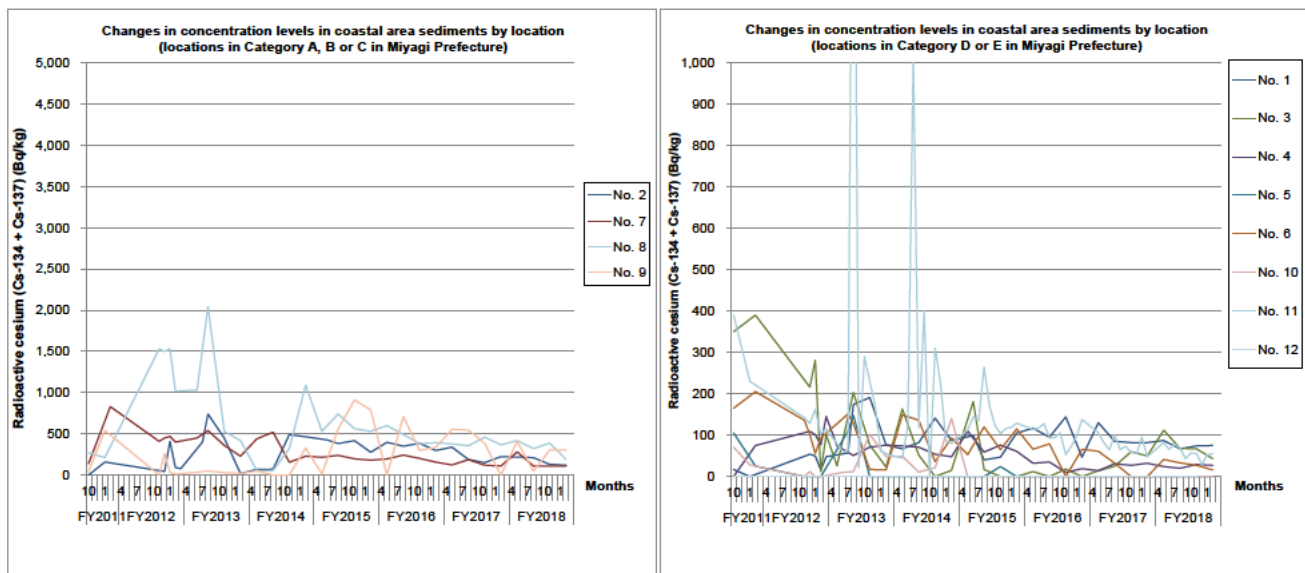
In Miyagi Prefecture, surveys were conducted 15 to 67 times from October 2011 to February 2019 for coastal area sediment samples collected at 12 locations (this analysis excludes the survey results from 28 locations where the survey was conducted only in FY2011).

Regarding the concentration levels of detected values, one location was categorized as Category A, one location as Category B, two locations as Category C, four locations as Category D, and four locations as Category E (see Table 4.1.2-40 and Table 4.1.2-41).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were approximately 60% (seven locations), while decreasing at three locations and fluctuations at two locations.

Table 4.1.2-40 Categorization of detected values at respective locations
(Miyagi Prefecture: coastal area sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	1	No. 8
B	Upper 5th to 10th percentile	1	No. 9
C	Upper 10th to 25th percentile	2	No. 2, No. 7
D	Upper 25th to 50th percentile	4	No. 1, No. 3, No. 6, No. 11
E	Upper 50th to 100th percentile (lower 50%)	4	No. 4, No. 5, No. 10, No. 12



- Notes: 1) For locations where surveys were conducted multiple times in one month, their average value is used in the figures.
2) Scales of the vertical axes differ in the left and right figures.

Figure 4.1.2-26 Changes in concentration levels over the years at respective locations
(Miyagi Prefecture: coastal area sediment)

Table 4.1.2-41 Detection of radioactive cesium at respective locations
(Miyagi Prefecture: coastal area sediment)

No.	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
	Location		Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Kesenuma Bay (B)	Offshore of Hachigasaki	67	87	76	0	191	81		0.54	—
2	Kesenuma Bay (C)	Offshore of Oshimakita	120	220	170	0	740	267		0.66	
3	All other neighboring sea areas	Oppa Bay (Jyusanhama Beach)	43	112	73	0	390	86		1.25	—
4	Neighboring sea area of Ishinomaki (C)	Lake Mangokuura, M-6 (center)	20	29	25	0	145	54		0.63	—
5	Neighboring sea area of Ishinomaki (B-3)	Offshore of Kitakami River Estuary	0	0	0	0	148	14		2.72	—
6	Neighboring sea area of Ishinomaki (C)	Offshore of Naruse	16	41	29	0	205	75		0.73	—
7	Matsushima Bay (B)	Nishihama Beach	110	282	153	110	830	280		0.61	
8	Neighboring sea area of Sendai Port (A)	Naiko Inner Port, 4-Nai	190	418	329	54	2,040	624		0.78	
9	Neighboring sea area of Sendai Port (B)	Gamo-3	46	408	265	0	910	252		1.08	
10	All other neighboring sea areas	Ido-5	0	0	0	0	140	17		2.01	—
11	Offshore of Abukuma River Estuary		29	82	59	0	2,030	156		1.73	
12	Offshore of Tsuyagawa River Estuary		0	0	0	0	0	0		-	—
Total number of samples		382	0	418	97	0	2,040	165	↗ : Increasing ↘ : Decreasing ⚡ : Fluctuations ⇄ : Unchanged — : ≤ 100 Bq/kg		
Number of detections		306	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
			A	B	C	D	E				

iii) Fukushima Prefecture

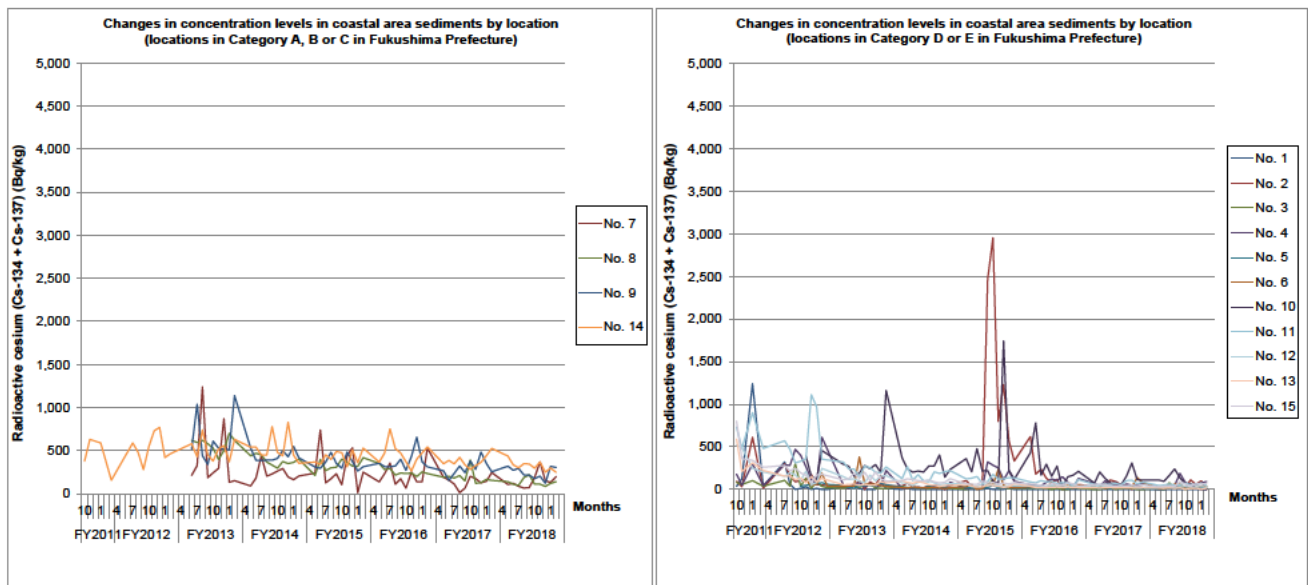
In Fukushima Prefecture, surveys were conducted 60 to 73 times from October 2011 to February 2019 for coastal area sediment samples collected at 15 locations (this analysis excludes the survey results from 11 locations where the survey was conducted only once in FY2011).

Regarding the concentration levels of detected values, one location was categorized as Category A, one location as Category B, two locations as Category C, five locations as Category D, and six locations as Category E (see Table 4.1.2-42 and Table 4.1.2-43).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were 40% (six locations), while decreasing at eight locations and fluctuations at one location.

Table 4.1.2-42 Categorization of detected values at respective locations
(Fukushima Prefecture: coastal area sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	1	No. 14
B	Upper 5th to 10th percentile	1	No. 9
C	Upper 10th to 25th percentile	2	No. 7, No. 8
D	Upper 25th to 50th percentile	5	No. 2, No. 4, No. 10, No. 11, No. 15
E	Upper 50th to 100th percentile (lower 50%)	6	No. 1, No. 3, No. 5, No. 6, No. 12, No. 13



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-27 Changes in concentration levels over the years at respective locations
(Fukushima Prefecture: coastal area sediment)

Table 4.1.2-43 Detection of radioactive cesium at respective locations
(Fukushima Prefecture: coastal area sediment)

No.	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
	Location		Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Neighboring sea area of Soso	Approx. 2,000 m offshore of Tsurushihama Fishing Port	0	0	0	0	1,240	29		5.21	—
2	Matsukawaura sea area	Around center of Fishing Right Area-1 in Matsukawaura sea area	0	110	36	0	2,950	186		2.53	
3	Neighboring sea area of Soso	Approx. 2,000 m offshore of Manogawa River	0	77	19	0	300	30		1.44	—
4	Neighboring sea area of Haramachi City	Approx. 1,000 m offshore of Nida River	27	187	70	0	610	104		1.11	
5		Approx. 1,000 m offshore of Ota River	0	31	14	0	81	27		0.60	—
6	Neighboring sea area of Soso District	Approx. 1,000 m offshore of Odaka River	12	61	29	0	380	48		1.20	—
7		Approx. 2,000 m offshore of Ukedo River	67	369	149	12	1,240	236		0.87	
8		Approx. 1,000 m offshore of Kumagawa River	85	220	132	85	700	311		0.51	
9		Approx. 1,000 m offshore of Tomioka River	122	320	245	122	1,600	397		0.55	
10	Neighboring sea area of Naraha Town	Approx. 1,000 m offshore of Kidogawa River	0	238	89	0	1,740	249		1.04	
11	Approx. 1,000 m offshore of Asami River Estuary		42	73	56	41	1,110	203		1.06	
12	Approx. 1,000 m offshore of Ohisa River Estuary		25	34	29	22	520	88		1.05	—
13	Neighboring sea area of Iwaki City	Approx. 1,500 m offshore of Natsui River	0	18	12	0	590	64		1.31	—
14	Onahama Port	Approx. 400 m north of Nishibouhatei No. 2	248	437	323	156	830	449		0.30	
15	Joban coastal sea area	Approx. 1,000 m offshore of Binda River	29	91	53	29	800	112		0.97	
Total number of samples		1,033	0	437	84	0	2,950	165	: Increasing : Decreasing : Fluctuations : Unchanged : ≤ 100 Bq/kg		
Number of detections		952	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
			A	B	C	D	E				

iv) Ibaraki Prefecture

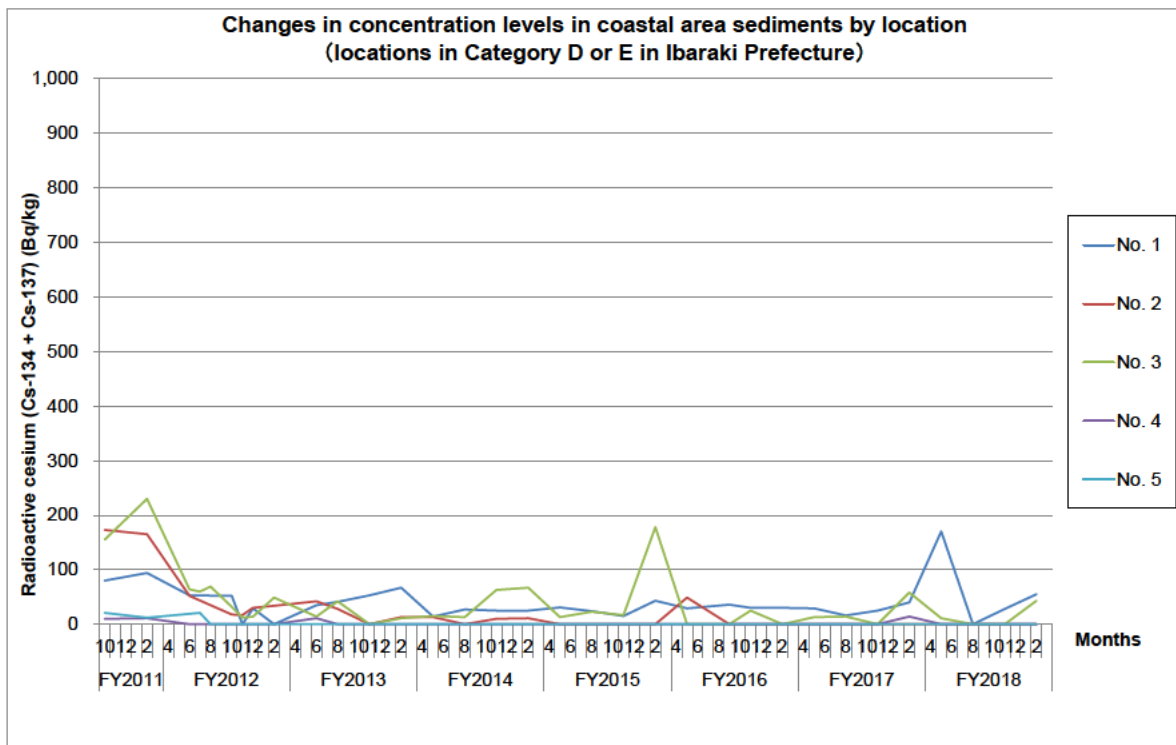
In Ibaraki Prefecture, surveys were conducted 31 to 33 times from October 2011 to February 2019 for coastal area sediment samples collected at five locations (this analysis excludes the survey results from 18 locations where the survey was conducted only once in FY2011).

Regarding the concentration levels of detected values, one location was categorized as Category D and four locations as Category E (see Table 4.1.2-44 and Table 4.1.2-45).

As for the trends of detected values, mean values including past years were 100 Bq/kg or less at all the five locations.

Table 4.1.2-44 Categorization of detected values at respective locations
(Ibaraki Prefecture: coastal area sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	0	(None)
D	Upper 25th to 50th percentile	1	No. 1
E	Upper 50th to 100th percentile (lower 50%)	4	No. 2, No. 3, No. 4, No. 5



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-28 Changes in concentration levels over the years at respective locations
(Ibaraki Prefecture: coastal area sediment)

Table 4.1.2-45 Detection of radioactive cesium at respective locations
(Ibaraki Prefecture: coastal area sediment)

Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
No.	Location	Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Offshore of Satone River Estuary	0	170	63	0	170	39		0.84	—
2	Offshore of Okita River Estuary	0	0	0	0	173	21		2.01	—
3	Offshore of Momiya River/Kujigawa River Estuaries	0	43	14	0	230	40		1.35	—
4	Neighboring water body of Ken-o Offshore of Nakagawa River	0	0	0	0	14	1.4		2.76	—
5	Offshore of Tonegawa River Estuary	0	0	0	0	25	2.3		2.84	—
Total number of samples	161	0	170	15	0	230	20	↗ : Increasing ↘ : Decreasing ⚡ : Fluctuations ~ : Unchanged — : ≤ 100 Bq/kg		
Number of detections	76	*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
		A	B	C	D	E				

v) Chiba Prefecture and Tokyo Metropolis

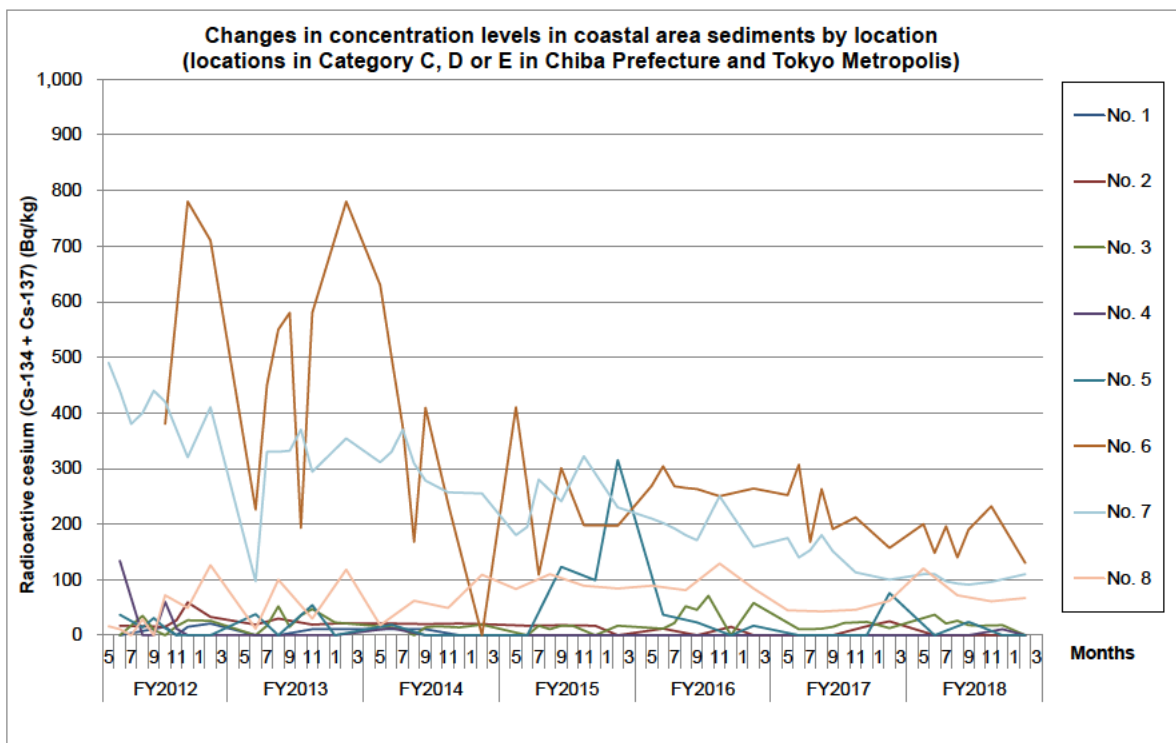
In Chiba Prefecture and Tokyo Metropolis, surveys were conducted 29 to 50 times from May 2012 to February 2019 for coastal area sediment samples collected at eight locations in total.

Regarding the concentration levels of detected values, two locations were categorized as Category C, one location was categorized as Category D and five locations were categorized as Category E (see Table 4.1.2-46 and Table 4.1.2-47).

As for the trends of detected values, locations with mean values of 100 Bq/kg or less, including past years, were 75% (six locations), while decreasing at the two remaining locations.

Table 4.1.2-46 Categorization of detected values at respective locations
(Chiba Prefecture and Tokyo Metropolis: coastal area sediment)

Category	Percentile (percentile in all detected values)	Number of locations	Locations
A	Upper 5th percentile	0	(None)
B	Upper 5th to 10th percentile	0	(None)
C	Upper 10th to 25th percentile	2	No. 6, No. 7
D	Upper 25th to 50th percentile	1	No. 8
E	Upper 50th to 100th percentile (lower 50%)	5	No. 1, No. 2, No. 3, No. 4, No. 5



Notes: For locations where surveys were conducted multiple times in one month, their average value is used in the figures.

Figure 4.1.2-29 Changes in concentration levels over the years at respective locations
(Chiba Prefecture and Tokyo Metropolis: coastal area sediment)

Table 4.1.2-47 Detection of radioactive cesium at respective locations
(Chiba Prefecture and Tokyo Metropolis: coastal area sediment)

No.	Prefecture	Location		FY2018			FY2011 - FY2018			Changes	Coefficient of variation	Trends (*3)
				Minimum value	Maximum value	Average	Minimum value	Maximum value	Average			
1	Chiba Prefecture	Tokyo Bay 7	Offshore of Yorogawa River Estuary	0	0	0	0	21	3.3		1.88	—
2		Tokyo Bay 5	Offshore of Miyako River Estuary	0	0	0	0	59	15		0.87	—
3		Coastal sea area of Makuhari	Offshore of Inbanuma Discharge Channel	0	37	20	0	71	20		0.81	—
4		Approx. 1 km offshore of Ebigawa River Estuary	Coastal area of Keiyo Port	0	11	2.8	0	134	7.4		3.50	—
5		Approx. 1 km offshore of Edogawa River Estuary		0	24	6.0	0	315	30		2.07	—
6	Tokyo Metropolis	Approx. 1 km offshore of Kyu-Edogawa River Estuary	Offshore of Kyu-Edogawa River Estuary	130	232	177	0	780	311		0.58	↘
7		St-8	Offshore of Arakawa River / Kyu-Edogawa River Estuaries	91	110	101	91	490	246		0.45	↘
8		Southwestern area of Toyosu Wharf	Offshore of Sumida River Estuary	61	120	80	0	129	65		0.59	—
Total number of samples		296		0	232	59	0	780	105	↗ : Increasing ↘ : Decreasing : Fluctuations : Unchanged — : ≤ 100 Bq/kg		
Number of detections		212		*1 Detected values are the total of Cs-134 and Cs-137 (Bq/kg-dry). *2 Average values are arithmetic; calculated by assuming ND=0; Color codes show categories according to 1) (i) *3 Results of the analysis of trends at respective locations using the method explained in 1) (ii)								
				A	B	C	D	E				

2)-4 Conclusion

The concentration levels of detected values for sediment samples from public water areas (rivers, lakes, and coastal areas) from FY2011 to FY2018 and their changes shown so far are summarized as follows (see Figure 4.1.2-30 and Table 4.1.2-48).

i) Concentration levels of detected values

- Rivers

Out of all surveyed locations (396 locations), the locations categorized as Categories A or B, which fall under the upper 10%, were found in Miyagi Prefecture, Nakadori and Aizu in Fukushima Prefecture, Ibaraki Prefecture, Gunma Prefecture and Chiba Prefecture, as well as in Hamadori in Fukushima Prefecture.

- Lakes

Out of all surveyed locations (164 locations), locations categorized as Category A or B were found in Hamadori in Fukushima Prefecture.

- Coastal areas

Out of all surveyed locations (42 locations), locations categorized as Category A or B were found in Miyagi and Fukushima Prefectures.

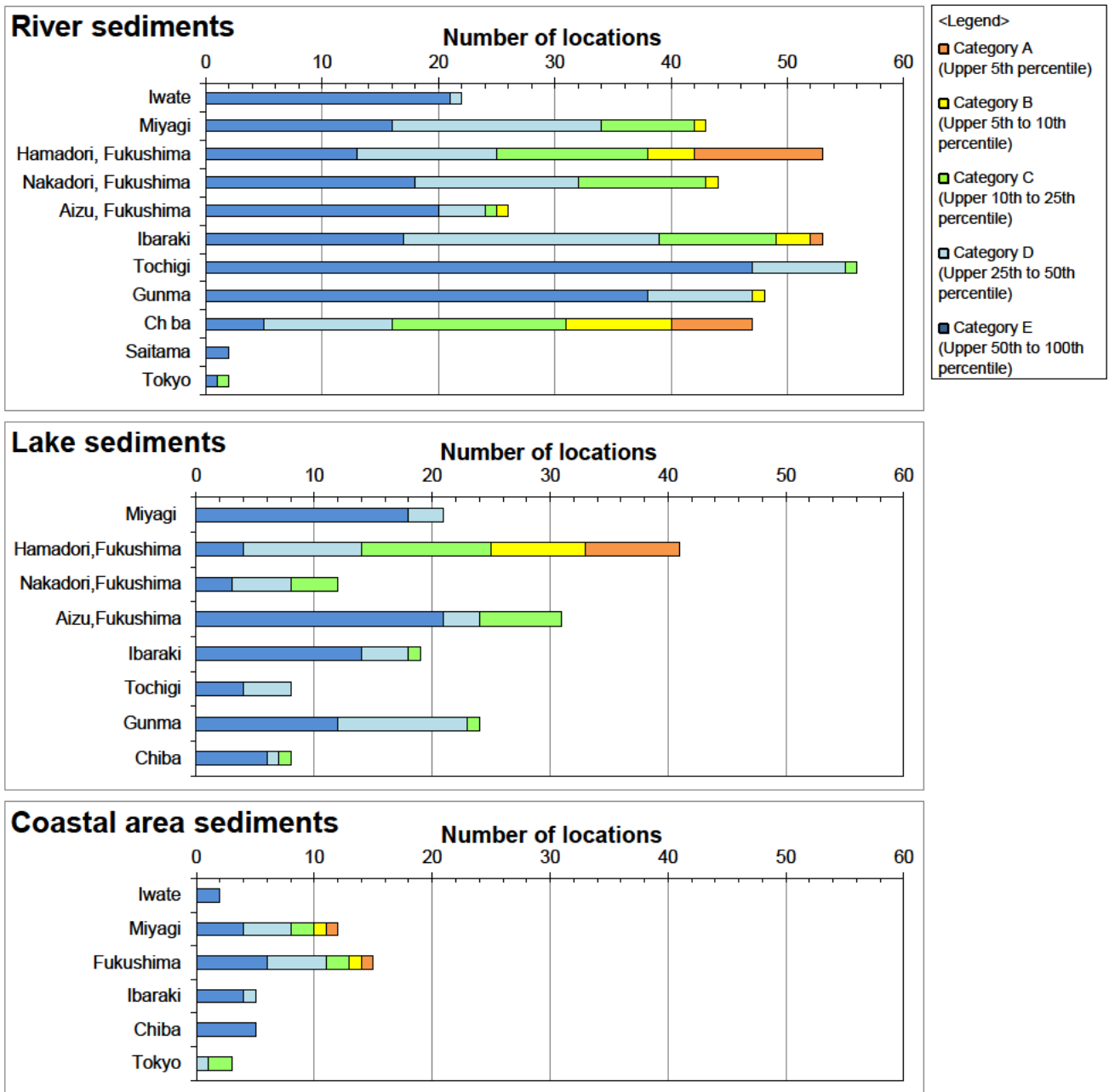


Figure 4.1.2-30 Categorization by concentration levels of detected values for sediment samples (upper: rivers; middle: lakes; lower: coastal areas)

(* Figure 4.1.2-30 shows the aforementioned Table 3.1-1 graphically.)

ii) Changes in detected values

• Rivers

The average values including past years were 100 Bq/kg or less at approximately a half of the locations, while a decreasing trend was observed at over 90% of the remaining locations.

• Lakes

The average values including past years were 100 Bq/kg or less at 10% of the monitoring locations. For the remaining locations, fluctuations were observed at approximately 30% of them and decreasing or an unchanged trend was observed at approximately 70% of them.

• Coastal areas

The average values including past years were 100 Bq/kg or less at approximately 60% of the locations, while a decreasing trend was observed at over 80% of the remaining locations.

Table 4.1.2-48 Changes in detected values for sediment samples from public water areas (rivers, lakes, and coastal areas)

<Rivers>

Trends	Number of locations												Total	
	Iwate	Miyagi	Fukushima			baraki	Tochigi	Gunma	Chiba	Saitama	Tokyo	Number of locations	Percentage	
			Hamadori	Nakadori	Aizu									
≤100 Bq/kg	17	19	11	16	17	12	45	43	4	1	0	185	46.7	
Decreasing	5	21	40	27	8	40	11	4	40	1	2	199	50.3	
Unchanged	0	0	0	0	0	0	0	0	0	0	0	0	0.0	
Fluctuations	0	3	1	1	1	1	0	1	3	0	0	11	2.8	
Increasing	0	0	1	0	0	0	0	0	0	0	0	1	0.3	
Total	22	43	53	44	26	53	56	48	47	2	2	396	100.0	

<Lakes>

Trends	Number of locations									Total	
	Miyagi	Fukushima			baraki	Tochigi	Gunma	Chiba	Number of locations	Percentage	
		Hamadori	Nakadori	Aizu							
≤100 Bq/kg	2	0	0	5	2	0	0	0	9	5.5	
Decreasing	15	25	6	6	12	4	12	8	88	53.7	
Unchanged	2	2	2	3	2	1	5	0	17	10.4	
Fluctuations	2	13	3	11	2	2	7	0	40	24.4	
Increasing	0	1	1	6	1	1	0	0	10	6.1	
Total	21	41	12	31	19	8	24	8	164	100.0	

<Coastal areas>

Trends	Number of locations						Total	
	Iwate	Miyagi	Fukushima	baraki	Chiba	Tokyo	Number of locations	Percentage
Decreasing	0	3	8	0	0	2	13	31.0
Unchanged	0	0	0	0	0	0	0	0.0
Fluctuations	0	2	1	0	0	0	3	7.1
Increasing	0	0	0	0	0	0	0	0.0
Total	2	12	15	5	5	3	42	100.0

(*) "100 Bq/kg or less" shows the average values including past years was 100 Bq/kg or less.

iii) Summary by prefecture

Concentration levels of detected values and their changes are summarized by prefecture as follows (see Figures 4.1.2-31 to 4.1.2-33).

i. Iwate Prefecture

- For rivers, all the 22 surveyed locations were categorized as either Category D or E. The average values including past years were 100 Bq/kg or less at approximately 80% of the locations. For all the remaining locations, a decreasing trend was observed.
- For coastal areas, the two surveyed locations were both categorized as Category E. The average values including past years were 100 Bq/kg or less at both locations.

ii. Miyagi Prefecture

- For rivers, of the 43 surveyed locations, a number of locations in the lower reaches were categorized as Category B or C, while approximately 80% of the surveyed locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 40% of the locations. For the remaining locations, a decreasing trend was observed at approximately 90% of the locations.
- For lakes, of the 21 surveyed locations, all locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 10% of the locations. For the remaining locations, a decreasing trend was observed at approximately 80% of the locations.
- For coastal areas, approximately 70% of the 12 surveyed locations were categorized as Category D or E, rest of them were categorized as Category A, B or C. One location categorized as Category A was seen in Sendai Port. The average values including past years were 100 Bq/kg or less at approximately 60% of the locations. For the remaining locations, a decreasing trend was observed at approximately 60% of the locations, while fluctuations were observed at 40% of them.

iii. Hamadori, Fukushima Prefecture

- For rivers, approximately 50% of the 53 surveyed locations were categorized as Category A, B or C. Many locations categorized as Category A or B were found near or between the north-northwest side of Fukushima Daiichi NPS, while locations categorized as Category C were seen in the southern parts of the district. The average values including past years were 100 Bq/kg or less at approximately 20% of the locations. For the remaining locations, a decreasing trend was observed at over 90% of the locations.
- For lakes, approximately 70% of the 41 surveyed locations were categorized as Category A, B or C. Many locations categorized as Category A or B were found northwest of Fukushima Daiichi NPS. A decreasing trend was observed at approximately 60% of the locations, while fluctuations were observed at approximately 30% of them.
- For coastal areas, approximately 70% of the 15 surveyed locations were categorized as Category D or E, while the remaining locations were categorized as Category A, B, or C. One location categorized as Category A was seen in Onahama Port. The average values including past years were 100 Bq/kg or less at 40% of the locations. For the remaining locations, a decreasing trend was observed at approximately 90% of the locations.

iv. Nakadori, Fukushima Prefecture

- For rivers, more than 70% of the 44 surveyed locations were categorized as Category D or E, and the rest

were categorized as Category B or C. Many locations categorized as Category B or C were found between the center and the northern part of the Abukuma River system. The average values including past years were 100 Bq/kg or less at approximately 40% of the locations. For the remaining locations, a decreasing trend was observed at over 90% of the locations.

- For lakes, eight of the 12 surveyed locations were categorized as Category D or E, and the remaining four locations were categorized as Category C. The locations categorized as Category C were seen in the upper and lower reaches of the Abukuma River basin. A decreasing or an unchanged trend was observed at approximately 70% of the locations, while 25 % of them showed fluctuations.

v. Aizu, Fukushima Prefecture

- For rivers, two of the 26 surveyed locations were categorized as Category B or C, and all the remaining locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 70% of the locations, while a decreasing trend was observed at approximately 90% of the remaining locations.
- For lakes, seven of the 31 surveyed locations were categorized as Category C, and approximately 80% of the locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 20% of the locations. For the remaining locations, concentration levels were fluctuating at approximately 40% of the locations, while the remaining locations showed a variation of trends.

vi. Ibaraki Prefecture

- For rivers, approximately 70% of the 53 surveyed locations were categorized as Category D or E, while the remaining were categorized as Category A, B, or C. The locations categorized as Category A or B were found in rivers flowing into Lake Kasumigaura. The average values including past years were 100 Bq/kg or less at approximately 20% of the locations. For the remaining locations, a decreasing trend was observed at over 90% of the locations.
- For lakes, out of the 19 surveyed locations, one in the northern part of the prefecture was categorized as Category C, and the other locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 10% of the locations. For the remaining locations, a decreasing trend was observed at approximately 70% of the locations.
- For coastal areas, all the five surveyed locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at all locations.

vii. Tochigi Prefecture

- For rivers, one of the 56 surveyed locations was categorized as Category C, and the remaining locations were all categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 80% of the locations, while a decreasing trend was observed at all the remaining locations.
- For lakes, all the eight locations were categorized as Category D or E. Concentration levels showed fluctuations at 25% of the locations, and approximately 60% of the locations showed a decreasing or an unchanged trend.

viii. Gunma Prefecture

- For rivers, out of the 48 surveyed locations, one location in the lower reaches of the Watarase River basin

was categorized as Category B, and all the remaining locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at approximately 90% of the locations, while a decreasing trend was observed at 80% of the remaining locations.

- For lakes, one of the 24 surveyed locations was categorized as Category C, and the remaining locations were all categorized as Category D or E. Although approximately 30% of the locations showed fluctuations, a decreasing or an unchanged trend was observed at approximately 70% of the locations.

ix. Chiba and Saitama Prefectures and Tokyo Metropolis

- For rivers, over 60% of the 51 surveyed locations were categorized as Category A, B, or C. The locations categorized as Category A or B were found in rivers flowing into Lake Teganuma or Lake Inbanuma, the Edogawa River system and a part of the Tonegawa River system. The average values including past years were 100 Bq/kg or less at approximately 10% of the locations, while a decreasing trend was observed at over 90% of the remaining locations.
- For lakes, one of the eight surveyed locations, in Lake Teganuma, was categorized as Category C, and all the remaining locations were categorized as Category D or E. A decreasing trend was observed at all the locations.
- For coastal areas, two of the eight surveyed locations, at the mouth of the Kyuedogawa River, were categorized as Category C, and all the remaining locations were categorized as Category D or E. The average values including past years were 100 Bq/kg or less at 75% of the locations, while a decreasing trend was observed at all the remaining locations.

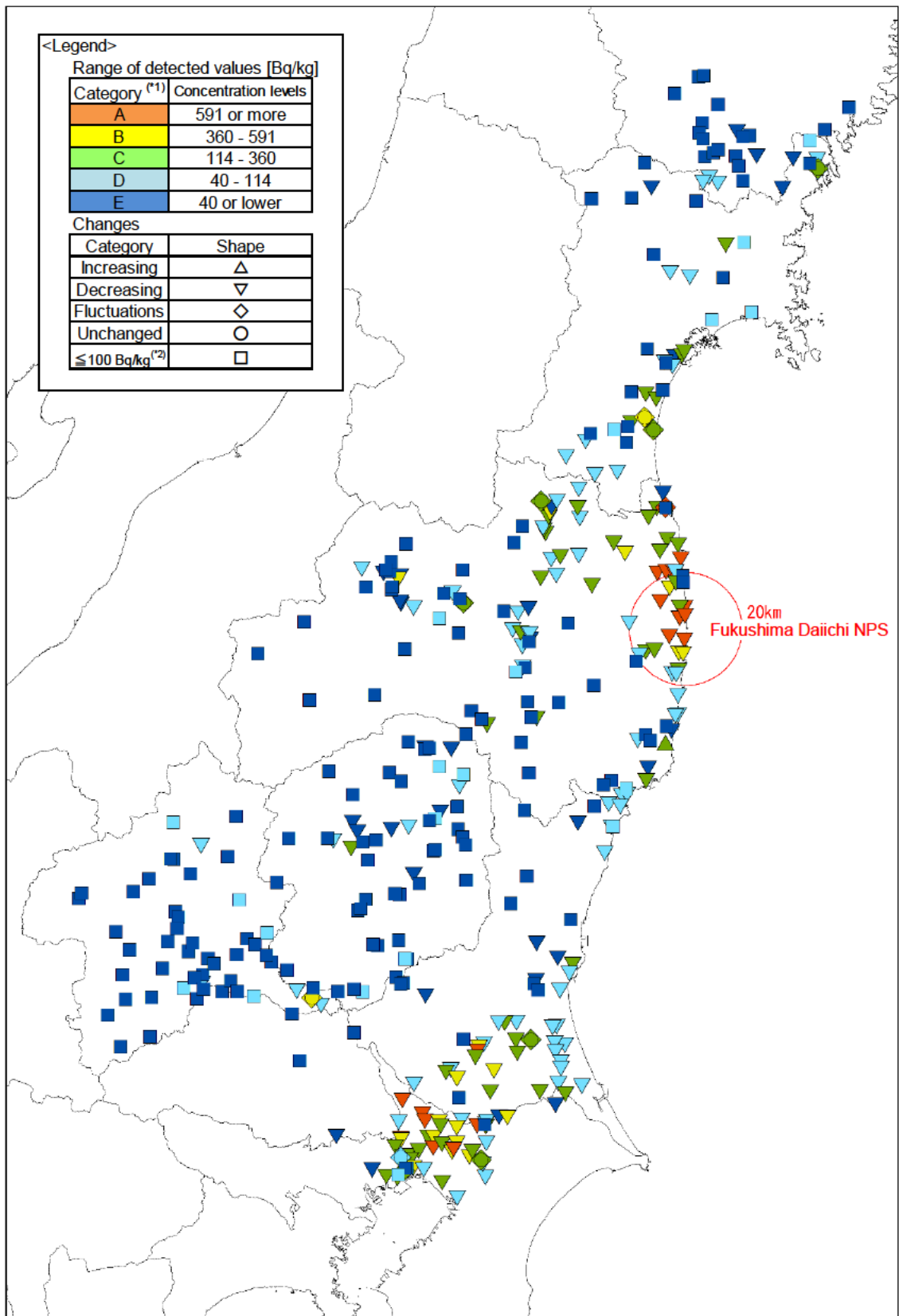


Figure 4.1.2-31 Categorization of and changes in concentration levels for river sediment samples from public water areas

(*1) Categories A to E show relative concentration levels for river sediment samples and cannot be compared with those for lake sediment samples or coastal area sediment samples.

(*2) "100 Bq/kg or less" shows the average values including past years was 100 Bq/kg or less.

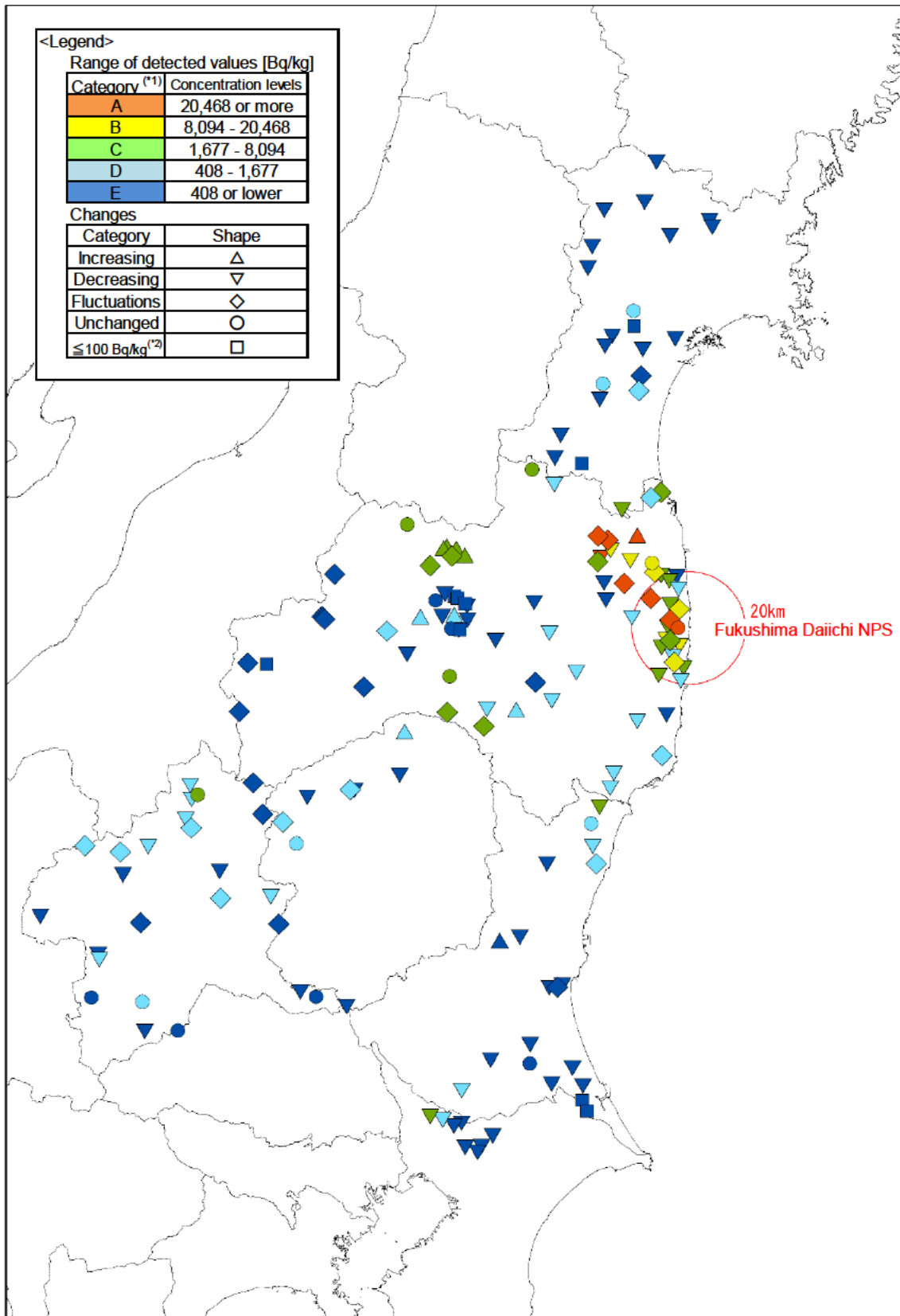


Figure 4.1.2-32 Categorization of and changes in concentration levels for lake sediment samples from public water areas

(*1) Categories A to E show relative concentration levels for lake sediment samples and cannot be compared with those for river sediment samples or coastal area sediment samples.

(*2) "100 Bq/kg or less" shows the average values including past years was 100 Bq/kg or less.

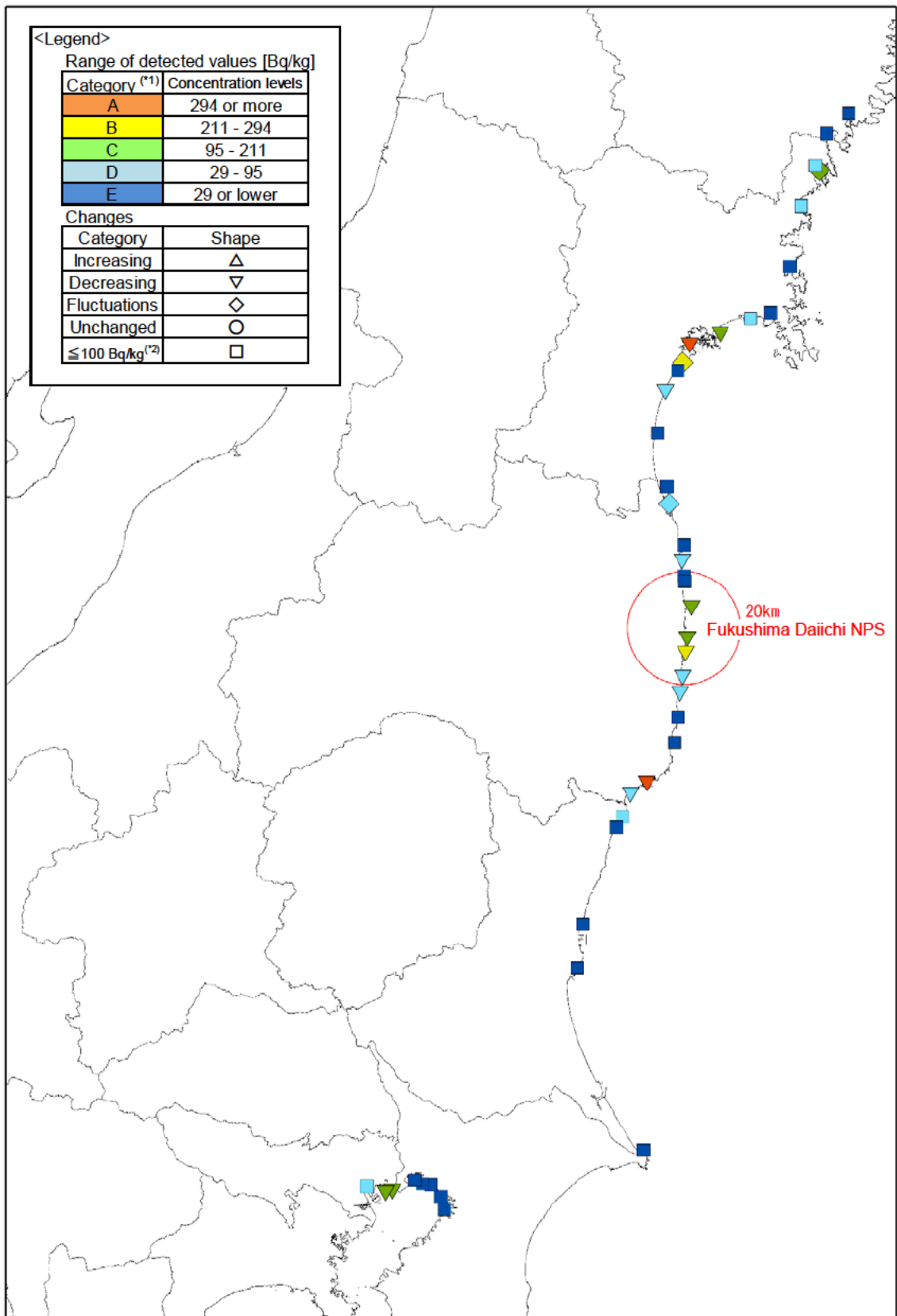


Figure 4.1.2-33 Categorization of and changes in concentration levels for coastal area sediment samples from public water areas

(*1) Categories A to E show relative concentration levels for coastal area sediment samples and cannot be compared with those for river sediment samples or lake sediment samples.

(*2) "100 Bq/kg or less" shows the average values including past years was 100 Bq/kg or less.

4.2 Results (Radionuclides other than radioactive cesium)

4.2-1 Radioactive strontium (Sr-90 and Sr-89)

(1) Public water areas

In principle, radioactive strontium was measured at locations where the radioactive cesium concentration in the sediment was high. (detection limit: approx. 1 Bq/kg for Sr-90 and approx. 2 Bq/kg for Sr-89, both for sediment samples).

From FY2016, Sr-90 was surveyed (detection limit: approx. 1 Bq/L for Sr-90 for water samples) for the water samples collected on the same day from the same public water area (lakes) sediment samples where Sr-90 concentration levels were relatively high (1.0 Bq/kg or more in FY2016 and 10 Bq/kg or more in FY2017 and thereafter). On the other hand, a survey was conducted for Sr-89 on 22 samples (13 river sediment samples and nine lake sediment samples) in FY2011, Sr-89 was not detectable in any of them, and the survey has not been conducted since FY2012.

1) Sediment

i) River sediment

Sr-90 was detected at 10 out of 19 river sediment samples surveyed in FY2018 (detection rate: 52.6%). Detected value was approximately 1 Bq/kg for each (see Table 4.2-1).

Sr-90 had been continuously detected at some locations in the Ota River and Ukedo River in Fukushima Prefecture, but the detected values have gradually decreased to fall below 2 Bq/kg from FY2014 on (see Figure 4.2-1).

ii) Lake sediment

In FY2018, 66 lake sediment samples were surveyed for Sr-90; Sr-90 was detected at 65 samples (detection rate: 98.5%) (see Table 4.2-1).

Sr-90 has been continuously detected until FY2018 in each prefecture surveyed.

When reviewed location by location, detected values have basically been at relatively low levels, and the range of measured values in FY2018 was from not detectable to 17 Bq/kg (see Figure 4.2-1).

iii) Coastal area sediment

In FY2018, 32 coastal area sediment samples were surveyed; Sr-90 was not detectable in any of them (see Table 4.2-1).

2) Water

Surveys for Sr-90 on three samples collected from water areas (lakes) were conducted in FY2018. Sr-90 was not detectable at any surveyed locations even in measurements at the lower limit values (0.037 to 0.039 Bq/L) which were even lower than 1 Bq/L.

Table 4.2-1 Detection of Sr-90 in sediment samples from public water areas (rivers, lakes, and coastal areas)

Property	Prefecture	FY2018				FY2011 - FY2018			
		Number of samples	Number of detections	Detection rate (%)	Range of measured values [Bq/kg]	Number of samples	Number of detections	Detection rate (%)	Range of measured values [Bq/kg]
Rivers	Miyagi	2	2	100.0	0.38 - 0.62	26	13	50.0	ND - 1.2
	Fukushima	6	2	33.3	ND - 0.44	98	53	54.1	ND - 12
	Ibaraki	4	3	75.0	ND - 1.1	33	18	54.5	ND - 1.8
	Tochigi	N/A	N/A	N/A	N/A	8	3	37.5	ND - 1.3
	Gunma	N/A	N/A	N/A	N/A	6	2	33.3	ND - 0.70
	Chiba	7	3	42.9	ND - 0.41	40	17	42.5	ND - 1.1
	Total	19	10	52.6	ND - 1.1	211	106	50.2	ND - 12
Lakes	Miyagi	5	5	100.0	0.57 - 1.2	43	38	88.4	ND - 2.2
	Fukushima	37	37	100.0	1.0 - 17	273	272	99.6	ND - 150
	Ibaraki	7	6	85.7	ND - 2.3	46	37	80.4	ND - 7.0
	Tochigi	4	4	100.0	0.45 - 0.86	16	15	93.8	ND - 2.2
	Gunma	9	9	100.0	0.49 - 1.8	48	47	97.9	ND - 2.6
	Chiba	4	4	100.0	0.51 - 0.69	27	21	77.8	ND - 4.4
	Total	66	65	98.5	ND - 17	453	430	94.9	ND - 150
Coastal areas	Miyagi	2	0	0.0	ND	16	0	0.0	ND
	Fukushima	30	0	0.0	ND	201	8	4.0	ND - 0.78
	Tokyo	N/A	N/A	N/A	N/A	2	0	0.0	ND
	Total	32	0	0.0	ND	219	8	3.7	ND - 0.78

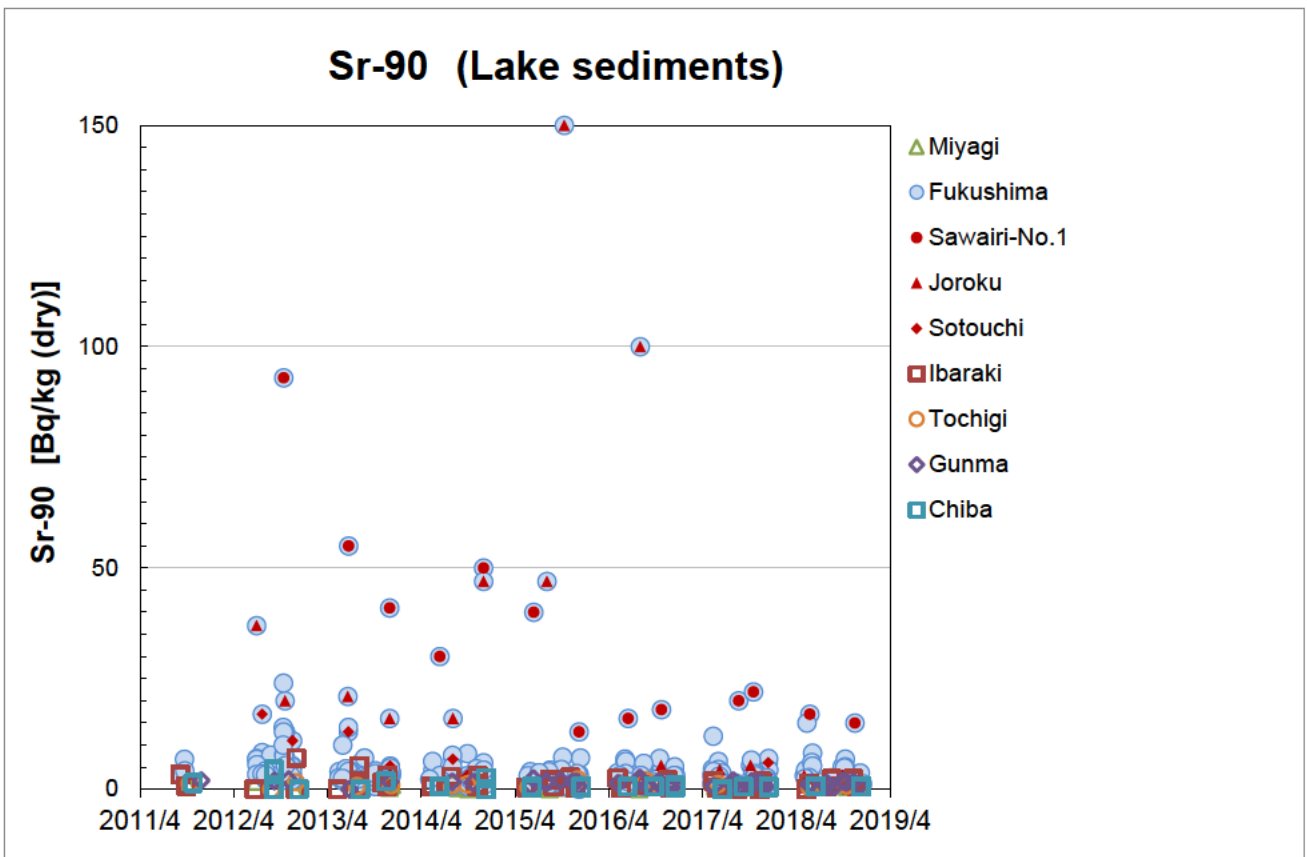
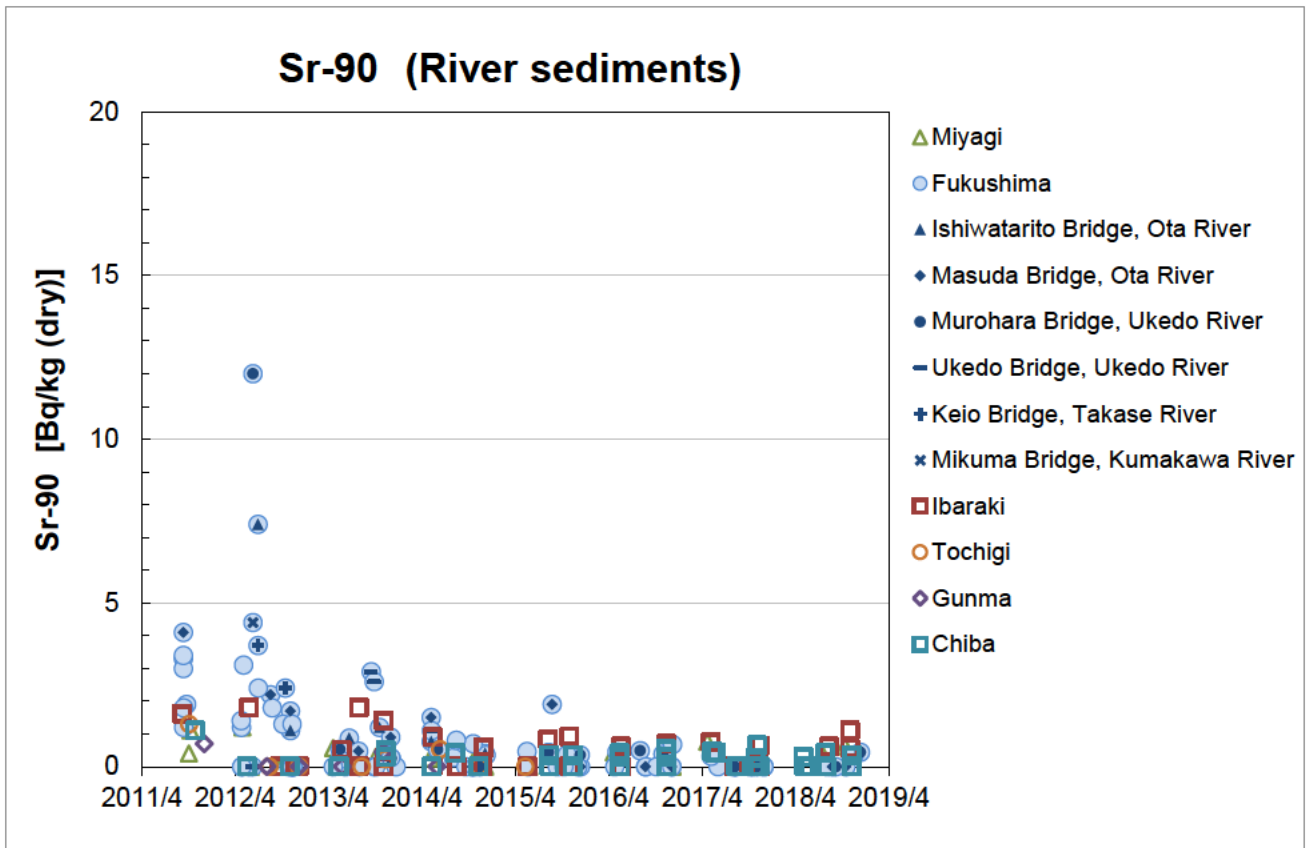


Figure 4.2-1 Detection of Sr-90 in sediment samples from public water areas
(upper: rivers; lower: lakes)

(2) Groundwater

Surveys for Sr-89 and Sr-90 were conducted on 385 groundwater samples collected in Fukushima Prefecture between January 2012 and November 2018.

An outline of these survey results is as shown in Table 4.2-2. Detected values of Sr-89 and Sr-90 were all below the detection limit (1 Bq/L).

Table 4.2-2 Detection of Sr-89 and Sr-90 in groundwater samples (all collected in Fukushima Prefecture)

Year (FY)	Sr-90				Sr-89			
	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L) (*1)	Number of samples	Number of detections	Detection rate (%)	Range of measured values (Bq/L) (*1)
FY2011	8	0	0.0	ND	8	0	0.0	ND
FY2012	60	0	0.0	ND	60	0	0.0	ND
FY2013	77	0	0.0	ND	77	0	0.0	ND
FY2014	48	0	0.0	ND	48	0	0.0	ND
FY2015	48	0	0.0	ND	48	0	0.0	ND
FY2016	48	0	0.0	ND	48	0	0.0	ND
FY2017	48	0	0.0	ND	48	0	0.0	ND
FY2018	48	0	0.0	ND	48	0	0.0	ND
Total	385	0	0.0	ND	385	0	0.0	ND

*1: Results were compiled by setting the detection limit at 1 Bq/L.

Additionally, the detection limit of Sr-90 was 0.0002 Bq/L in FY2011, and 1 Bq/L thereafter, and similarly, the detection limit of Sr-89 was 0.001 Bq/L in FY2011, and 1 Bq/L thereafter.

In FY2011 survey (calendar year 2012), Sr-90 was detected in all eight samples, with detected values ranging from 0.0004 to 0.0029 Bq/L. Similarly, while the detection limit for Sr-89 was 0.001 Bq/L in FY2011 (calendar year 2012), Sr-89 in all eight samples was below the detection limit.

4.2-2 Other γ -ray emitting radionuclides

Apart from the aforementioned radionuclides (Cs-134, Cs-137, Sr-89 and Sr-90), measurement results for water samples and sediment samples using a germanium semiconductor detector were analyzed from FY2011 to FY2018 to obtain activity concentrations of accident-derived radionuclides (Ag-110m, Te-129m, Nb-95, Sb-125 and Ce-144, etc.¹²) and major naturally occurring radionuclides such as K-40. The summary of the results is as shown in Table 4.2-3 and Table 4.2-4.

Among the detected radionuclides, no artificial radionuclides were detected in water samples for FY2011 and FY2012, while two types of radionuclides, Ag-110m and Sb-125, were detected in sediment samples with detection rates of 1% or less. Since FY2013, neither radionuclide has been detected.

Although six naturally occurring radionuclides (K-40, Pb-212, Pb-214, Tl-208, Ac-228 and Bi-214) were detected, K-40 is a naturally occurring radionuclide entrained during the Earth's formation, while other species are all either uranium series or thorium series radionuclides, which are widely distributed in nature including the Earth's crust.

Table 4.2-3 Detection of other radionuclides (Water)

Year (FY)	Number of samples	Major detected artificial radionuclide		Major detected naturally occurring radionuclide	
		Nuclide	Detection rate and detected values	Nuclide	Detection rate
FY2011	1,755	-	-	K-40	10%
FY2012	3,518	-	-	K-40	6%
FY2013	3,860	-	-	K-40	13%
FY2014	3,856	-	-	K-40	10%
FY2015	3,916	-	-	K-40	7%
				Pb-212	7%
				Pb-214	9%
FY2016	3,890	-	-	K-40	8%
				Pb-212	17%
				Pb-214	10%
FY2017	3,836	-	-	K-40	7%
				Pb-214	8%
FY2018	3,936	-	-	K-40	8%
				Pb-214	7%

¹² Among the accident-derived radionuclides, I-131 was investigated in water samples from public water areas (3,111 river water samples, 1,416 lake water samples, and 715 coastal area water samples) and sediment samples (3,073 river sediment sample, 877 lake sediment samples, and 393 coastal area sediment samples) from FY 2011 to FY 2012, and in groundwater samples (3,793 samples) from FY 2011 to FY 2014. In none of these samples was I-131 detected (detection limit values: 1 Bq/L for water and 10 Bq/kg for sediment).

Table 4.2-4 Detection of other radionuclides (Sediment)

Year (FY)	Number of samples	Major detected artificial radionuclide		Major detected naturally occurring radionuclide	
		Nuclide	Detection rate and detected values	Nuclide	Detection rate
FY2011	1,559	Ag-110m	4 samples (0.26%) 46 - 170 Bq/kg	K-40	79%
				Pb-212	41%
				Pb-214	16%
				Tl-208	14%
FY2012	2,885	Ag-110m	26 samples (0.90%) 7.9 - 350 Bq/kg	Ac-228	41%
				Bi-214	43%
		Sb-125	3 samples (0.10%) 140 - 420 Bq/kg	K-40	97%
				Pb-212	75%
FY2013	3,062	-	-	Pb-214	44%
				Tl-208	39%
				Ac-228	25%
				Bi-214	25%
				K-40	91%
FY2014	3,035	-	-	Pb-212	49%
				Pb-214	23%
				Tl-208	23%
				Ac-228	24%
				Bi-214	24%
FY2015	3,158	-	-	K-40	91%
				Pb-212	48%
				Pb-214	24%
				Tl-208	24%
				Ac-228	32%
FY2016	3,088	-	-	Bi-214	60%
				K-40	88%
				Pb-212	63%
				Pb-214	67%
				Tl-208	37%
FY2017	3,056	-	-	Ac-228	35%
				Bi-214	66%
				K-40	92%
				Pb-212	64%
				Pb-214	75%
FY2018	3,128	-	-	Tl-208	40%
				Ac-228	45%
				Bi-214	35%
				K-40	92%
				Pb-212	73%
FY2018	3,128	-	-	Pb-214	80%
				Tl-208	46%
				Ac-228	41%
				Bi-214	37%
				K-40	93%
FY2018	3,128	-	-	Pb-212	71%
				Pb-214	83%
				Tl-208	44%

Note: Detection limits of artificial radionuclides (detected radionuclides): 7 - 180 Bq/kg for Ag-110m, and 130 - 330 Bq/kg for Sb-125

Part 3: Other Radioactive Material Monitoring Conducted Nationwide (FY2018)

1 Outline of the Monitoring

1.1 Covered monitoring

As other radioactive material monitoring activity conducted nationwide, the results of the Monitoring of Environmental Radioactivity Levels in FY2018, which was conducted in FY2018 by the Nuclear Regulation Authority for the purpose of clarifying the existence or nonexistence of the effects from nuclear facilities, etc. nationwide, are compiled here.

Monitoring locations are as shown in Table 1.1-1 and Figure 1.1-1. See the relevant website for more details. (<http://www.env.go.jp/air/rmcm/result/nsr.html>; Japanese only)

1.2 Compilation methods

Measurement data are available on the website of Environmental Radioactivity and Radiation in Japan.¹³

Data for this report were collected from this website under the following search criteria.

- (i) Period: April 2018 to March 2019 (Published on Mar 23, 2020)
- (ii) Coverage: Nationwide
- (iii) Targets: All radionuclides
- (iv) Targeted samples: Inland water (river water, lake water, freshwater), seawater, sediment (river sediment, sea sediment)

¹³ Environmental Radioactivity and Radiation in Japan "Environmental Radiation Database"
<http://search.kankyo-hoshano.go.jp/servlet/search.top>. (Japanese only, accessed on Mar 23, 2020)

Table 1.1-1 Locations for the Monitoring of Environmental Radioactivity Levels (30 in total)

No.	Prefecture	Property	Sampling locations	Water	Sediment
1	Hokkaido	Lake	Oyafuru, Ishikari City (Lake Barato)	○	-
2		Coastal area	Yoichi Town, Yoichi County (Yoichi Bay)	○	○
3	Aomori	Coastal area	Fukaura Town, Nishitsugaru County (off Kasose)	○	○
4		Coastal area	Hiranai Town, Higashitsugaru County (Mutsu Bay)	○	○
5	Iwate	Coastal area	Hirono Town, Kunohe County (off Taneichi)	○	○
6	Akita	River	Asahikawa, Akita City	○	-
7	Fukushima	Coastal area	Soma City (off Haragama Beach)	○	○
8		River	Zainiwasaka, Fukushima City	○	-
9	Ibaraki	Lake	Kasumigaura	○	-
10		Coastal area	Tokai Village, Naka County (off the NPS)	○	○
11	Chiba	Coastal area	Tokyo Bay (off Sodegaura City)	○	○
12	Kanagawa	Coastal area	Yokosuka City (Odawa Bay)	○	○
13	Niigata	Lake	Shichikuyama, Chuo Ward, Niigata City	○	-
14		Coastal area	off Niigata Port	○	○
15	Fukui	Lake	Inogaiké Pond, Tsuruga City	○	-
16	Nagano	Lake	Lake Suwa	○	-
17	Aichi	Coastal area	Tokoname City (off Kosugaya)	○	○
18	Mie	River	Seki Town, Kameyama City (Suzuka River)	○	-
19	Kyoto	Freshwater	Tenno, Ogura Town, Uji City	○	-
20	Osaka	Coastal area	Osaka City (Entrance to Osaka Port)	○	○
21	Tottori	River	Katamo (Katamo River System)	○	○
22		River	Kawakami (Kawakami River System)	○	○
23		River	Hotani (Iwakura River System)	○	○
24		River	Bessho (except for Katamo River System)	○	○
25		River	Kannokura (Oshika River System)	○	○
26	Hiroshima	River	Kawate Town, Shobara City (Saijo River)	○	-
27	Yamaguchi	Coastal area	Ajisu, Yamaguchi City (Yamaguchi Bay)	○	○
28	Fukuoka	Coastal area	Higashiminato Town, Moji Ward, Kitakyushu City (off Chichisaki)	○	○
29	Kagoshima	Coastal area	Minamisatsuma City (off the mouth of Manose River)	○	○
30	Okinawa	Coastal area	Katsuren White Beach, Uruma City	○	○

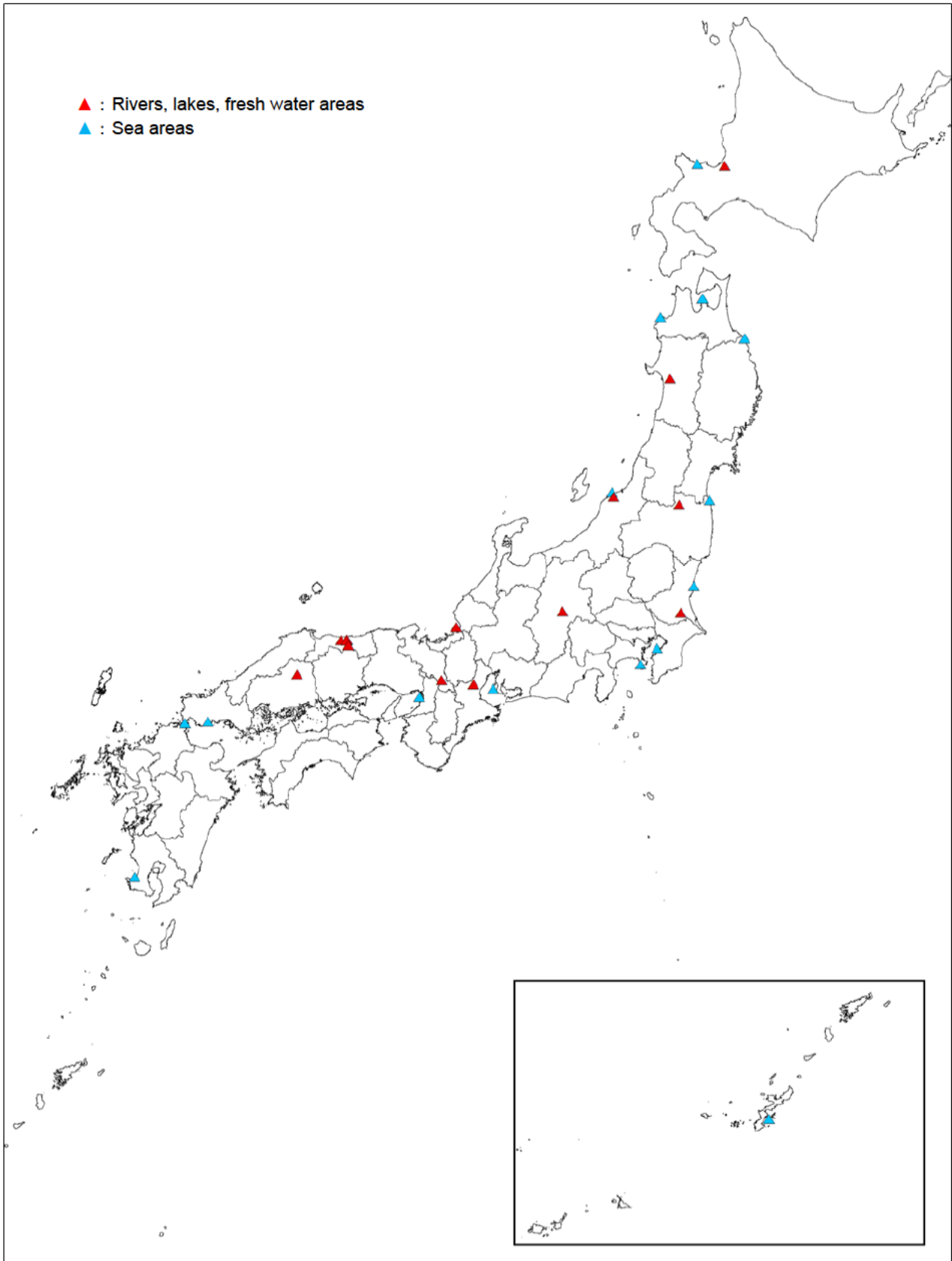


Figure 1.1-1 Locations for the Monitoring of Environmental Radioactivity Levels

2 Results

2.1 Water

(1) Inland water¹⁴

In the Monitoring of Levels in FY2018, nine radionuclides (Be-7, K-40, U-234, U-235, U-238, Cs-134, Cs-137, I-131 and Sr-90) were reported from inland water samples, as shown in Table 2.1-1.

A comparison with the results of the Monitoring of Levels for the past twenty years (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014) revealed that all these radionuclides were considered to be within the past measurement trends (see Figure 2.1-1).

Table 2.1-1 Detection of radionuclides in the Monitoring of Levels [inland water]

Nuclides		Number of reported data	Number of detections	Range of measured values (Bq/L)	Range of the past measurement records (Bq/L) (*1)
Naturally Occurring radionuclides	Be-7	7	4	ND - 0.0095	ND - 0.034
	K-40	10	10	0.019 - 0.17	0.0067 - 0.30
	U-234	10	10	0.0011 - 0.0057	0.00042 - 0.015
	U-235	10	0	ND	ND - 0.00054
	U-238	10	10	0.00086 - 0.0048	ND - 0.013
Artificial radionuclides	Cs-134	9	1	ND - 0.0017	ND - 0.015
	Cs-137	9	5	ND - 0.014	ND - 0.041
	I-131	9	0	ND	ND - 0.013
	Sr-90	10	8	ND - 0.0023	ND - 0.0050

(*1) Results of the Monitoring of Levels from FY1998 to FY2017 (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014)

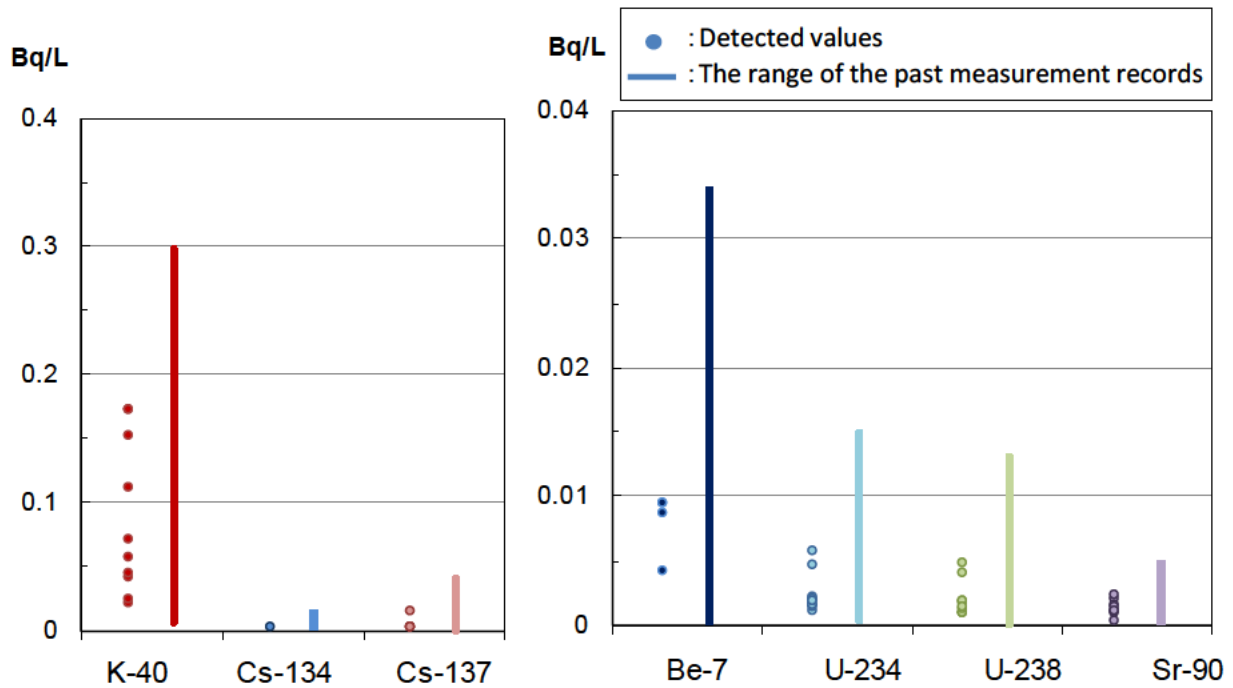


Figure 2.1-1 Detection of radionuclides in the Monitoring of Levels [inland water]

¹⁴ This report only covers data for river water, lake water, and freshwater in the Monitoring of Levels.

(2) Seawater

In the Monitoring of Levels in FY2018, six radionuclides (Be-7, K-40, Cs-134, Cs-137, I-131 and Sr-90) were reported from seawater samples, as shown in Table 2.1-2.

A comparison with the results of the Monitoring of Levels for the past twenty years (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014) revealed that detected values for all above-mentioned radionuclides were within the past measurement trends (see Figure 2.1-2).

Table 2.1-2 Detection of radionuclides in the Monitoring of Levels [seawater]

Nuclides		Number of reported data	Number of detections	Range of measured values (Bq/L)	Range of the past measurement records (Bq/L) (*1)
Naturally occurring radionuclides	Be-7	2	0	ND	ND
	K-40	16	16	0.16 - 12	0.078 - 15
Artificial radionuclides	Cs-134	16	0	ND	ND
	Cs-137	16	1	ND - 0.0018	ND - 0.064
	I-131	12	0	ND	ND
	Sr-90	15	15	0.00076 - 0.0014	ND - 0.0022

(*1) Results of the Monitoring of Levels from FY1998 to FY2017 (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014)

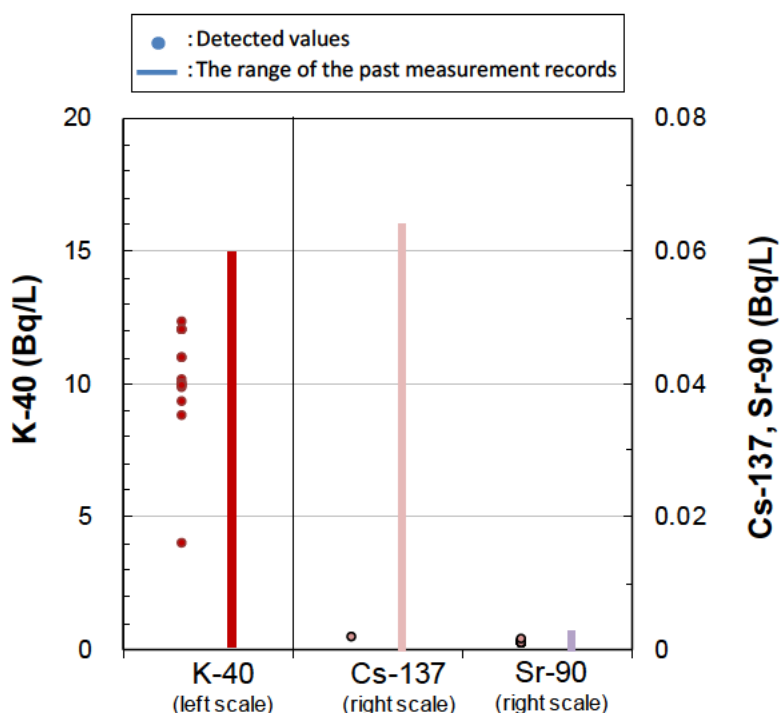


Figure 2.1-2 Detection of radionuclides in the Monitoring of Levels [seawater]

2.2 Sediment

(1) Inland water sediment (river sediment)

In the Monitoring of Levels in FY2018, three radionuclides (U-234, U-235 and U-238) were reported from inland water sediment samples (river sediment), as shown in Table 2.2-1.

A comparison with the results of the Monitoring of Levels for the past twenty years revealed that detected values for all three detected radionuclides were within the past measurement trends (see Figure 2.2-1).

Table 2.2-1 Detection of radionuclides in the Monitoring of Levels [Inland water sediment (river sediment)]

Nuclides		Number of reported data	Number of detections	Range of measured values (Bq/kg)	Range of the past measurement records (Bq/kg) (*1)
Naturally occurring radionuclides	U-234	5	5	17 - 29	6.5 - 64
	U-235	5	5	0.55 - 1.0	0.20 - 2.7
	U-238	5	5	17 - 30	6.6 - 66

(*1) Results of the Monitoring of Levels from FY1998 to FY2017 (excluding the results reported in mg/kg units)

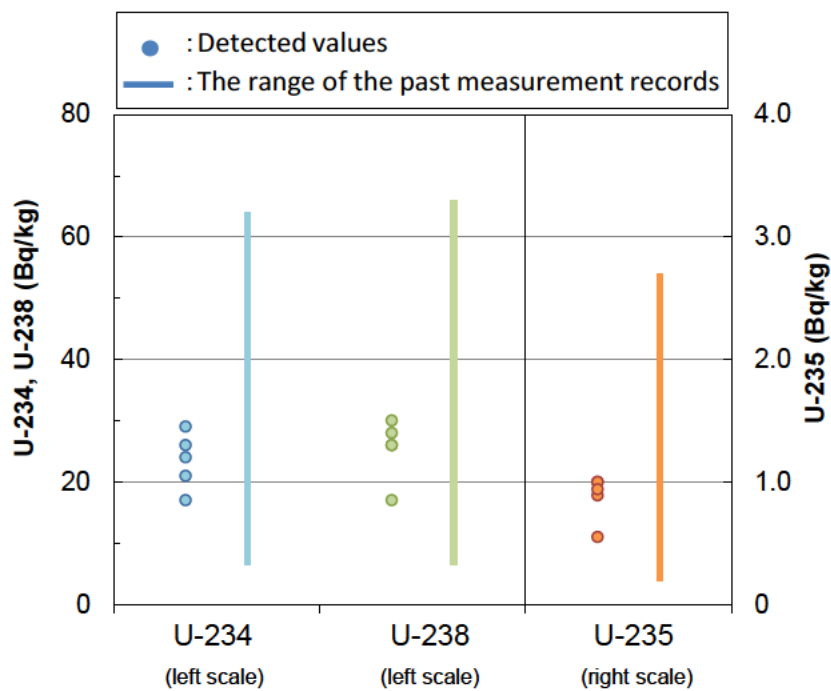


Figure 2.2-1 Detection of radionuclides in the Monitoring of Levels [Inland water sediment [(river sediment)]]

(2) Sea sediment

In the Monitoring of Levels in FY2018, six radionuclides (Be-7, K-40, Cs-134, Cs-137, and I-131) were reported from seawater sediment samples as shown in Table 2.2-2.

Comparison with the results of the Monitoring of Levels for the past twenty years (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014) revealed that detected values at two sampling locations for Cs-137 exceeded the range of the past measurement (see Figure 2.2-2). However, both values are at the same level as those of the past detected values and measurements in the vicinity¹⁵, and were within the past measurement trends.

Table 2.2-2 Detection of radionuclides in the Monitoring of Levels [Sea sediment]

Nuclides		Number of reported data	Number of detections	Range of measured values (Bq/kg)	Range of the past measurement records (Bq/kg) (*1)
Naturally occurring radionuclides	Be-7	4	1	ND - 5.2	ND - 13
	K-40	15	15	78 - 930	33 - 750
Artificial radionuclides	Cs-134	15	2	ND - 3.1	ND - 4.4
	Cs-137	15	10	ND - 33	ND - 13
	I-131	8	0	ND	ND
	Sr-90	15	0	ND	ND - 0.41

(*1) Results of the Monitoring of Levels from FY1998 to FY2017 (excluding data of artificial radionuclides from Mar 11, 2011 to Mar 10, 2014)

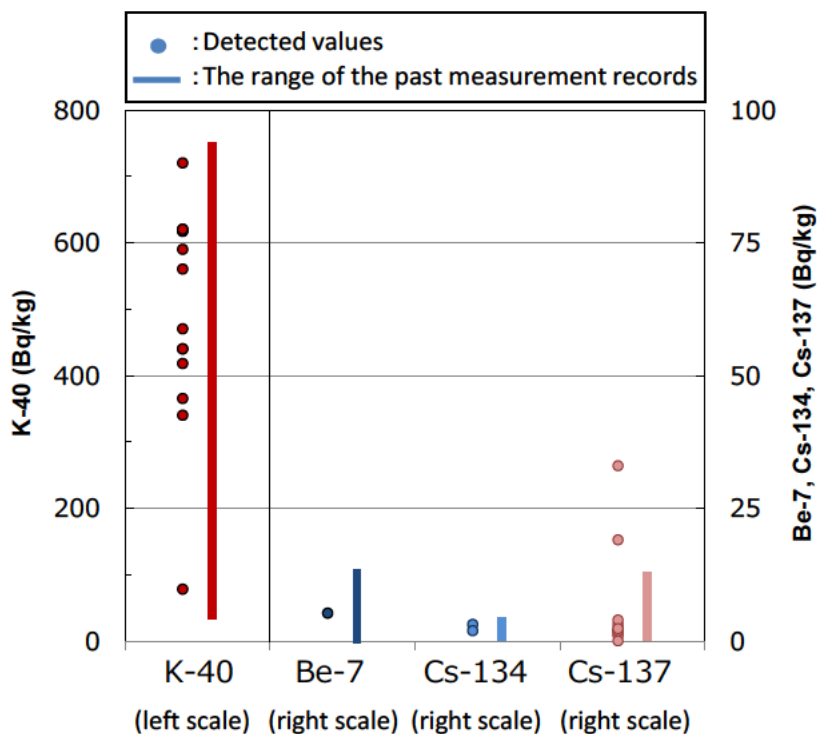


Figure 2.2-2 Detection of radionuclides in the Monitoring of Levels [Sea sediment]

¹⁵ Post-Earthquake Monitoring and Sea Area Monitoring (conducted by NRA)