FY2018 Radioactive Material Monitoring of Aquatic Organisms (October-November)

1. Survey Overview

Samples of aquatic organisms (algae, aquatic insects, crustaceans, shellfishes, fishes, and amphibians, etc.) were mainly collected in Fukushima Prefecture and concentrations of radioactive cesiums and radioactive strontium in the samples were measured (survey period: October 16 to November 7, 2018).

In order to clarify the environment of the water areas where aquatic organisms live, surveys were also conducted on general items concerning water and sediments and activity concentrations in these water areas.

The following water areas were selected based on the results of the past Radioactive Material Monitoring of Aquatic Organisms, Radioactive Material Monitoring in the Water Environment in and around Fukushima Prefecture, the measurement of radioactive materials in fisheries products conducted by other relevant organizations, and interviews with local fishermen.

(i) Rivers: Abukuma River, Uda River, Mano River, Niida River, and Ota River

(ii) Lakes: Lake Hayama, Lake Akimoto, and Lake Inawashiro

(iii) Sea areas: Off the mouth of the Abukuma River, off Soma City, and off Iwaki City

○ Survey locations and dates

Area		Targeted water areas	Zone	Item	Survey dates	Remarks
River area	A	Abukuma River	Shinfuna Bridge to the Iino Dam; Harase River (a tributary)	Aquatic organisms sampling	October 17, and 19, 2018	Algae/Plants, Crustanceans, Shellfishes, Fishes, Amphibians, Fallen leaves, etc.
				Water/sediment sampling	October 25, 2018	(Water sampling) A-1,A-2 (Sediment sampling) A-1,A-2
	B		Confluence with the Surikami River (a tributary) to Taisho Bridge;Surikami River (a tributary)	Aquatic organisms sampling	October 19, and 20, 2018	Algae/Plants, Aquatic insects, Crustanceans, Fishes, Fallen leaves, etc.
				Water/sediment sampling	October 25, 2018	(Water sampling) B-2,B-3 (Sediment sampling) B-2,B-3
	C	Uda River	Around Horisaka Bridge	Aquatic organisms sampling	October 20, 2018	Algae/Plants, Aquatic insects, Fishes, Fallen leaves, etc.
				Water/sediment sampling	October 23, 2018	(Water sampling) C-6 (Sediment sampling) C-6
	D	Mano River	Furukawa Bridge to Sakurada Bridge	Aquatic organisms sampling	October 23, and 31, 2018	Algae/Plants, Crustanceans, Fishes, Amphibians, Fallen leaves, etc.
				Water/sediment sampling	October 23, 2018	(Water sampling) D-4a (Sediment sampling) D-4a
	E	Niida River	Around Monzen Bridge	Aquatic organisms sampling	October 21, 2018	Algae/Plants, Aquatic insects, Fishes, Fallen leaves, etc.
				Water/sediment sampling	October 24, 2018	(Water sampling) E-2a (Sediment sampling) E-2a
	F	Ota River	Yaigomesaka Bridge to Daimonji Bridge	Aquatic organisms sampling	October 24, 2018	Algae/Plants, Crustanceans, Shellfishes, Fishes, Amphibians, Fallen leaves, etc.
				Water/sediment sampling	October 24, 2018	(Water sampling) F-1 (Sediment sampling) F-1
Lake area	G	Lake Hayama		Aquatic organisms sampling	October 22, and 31, 2018	Algae/Plants, Fishes, Amphibians, Fallen leaves, etc.
				Water/sediment sampling	October 22, 2018	(Water sampling) G-1,G-4 (Sediment sampling) G-1,G-4
	H	Lake Akimoto		Aquatic organisms sampling	October 18, and 19, November 7, 2018	Algae/Plants, Crustanceans, Shellfishes, Fishes, Fallen leaves, etc.
				Water/sediment sampling	October 18, 2018	(Water sampling) H-1 (Sediment sampling) H-1
	I	Lake Inawashiro	North lakeside	Aquatic organisms sampling	October 17, 2018	Fishes
	J		South lakeside	Aquatic organisms sampling	October 17, 2018	Algae/Plants, Aquatic insects, Crustanceans, Shellfishes, Fishes, Amphibians
				Water/sediment sampling	October 17, 2018	(Water sampling) J-1 (Sediment sampling) J-1
Sea area	K	Off the mouth of the Abukuma River	Sea area in front of the Abukuma River Estuary	Aquatic organisms sampling	October 22, 2018	Crustanceans, Fishes
				Water/sediment sampling	October 17, 2018	(Water sampling) K-3 (Sediment sampling) K-3
	L	Off Soma City	Matsukawaura Lagoon	Aquatic organisms sampling	October 20, 21, and 23, 2018	Seaweeds/Algae, Shellfishes, Fishes
				Water/sediment sampling	October 17, 2018	(Water sampling) L-2 (Sediment sampling) L-2
	M	Off Iwaki City	Offshore of Hisanohama and Coast of Hisanohama	Aquatic organisms sampling	October 16, 2018	Sea urchins, Shellfishes, Fishes
				Water/sediment sampling	October 16, 2018	(Water sampling) M-2 (Sediment sampling) M-2

2. Survey Items and Locations, etc.

2.1 Survey Items

For all samples of aquatic organisms, analysis of radioactive cesiums (Cs-134, Cs-137) was conducted. Additionally, for samples of large fish, etc. analysis of radioactive strontium (Sr-90) was also conducted.

With regard to surveys of water and sediments, locations where aquatic organism samples were scheduled to be collected and where clay particles and coarse particulate organic matters (Fallen leaves at the bottom, etc.: hereinafter called "CPOMs") are supposed to accumulate due to inflows from the surrounding environment, etc. were selected for the analysis of radioactive materials and general survey items.

Survey items and samples for aquatic organisms, water, and sediments are as shown in the following table.

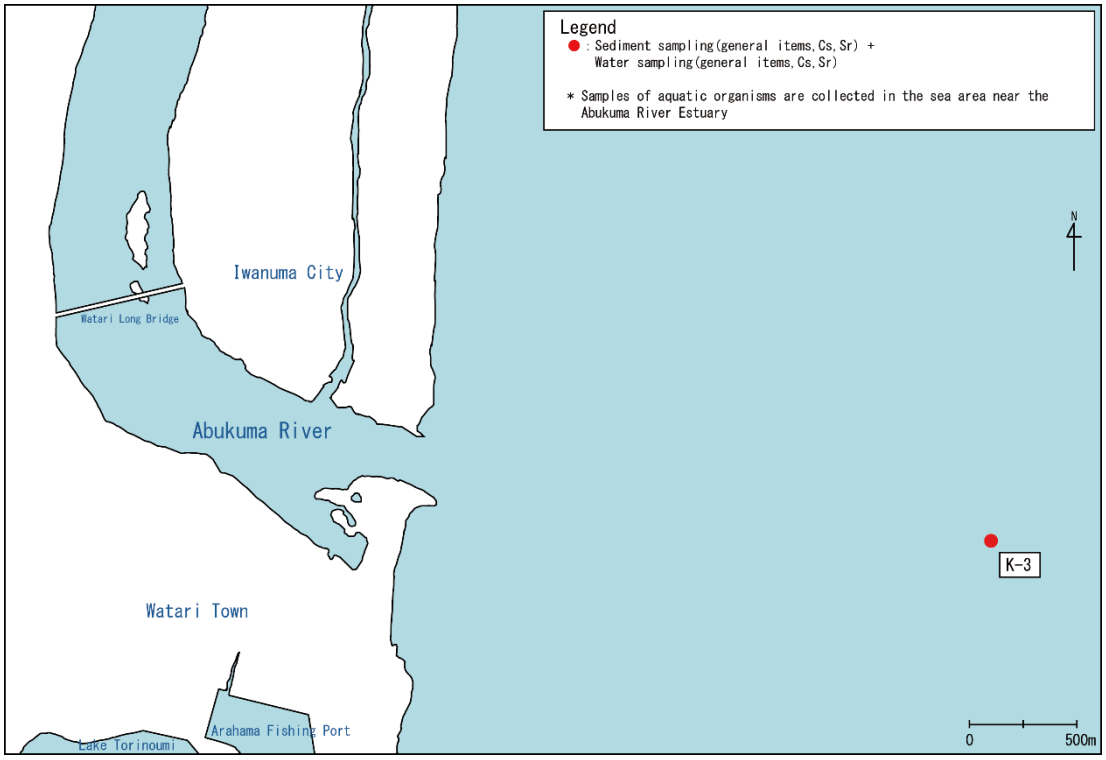
○ Survey targets and items

Target	Measurement item		Analyzed samples
Aquatic Organisms	Radioactive materials	Radioactive cesiums (Cs-134,Cs-137)	All samples
		Radioactive strontium (Sr-90)	Large fish, etc.
Water	Radioactive materials	Radioactive cesiums (Cs-134,Cs-137)	Samples collected at one to four locations for each water area
		Radioactive strontium (Sr-90)	Samples collected at one location for each water area
	General items	pH	Samples collected at one to four locations for each water area
		BOD (Biochemical oxygen demand)	
		COD (Chemical oxygen demand)	
		DO (Dissolved oxygen level)	
		Electric conductivity	
		Salinity	
		TOC (Total organic carbon)	
		SS (Suspended solids)	
		Turbidity	
Sediments	Radioactive materials	Radioactive cesiums (Cs-134,Cs-137)	Samples collected at one to four locations for each water area
		Radioactive strontium (Sr-90)	Samples collected at one location for each water area
	General items	pH	Samples collected at one to four locations for each water area
		Oxidation-reduction potential	
		Water content	
		IL (Ignition loss)	
		TOC (Total organic carbon)	
		Soil particle density	
		Grain size distribution	

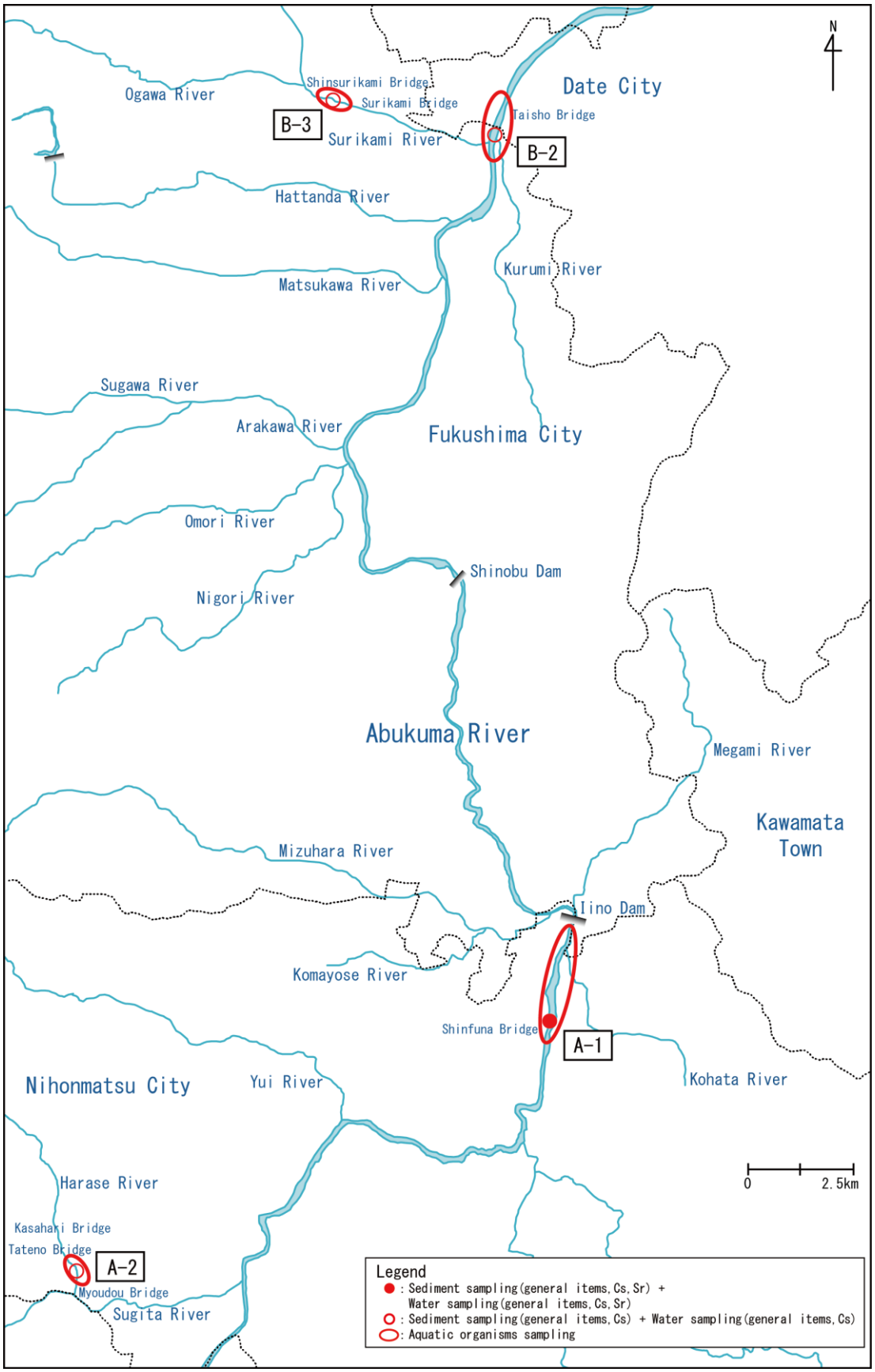
2.2 Survey Locations at Respective Water Areas

(1) Abukuma River System (Location A along the Abukuma River; Location B along the Abukuma River; Location K off the mouth of the Abukuma River).

As water areas where clay particles and CPOMs are supposed to accumulate topographically, Location A along the Abukuma River was set from the Harase River (a tributary of the Abukuma River) and Shinfuna Bridge (Nihonmatsu City, Fukushima Prefecture) to the Iino Dam, and Location B along the Abukuma River was set from the confluence with the Surikami River to Taisho Bridge (Date City, Fukushima Prefecture) as well as the zone where a tributary of the Surikami River inflows. Additionally, Location K was set off the mouth of the Abukuma River in order to survey the sea area in front of the mouth of the Abukuma River, where the outflow of radioactive materials through the Abukuma River is suspected.



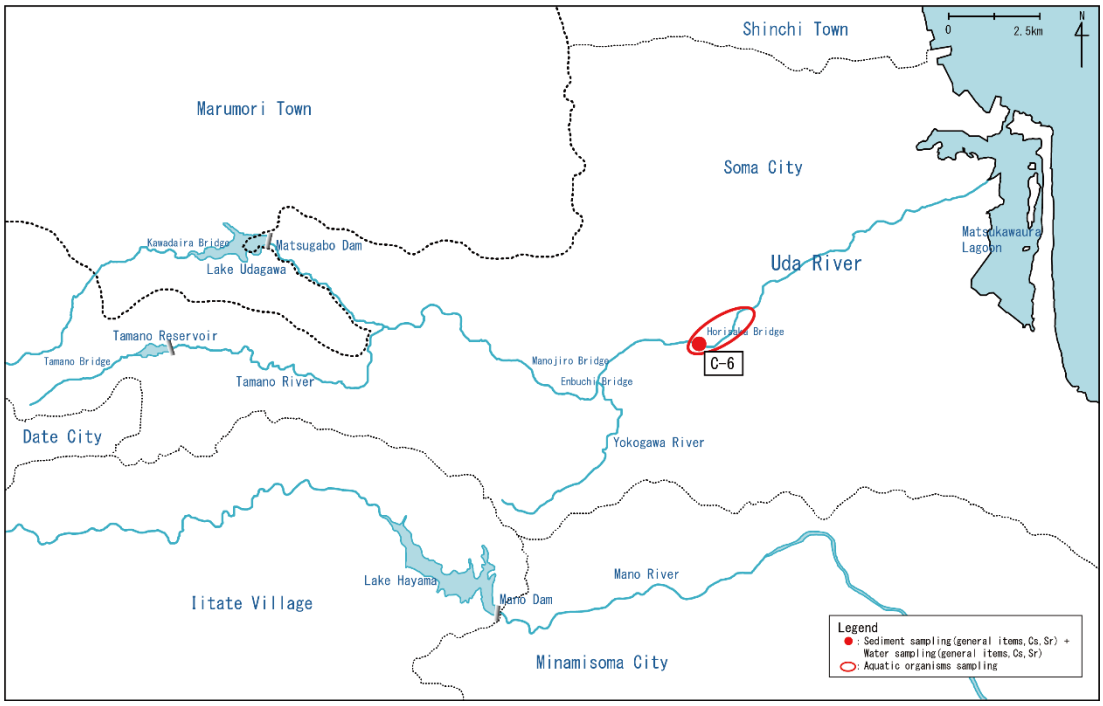
Detailed map showing Location K off the mouth of the Abukuma River



Map showing Location A and Location B along the Abukuma River

(2) Location C along the Uda River

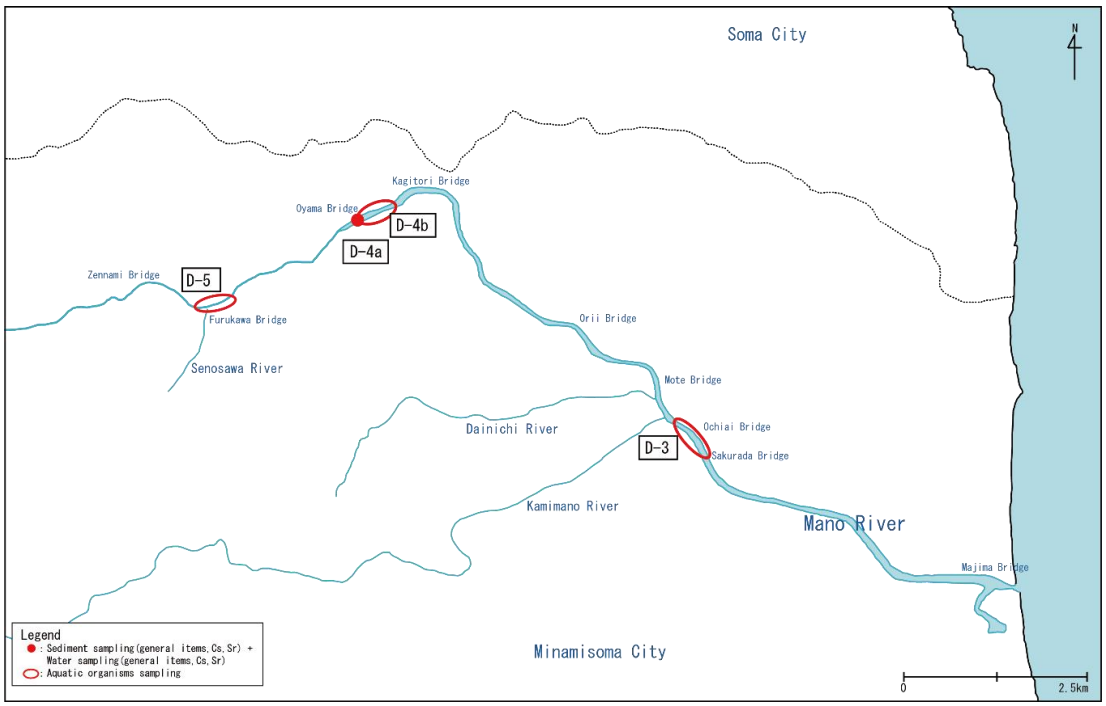
Surveys were started in the autumn term of FY2012 and conducted around Horisaka Bridge in 2018.



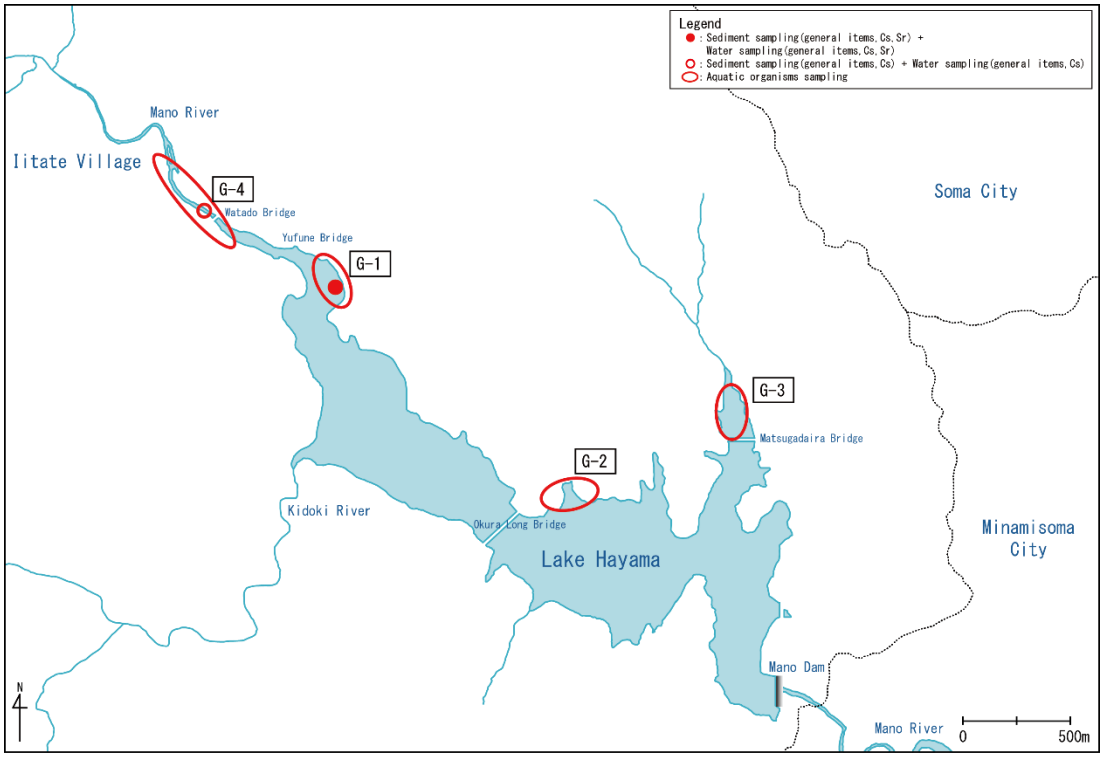
Detailed map showing Location C along the Uda River

(3) Mano River System (Location D along the Mano River; Location G in Lake Hayama)

Surveys were conducted at Location D along the Mano River, which covers from Furukawa Bridge to Sakurada Bridge (Kashima Ward, Minamisoma City, Fukushima Prefecture), and at Location G in Lake Hayama (Mano Dam), which covers the lake as a whole and inflow points.



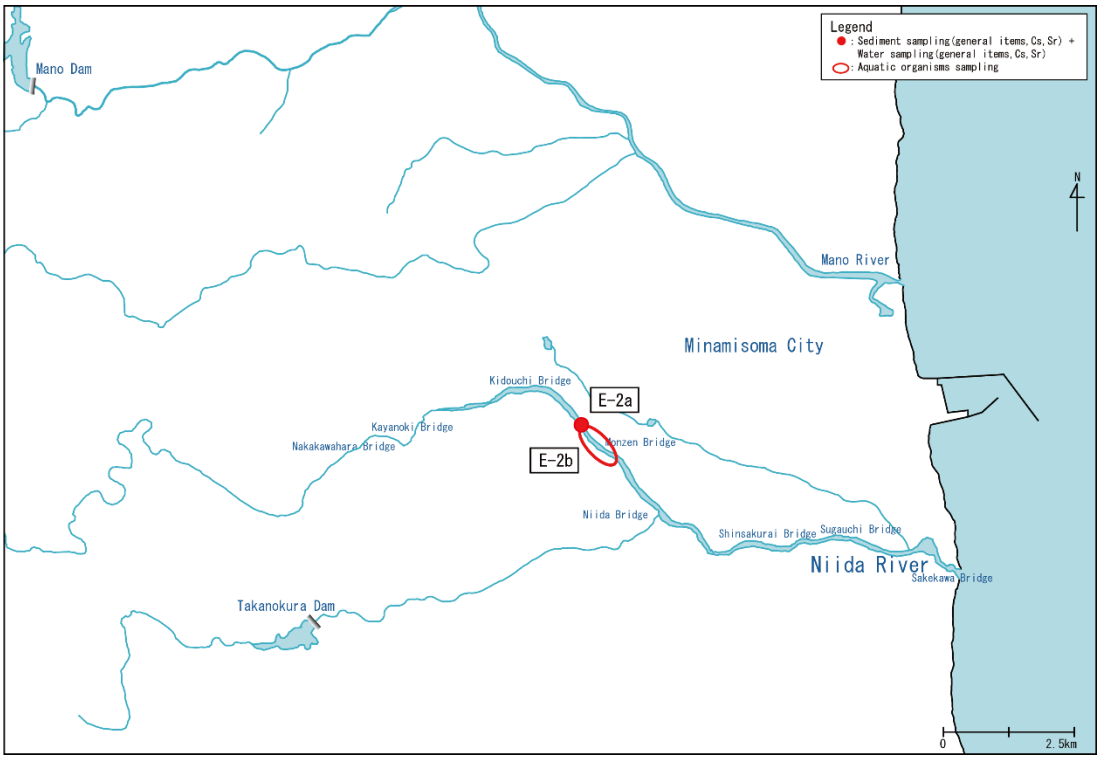
Detailed map showing Location D along the Mano River



Detailed map showing Location G in Lake Hayama (Mano Dam)

(4) Location E along the Niida River

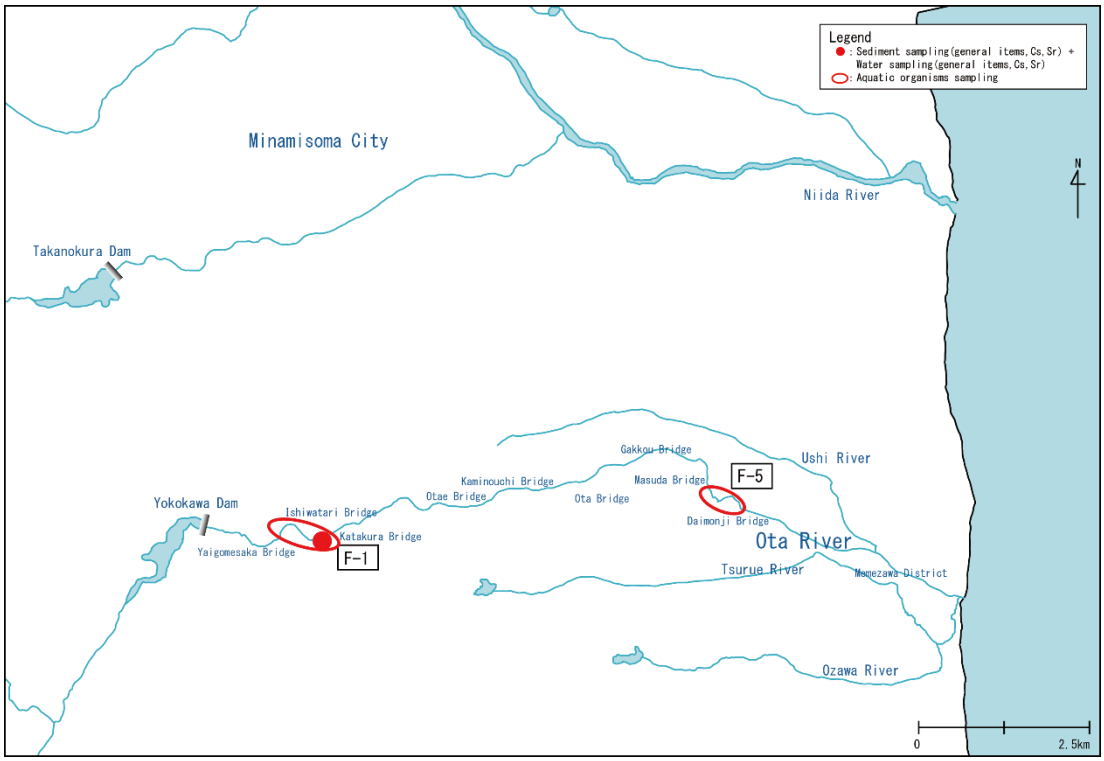
Surveys were conducted around Monzen Bridge.



Detailed map showing Location E along the Niida River

(5) Location F along the Ota River

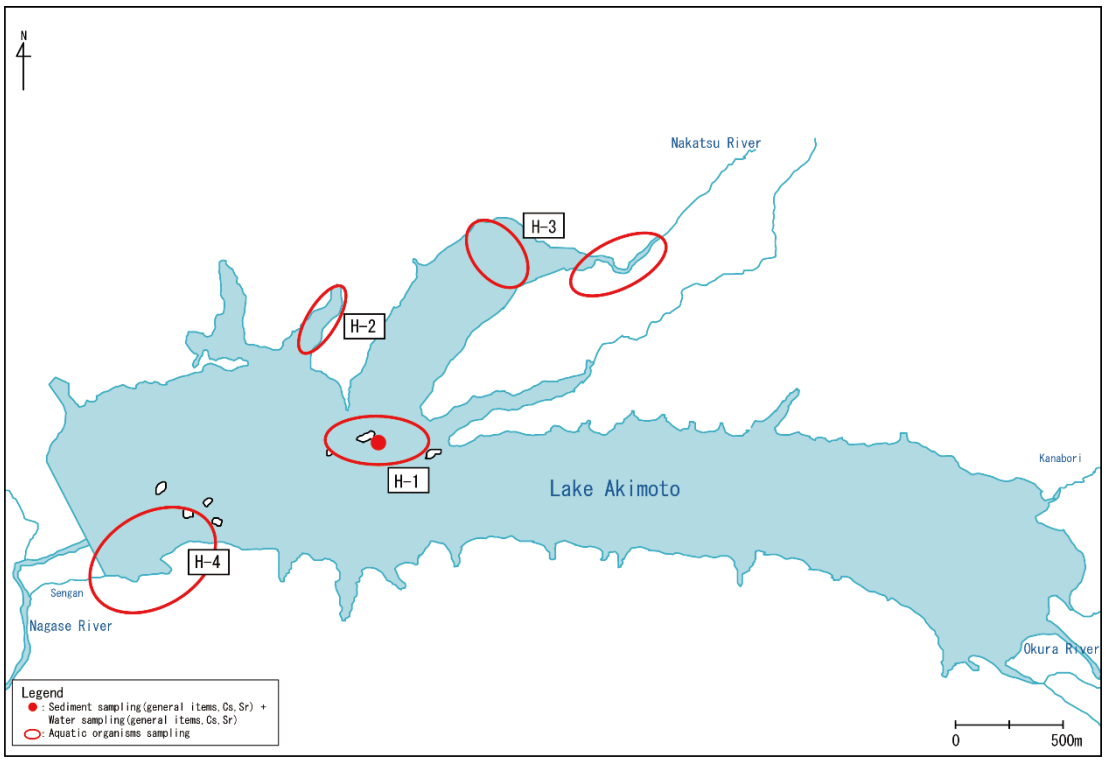
Surveys were started in the autumn term of FY2012 and conducted around Yaigomesaka Bridge and Daimonji Bridge in 2017.



Detailed map showing Location F along the Ota River

(6) Location H in Lake Akimoto

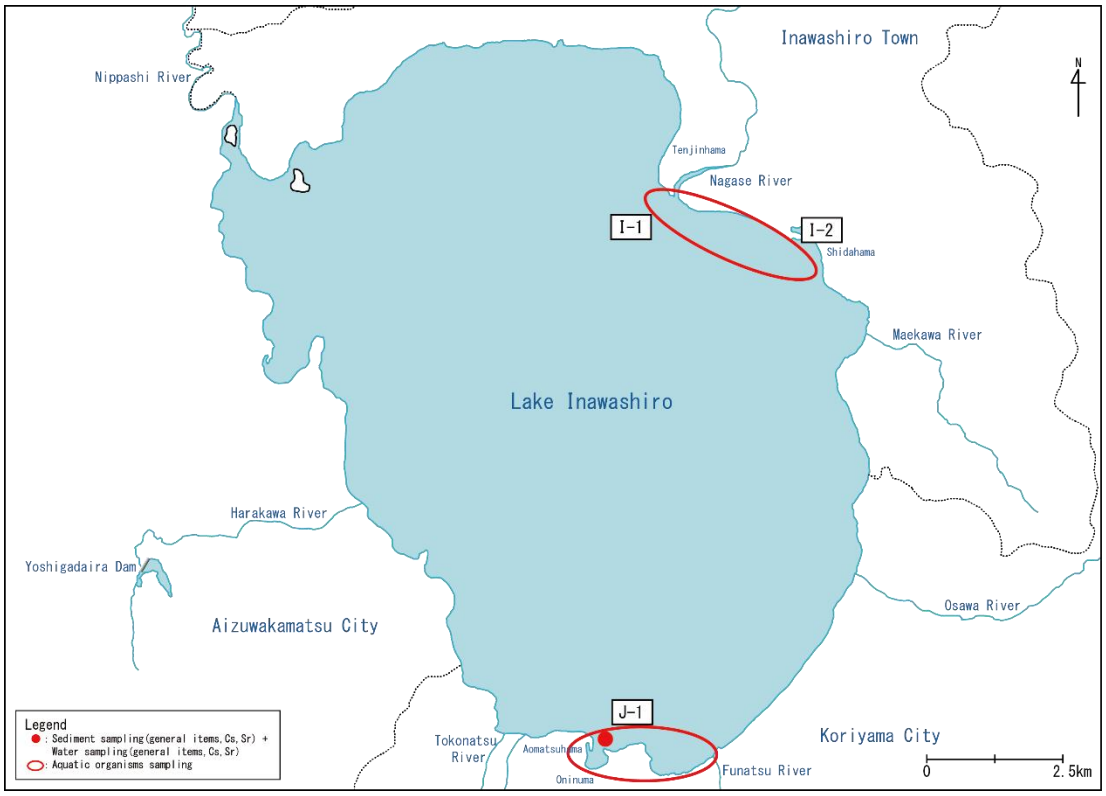
Surveys were conducted the center of Lake Akimoto, around the point where the Nakatsu River inflows into Lake Akimoto, and around Lake Akimoto.



Detailed map showing Location H in Lake Akimoto

(7) Location I (North Lakeside) and Location J (South Lakeside) in Lake Inawashiro

Surveys were conducted at around the point where the Nagase River flows into Lake Inawashiro and at the south lakeside.

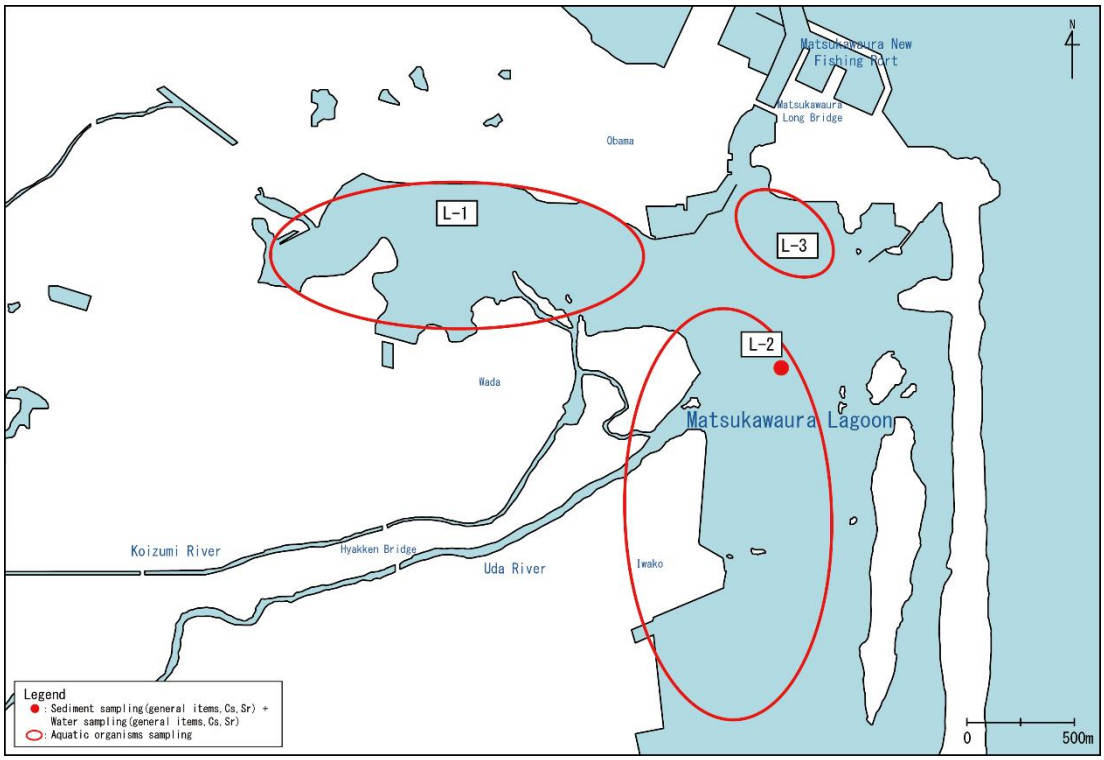


Detailed map showing Location I (north lakeside) and Location J (south lakeside) in Lake Inawashiro

(8) Location L off Soma City

Surveys were conducted within the Matsukawaura Lagoon, centering on the estuary region of the Uda River.

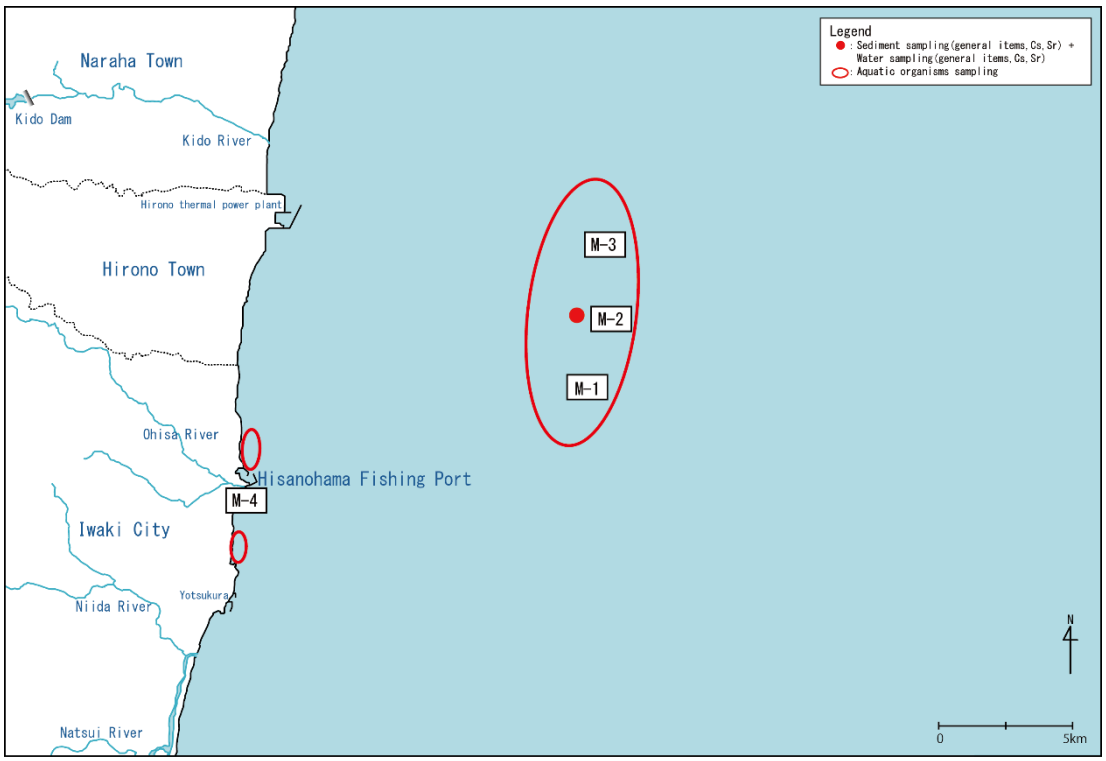
Sampling point in Location L-2 was expanded to the south in the FY2015 survey because sampling was impossible at the conventional point due to bank protection work.



Detailed map showing Location L off Soma City (Matsukawaura Lagoon)

(9) Location M off Iwaki City

Surveys were conducted at offshore of the Hisanohama Fishing Port and coastal areas in Hisanohama.



Detailed map showing Location M off Iwaki City

3. Results

Survey results are shown in the table.

The outline of the measurement results of radioactive cesiums (the total of Cs-134 and Cs-137) .

(i) Rivers and lakes

Unit:Bq/kg-wet

Water area		Time	Algae, Plants	Aquatic insects	Crustaceans	Shellfishes (Molluscan body)	Fishes	Amphibians	CPOMs
Abukuma River System	Abukuma River A	FY2018 Oct.	73.4	–	6.8	4.7 , 7.9 (2 species)	7.0 - 13 (3 species)	4.9 , 84.5 (2 species)	13
		FY2018 Aug.	9.7 , 75.9 (2 species)	6.8 - 19 (3 species)	15.6 , 16 (2 species)	14	N.D. - 14.3 (11 species)	–	3.9
		FY2018 May	79.5	18.1 , 33.2 (2 species)	14.4 , 14.8 (2 species)	154	6.2 - 10 (8 species)	6.78 - 134 (3 species)	32.3
	Abukuma River B	FY2018 Oct.	79.7	23	7.6	–	0.46 - 18.1 (11 species)	–	2.4
		FY2018 Aug.	23.1	N.D. - 14.3 (3 species)	–	6.0	3.21 - 32.9 (15 species)	5.8	3.0
		FY2018 May	40.1	1.6 - 29.1 (4 species)	11.2	–	3.5 - 40.9 (15 species)	7.24 - 82.8 (3 species)	13.1
Uda River C		FY2018 Oct.	16	19	–	–	N.D. - 17.5 (12 species)	–	5.6
		FY2018 Aug.	3.6 , 67.6 (2 species)	4.0	5.5 - 10 (4 species)	–	N.D. - 51.5 (12 species)	–	12
		FY2018 Jun.	2.5 , 49.0 (2 species)	40.9	5.3 - 13.4 (3 species)	–	4.50 - 26.9 (12 species)	N.D.	87.8
Mano River System	Lake Hayama G	FY2018 Oct.	3.5 , 67 (2 species)	–	–	–	5.9 - 163 (7 species)	10 , 23 (2 species)	18.8
		FY2018 Aug.	3.9 , 373 (2 species)	9.6 - 110 (3 species)	21	–	23 - 525 (14 species)	–	130
		FY2018 Jun.	2.3 , 119.7 (2 species)	18 , 39.0 (2 species)	25.5	–	29.4 - 331 (9 species)	20 - 386 (3 species)	144
	Mano River D	FY2018 Oct.	30.0 , 98 (2 species)	–	25	–	N.D. - 131 (16 species)	8.3 , 96.3 (2 species)	68.9
		FY2018 Aug.	17.8 , 34 (2 species)	16	15 , 19 (2 species)	27	4.5 - 55.0 (10 species)	–	31.3
		FY2018 Jun.	23.7 - 188 (4 species)	9.0 - 34 (4 species)	13.4 - 59.0 (4 species)	65.6 , 65.7 (2 species)	11 - 110 (13 species)	175	48.7
Niida River E		FY2018 Oct.	86.2 , 286 (2 species)	10	–	–	12 - 42.8 (5 species)	–	93.7
		FY2018 Aug. - Sep.	696	52.5 - 182 (3 species)	27 - 52.1 (4 species)	35.3	15.5 - 95 (15 species)	695	186
		FY2018 Jun. - Jul.	22.3 , 226 (2 species)	105	25.6 - 56.4 (4 species)	75	21.5 - 130 (12 species)	32.8 - 287 (3 species)	86.9

* N.D. means to be below the detection limit.

* Organisms were collected in or around the targeted water areas.

* Basically, measurements was conducted for all targeted samples, and not limited to edible parts.

*Since the autumn term of FY2012, sampling and analysis of aquatic insects had been conducted separately for four categories (Plecoptera, Trichoptera, Odonata, and Megaloptera) (by feeding habit and type). Since the FY2014 June-July survey, Ephemeroptera was added and sampling and analysis were conducted for five categories.

Unit:Bq/kg-wet

Water area		Time	Algae, Plants	Aquatic insects	Crustaceans	Shellfishes (Molluscan body)	Fishes	Amphibians	CPOMs
Ota River F		FY2018 Oct.	362 , 527 (2 species)	–	68.6	103	N.D. - 470 (7 species)	119.3	119.4
		FY2018 Aug.	5.6 , 256 (2 species)	54 - 232 (3 species)	170 - 353 (3 species)	–	69.2 - 578 (9 species)	–	251
		FY2018 Jun.	46.5 - 403 (4 species)	79.6 - 147 (4 species)	106.2 - 306 (3 species)	–	90.8 - 641 (7 species)	–	709
Lake Akimoto H		FY2018 Oct. - Nov.	7.7 , 17 (2 species)	–	27	6.6	N.D. - 38.6 (7 species)	–	9.4
		FY2018 Aug. - Sep.	N.D. , 4.5 (2 species)	N.D.	18.6	4.6	N.D. - 57.6 (9 species)	2.4 , 4.6 (2 species)	17.0
		FY2018 May	N.D.	N.D. - 26.7 (5 species)	13 , 15.9 (2 species)	11.3	4.1 - 52.1 (9 species)	16.2 - 69.2 (3 species)	18.5
Lake Inawashiro	Lake Inawashiro I (north lakeside)	FY2018 Oct.	–	–	–	–	2.8 - 32.8 (7 species)	–	–
		FY2018 Aug.	–	–	–	–	–	–	2.2
		FY2018 May	–	–	–	–	16.0 - 39.4 (8 species)	–	8.52
	Lake Inawashiro J (south lakeside)	FY2018 Oct.	N.D.	N.D.	4.8	N.D. - 0.63 (3 species)	4.4 - 41.1 (12 species)	N.D.	–
		FY2018 Aug.	N.D. - 1.3 (3 species)	–	–	1.5 , 2.5 (2 species)	N.D. - 2.3 (3 species)	N.D. - 1.5 (3 species)	–
		FY2018 May	N.D. - 8.20 (4 species)	5.0	9.56	7.9	11.0 - 25.1 (4 species)	N.D. , 1.3 (2 species)	–

* N.D. means to be below the detection limit.

* Organisms were collected in or around the targeted water areas.

* Basically, measurements was conducted for all targeted samples, and not limited to edible parts.

*Since the autumn term of FY2012, sampling and analysis of aquatic insects had been conducted separately for four categories (Plecoptera, Trichoptera, Odonata, and Megaloptera) (by feeding habit and type). Since the FY2014 June-July survey, Ephemeroptera was added and sampling and analysis were conducted for five categories.

(ii) Sea areas

Unit:Bq/kg-wet

Water area	Time	Seaweeds, Algae	Polychaetes	Sea urchins, Starfishes, Trepangs	Crustaceans	Shellfishes (Molluscan body)	Squids, Octopuses	Fishes
Location K off the mouth of the Abukuma River	FY2018 Oct.	—	—	—	N.D. , N.D. (2 species)	—	—	0.96
	FY2018 Aug.	—	—	—	—	—	N.D.	0.42 - 0.45 (3 species)
	FY2018 Jun.	—	—	—	N.D.	—	N.D.	N.D. - 1.7 (9 species)
Location L off Soma City (Matsukawaura Lagoon)	FY2018 Oct.	4.4	—	—	—	0.51 , 1.5 (2 species)	—	N.D. - 10.93 (7 species)
	FY2018 Aug.	N.D.	6.4	—	N.D. - 2.3 (3 species)	2.3	—	N.D. - 14.5 (5 species)
	FY2018 Jun.	N.D. - 22.9 (3 species)	5.91	—	1.6 - 4.1 (4 species)	0.99 , 1.2 (2 species)	—	N.D. -8.3 (8 species)
Location M off Iwaki City (Hisanohama)	FY2018 Oct.	—	—	0.41	—	0.39	—	2.0
	FY2018 Aug.	—	—	N.D.	—	—	N.D.	0.57 - 5.32 (10 species)
	FY2018 Jun.	0.34	—	N.D. , 0.54 (2 species)	—	N.D.	N.D.	N.D. - 2.03 (14 species)

* N.D. means to be below the detection limit.

* Organisms were collected in or around the targeted water areas.

* Basically, measurements was conducted for all targeted samples, not limited to edible parts.