Distribution of Japanese test results by prefecture

Background:

Following the March 11 earthquake in Japan, and the ensuing nuclear incident at the Fukushima Daichi plant, the Japanese government implemented an extensive sampling and testing program to identify and remove food contaminated with radionuclides from the domestic and export food chain. The results of this testing has been posted on the Japanese Ministry of Health, Labour and Welfare (MHLW) website and has been communicated to the Canadian Food Inspection Agency (CFIA) through the Canadian post in Japan. The results of this testing has been tabulated and analysed to identify the possibility of the contamination reaching the Canadian west coast and to estimate the extent of contaminated water in Japan.

Regulations:

The Japanese actionable limits were decreased after the first year of the incident to increase consumer confidence and to further enhance the Japanese commitment to ensure no contaminated products are exported from Japan. The Canadian actionable limits are based on international actionable limits that have been set out by CODEX Alimentarius. Table 1 describes the Canadian actionable limits and the current and previous Japanese actionable limits.

Radionuclide	Canadian (CODEX) actionable limits	Japanese actionable limits (March 2011 – March 2012)	Current Japanese actionable limits (April 2012 – present)
Iodine 131	1 000	500	100
Cesium 134	1 000	500	100
Cesium 137	1 000	500	100

Table 1: Radionuclide actionable limits in food (excluding dairy products). All values are in Bq/kg.

Method of analysis:

The results were analyzed based on the number of samples with level of radionuclides greater than the applicable Japanese actionable limits expressed as a percentage. The data has been presented for all foods tested in Japan and seafood products that have been caught off the coast of Japan. The data for all the tests results above the applicable Japanese actionable limits are presented in two tables in Appendix 1. The results of this analysis were mapped out by prefecture on a map of Japan and can be found in Appendix 2.

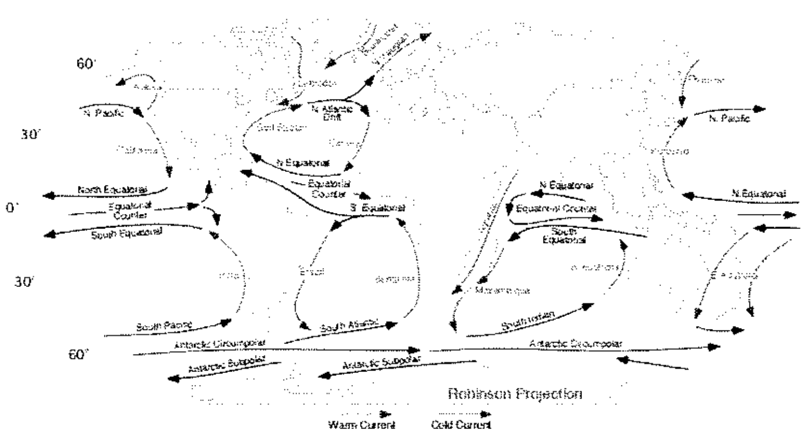
Results:

A total of 135392 samples of food products and 9367 sample of seafood products were analysed from March 2011 to March 2012 with an additional 48954 food samples and 5032 seafood samples analyzed from March 2012 to July 2012. Samples were considered to be unsatisfactory if the test results exceeded the appropriate Japanese actionable limit.

An analysis of the results indicated that the highest percentage of all food and seafood samples of actionable levels were from Fukushima prefecture. For all foods during the period of March 2011 to March 2012, the percentage of unsatisfactory samples of products was at 3.3 % in the Fukushima prefecture. The percentages within neighbouring prefectures (several hundred kilometres away from the Fukushima Daichi plant) had decreased to 0.35 % and 0.6% for Iwate and Shizuoka respectively. The same analysis can be done for the period of March 2012 to July 2012 where percentages observed at the Fukushima prefecture was 5.8 % and dropped to 0.16% in Aomori and 0.11 % at Niigata.

The same trend has been observed when the analysis was done on seafood products. During the first year (March 2011 – March 2012) 6.22 % of samples were unsatisfactory in Fukushima prefecture and decreased to 0.38 % in the adjoining prefecture of Ibaraki. In the latest rounds of testing from March 2012 – July of 2012, the percentage of unsatisfactory samples decreased from 22.0 % to 0.46 % in Chiba and 0.58 % in Aomori.

The higher percentage of unsatisfactory samples in the March 2012 –July 2012 is related to the lowering of the Japanese actionable limits from 500 Bq/Kg to 100 Bq/Kg. By analyzing the data, it appears that the dispersion pattern of the radionuclides is greater in prefectures north of Fukishima as compared to the southern prefectures. The distance between Fukushima and Aomori is greater than the distance between Fukushima and Shizuoka. The increased dispersion could be due to the directions of ocean currents as shown by the ocean currents map. Despite the ocean currents, the radionuclides were not carried to the Hokkaido prefecture only a few hundred kilometres away from the Fukushima Diachi plant as none of the 3830 samples tested were above the Japanese actionable limits.



Conclusions:

By analyzing the Japanese test results, the radionuclide contamination of food and seafood appears to be localized to several prefectures within a few hundred kilometres of the Fukushima Daichi nuclear plant.

Appendix 1

Testing of all food: Percentage of samples with levels of radionuclide contamination greater than the Japanese actionable limits. For the March 2011 to March 2012, these limits are at 500 Bq/Kg for Cesium. For the period of March 2012 to July 2012, these limits have been decreased to 100 Bq/Kg. All greyed out areas represent no samples having radionuclide contamination levels greater than the actionable limits. For a complete summary of all test results, consult Appendix 3.

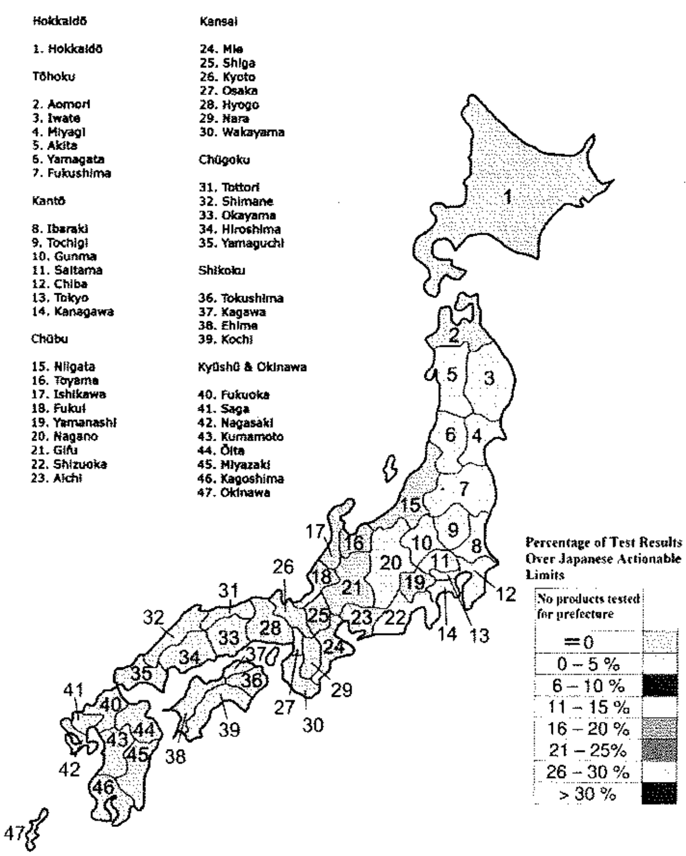
Prefecture	Prefecture # on map	March 2011 to March 2012		March 2012 to July 2012	
		# of food samples tested	% of food samples positive	# of food samples tested	% of food samples positive
Aomori	2			611	0.16 %
Iwate	3	9272	0.35 %	4373	4.94 %
Miyagi	4	14968	0.43 %	3740	2.46 %
Akita	5	1942	0.10 %		
Yamagata	6	12605	0.02 %	3624	0.06 %
Fukushima	7	21543	3.30 %	7437	5.86 %
Ibaraki	8	13450	0.64 %	4733	1.82 %
Tochigi	9	12197	0.61 %	5294	2.30 %
Gunma	10	12111	0.21 %	4992	0.12 %
Saitama	11	3489	3.64 %	944	0.11 %
Chiba	12	3529	0.91 %	1714	0.99 %
Tokyo	13	494	1.42 %	217	1.38 %
Kanagawa	14	1058	1.98 %	465	0.43 %
Niigata	15			892	0.11 %
Nagano	20	7230	0.01 %		
Shizuoka	22	1662	0.60 %		

Testing of Seafood products: Percentage of samples with levels of radionuclide contamination greater than the Japanese actionable limits. For the March 2011 to March 2012, these limits are at 500 Bq/Kg for Cesium. For the period of March 2012 to July 2012, these limits have been decreased to 100 Bq/Kg. All greyed out areas represent no samples having radionuclide contamination levels greater than the actionable limits. For a complete summary of all test results, consult Appendix 3.

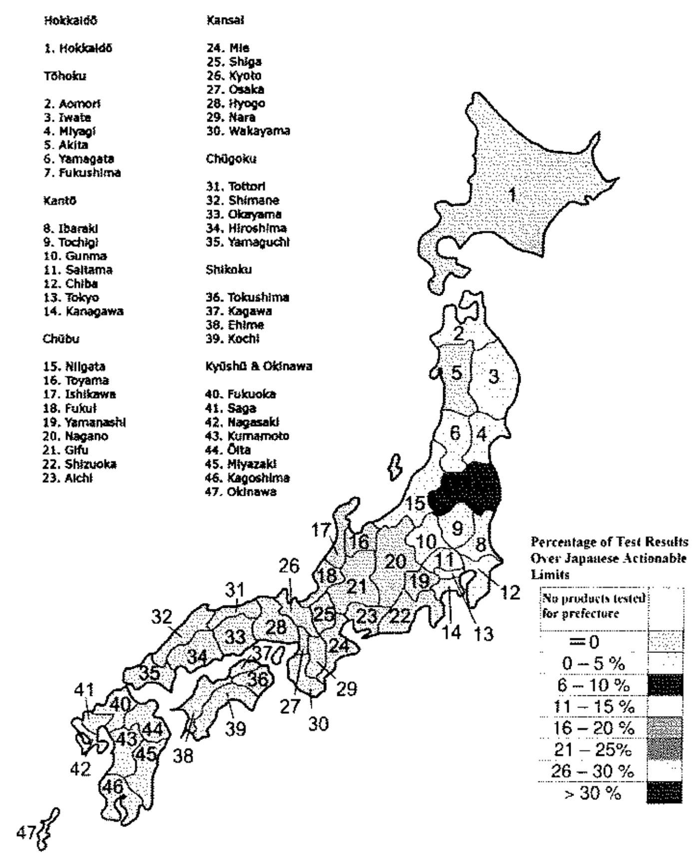
Prefecture	**Prefecture # on map**	**March 2011 to March 2012**		**March 2012 to July 2012**	
		# of seafood samples tested	**% of seafood samples positive**	**# of seafood samples tested**	**% of seafood samples positive**
Aomori	2			172	0.58 %
Iwate	3			363	2.20 %
Miyagi	4			718	4.6 %
Fukushima	7	3650	6.22 %	1547	22.04 %
Ibaraki	8	1595	0.38 %	861	5.11 %
Tochigi	9			376	9.31 %
Gunma	10	134	8.96 %	107	2.80 %
Saitama	11			36	2.78 %
Chiba	12			433	0.46 %
Kanagawa	14			57	1.75 %

Appendix 2

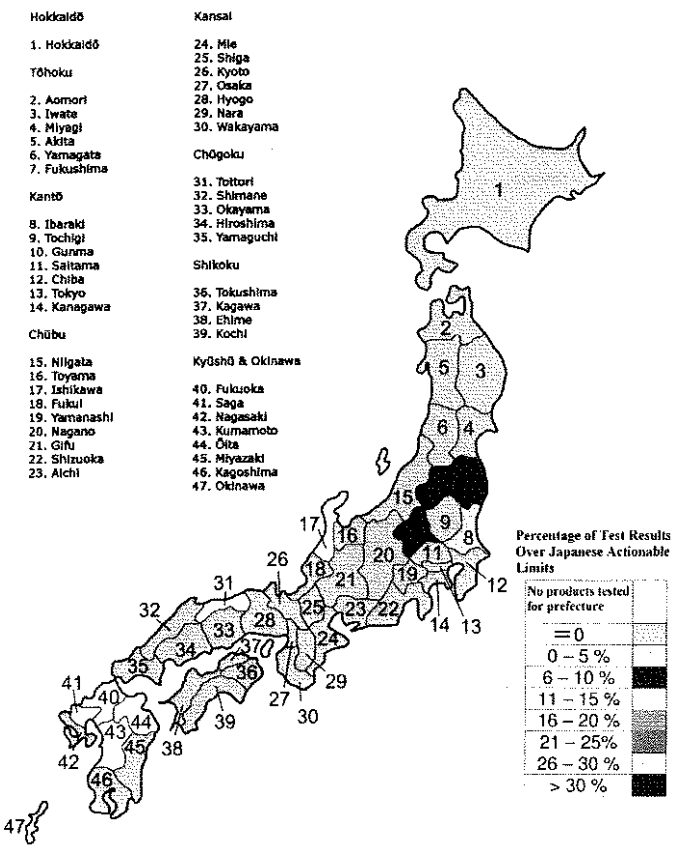
March 2011 to March 2012 (All food)



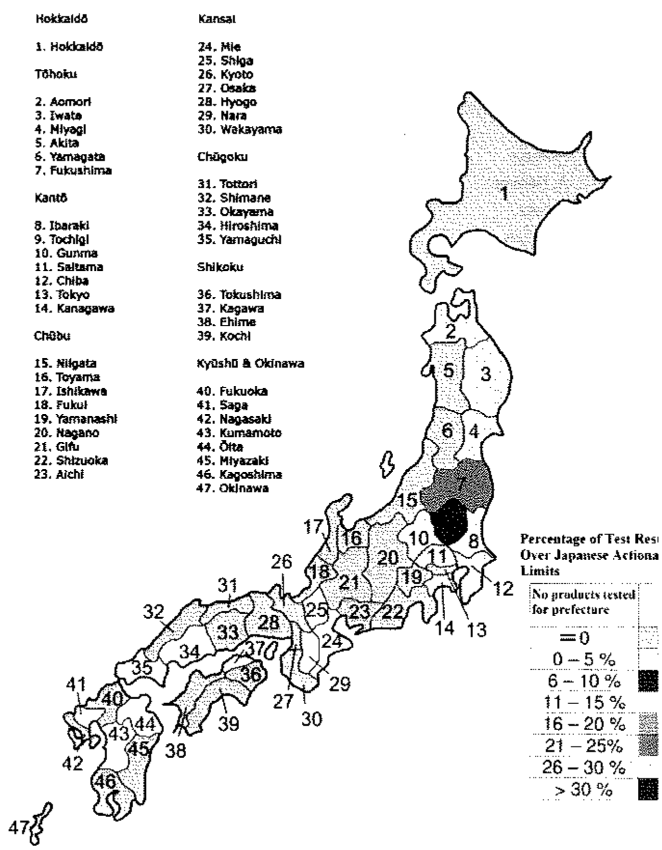
March 2012 to July 2012 (All food)



March 2011 to March 2012 (Seafood)



March 2012 to July 2012 (Seafood)



Appendix 3

Japanese testing data from March 2012 to July 2012							
Prefecture # on Map	Prefecture	Seafood products tested	Seafood products Unsatisfactory	%	All food products tested	All food products Unsatisfactory	%
1	Hokkaido	141	0	0.00%	1667	0	0.00%
2	Aomori	172	1	0.58%	611	1	0.16%
3	Iwate	363	8	2.20%	4373	216	4.94%
4	Miyagi	718	33	4.60%	3740	92	2.46%
5	Akita	26	0	0.00%	882	0	0.00%
6	Yamagata	19	0	0.00%	3624	2	0.06%
7	Fukushima	1547	341	22.04%	7437	436	5.86%
8	Ibaraki	861	44	5.11%	4733	86	1.82%
9	Tochigi	376	35	9.31%	5294	122	2.30%
10	Gunma	107	3	2.80%	4992	6	0.12%
11	Saitama	36	1	2.78%	944	1	0.11%
12	Chiba	433	2	0.46%	1714	17	0.99%
13	Tokyo	23	0	0.00%	217	3	1.38%
14	Kanagawa	57	1	1.75%	465	2	0.43%
15	Niigata	41	0	0.00%	892	1	0.11%
16	Toyama	2	0	0.00%	32	0	0.00%
17	Ishikawa	2	0	0.00%	9	0	0.00%
18	Fukui	1	0	0.00%	11	0	0.00%
19	Yamanashi	4	0	0.00%	142	0	0.00%
20	Nagano	21	0	0.00%	1453	0	0.00%
21	Gifu	1	0	0.00%	86	0	0.00%
22	Shizuoka	24	0	0.00%	391	0	0.00%
23	Aichi	3	0	0.00%	94	0	0.00%
24	Mie	0	0	-	49	0	0.00%
25	Shiga	0	0	-	32	0	0.00%
26	Kyoto	17	0	0.00%	568	0	0.00%
27	Osaka	3	0	0.00%	18	0	0.00%
28	Hyogo	4	0	0.00%	235	0	0.00%
29	Nara	0	0	-	32	0	0.00%
30	Wakayama	4	0	0.00%	36	0	0.00%
31	Tottori	2	0	0.00%	1908	0	0.00%
32	Shimane	1	0	0.00%	1091	0	0.00%
33	Okayama	1	0	0.00%	99	0	0.00%
34	Hiroshima	0	0	-	5	0	0.00%
36	Tokushima	3	0	0.00%	77	0	0.00%
37	Kagawa	0	0	-	12	0	0.00%
38	Ehime	4	0	0.00%	49	0	0.00%
39	Kochi	3	0	0.00%	13	0	0.00%
40	Fukuoka	2	0	0.00%	10	0	0.00%
41	Saga	0	0	-	72	0	0.00%

42	Nagasaki	5	0	0.00%	60	0	0.00%
43	Kumamoto	0	0	-	16	0	0.00%
44	Oita	0	0	-	17	0	0.00%
45	Miyazaki	2	0	0.00%	256	0	0.00%
46	Kagoshima	2	0	0.00%	494	0	0.00%
47	Okinawa	1	0	0.00%	2	0	0.00%
Sum		5032	469	9.32%	48954	985	2.01%

Japanese testing data from March 2011 to March 2012							
Prefecture # on Map	Prefecture	Seafood products tested	Seafood products Unsatisfactory	%	All food products tested	All food products Unsatisfactory	%
1	Hokkaido	567	0	0.00%	2163	0	0.00%
2	Aomori	406	0	0.00%	1438	0	0.00%
3	Iwate	530	0	0.00%	9272	32	0.35%
4	Miyagi	862	0	0.00%	14963	64	0.43%
5	Akita	9	0	0.00%	1942	2	0.10%
6	Yamagata	21	0	0.00%	12605	3	0.02%
7	Fukushima	3650	227	6.22%	21543	718	3.33%
8	Ibaraki	1595	6	0.38%	13450	86	0.64%
9	Tochigi	156	0	0.00%	12197	75	0.61%
10	Gunma	134	12	8.96%	12111	26	0.21%
11	Saitama	11	0	0.00%	3489	127	3.64%
12	Chiba	774	0	0.00%	3529	32	0.91%
13	Tokyo	48	0	0.00%	494	7	1.42%
14	Kanagawa	230	0	0.00%	1058	21	1.98%
15	Niigata	89	0	0.00%	2294	0	0.00%
16	Toyama	1	0	0.00%	180	0	0.00%
17	Ishikawa	0	0	-	151	0	0.00%
18	Fukui	1	0	0.00%	203	0	0.00%
19	Yamanashi	9	0	0.00%	360	0	0.00%
20	Nagano	15	0	0.00%	7230	1	0.01%
21	Gifu	0	0	0.00%	251	0	0.00%
22	Shizuoka	94	0	0.00%	1662	10	0.60%
23	Aichi	16	0	0.00%	193	0	0.00%
24	Mie	32	0	0.00%	173	0	0.00%
25	Shiga	0	0	0.00%	1596	0	0.00%
26	Kyoto	38	0	0.00%	1083	0	0.00%
27	Osaka	1	0	0.00%	33	0	0.00%
28	Hyogo	7	0	0.00%	507	0	0.00%
29	Nara	0	0	0.00%	23	0	0.00%
30	Wakayama	9	0	0.00%	98	0	0.00%
31	Tottori	0	0	-	3926	0	0.00%
32	Shimane	3	0	0.00%	2531	0	0.00%

33	Okayama	2	0	0.00%	165	0	0.00%
34	Hiroshima	12	0	0.00%	33	0	0.00%
35	Yamaguchi	1	0	0.00%	6	0	0.00%
36	Tokushima	2	0	0.00%	131	0	0.00%
37	Kagawa	1	0	0.00%	210	0	0.00%
38	Ehime	10	0	0.00%	143	0	0.00%
39	Kochi	17	0	0.00%	63	0	0.00%
40	Fukuoka	0	0	-	7	0	0.00%
41	Saga	0	0	-	160	0	0.00%
42	Nagasaki	7	0	0.00%	165	0	0.00%
43	Kumamoto	0	0	-	89	0	0.00%
44	Oita	0	0	-	8	0	0.00%
45	Miyazaki	4	0	0.00%	205	0	0.00%
46	Kagoshima	3	0	0.00%	1246	0	0.00%
47	Okinawa	0	0	-	13	0	0.00%
Sum		9367	245	2.62%	135392	1204	0.89%

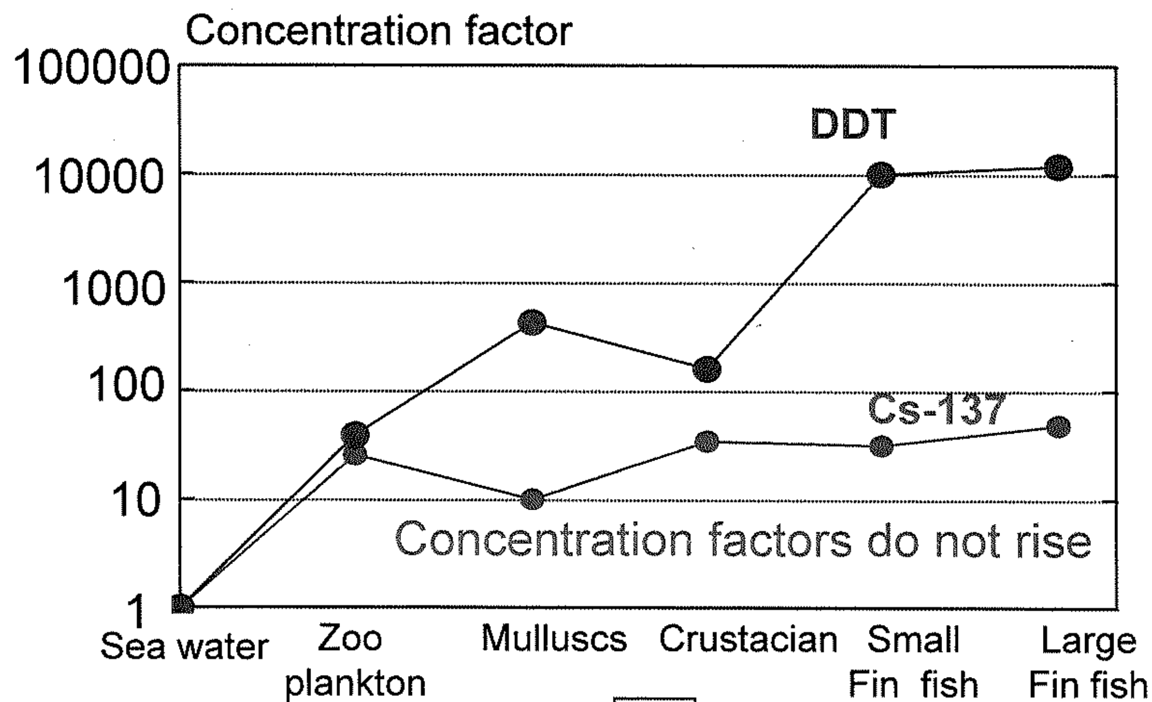
Bio-accumulation or bio-concentration of radionucleotides through food chain

$$\text{Concentration factor} = \frac{\text{Concentration in fish body}}{\text{Concentration in sea water}}$$

Materials	Concentration Factor of marine fish
Cs	5～100
I	10
U	10
Pt	3.5
Hg	360～600
DDT	12000
PCB	1200～1000000

▪ Very low Concentration Factors

Referance:
Fujio Kasamatsu
bio-concentration Edit. N. Yamagata、
Radioisotopes 48, 1999.



▪ Bio-accumulation or bio-concentration of radionucleotides through food chain is not increasing.

Why are not accumulated ?

Iodine and Cesium

- Iodine ....solid/gaseous (sublimation nucleotide)

  I-131 (Half life time: 8.04 days)

- Cs........solid , behaves like potassium :

  does not accumulate to specific organs

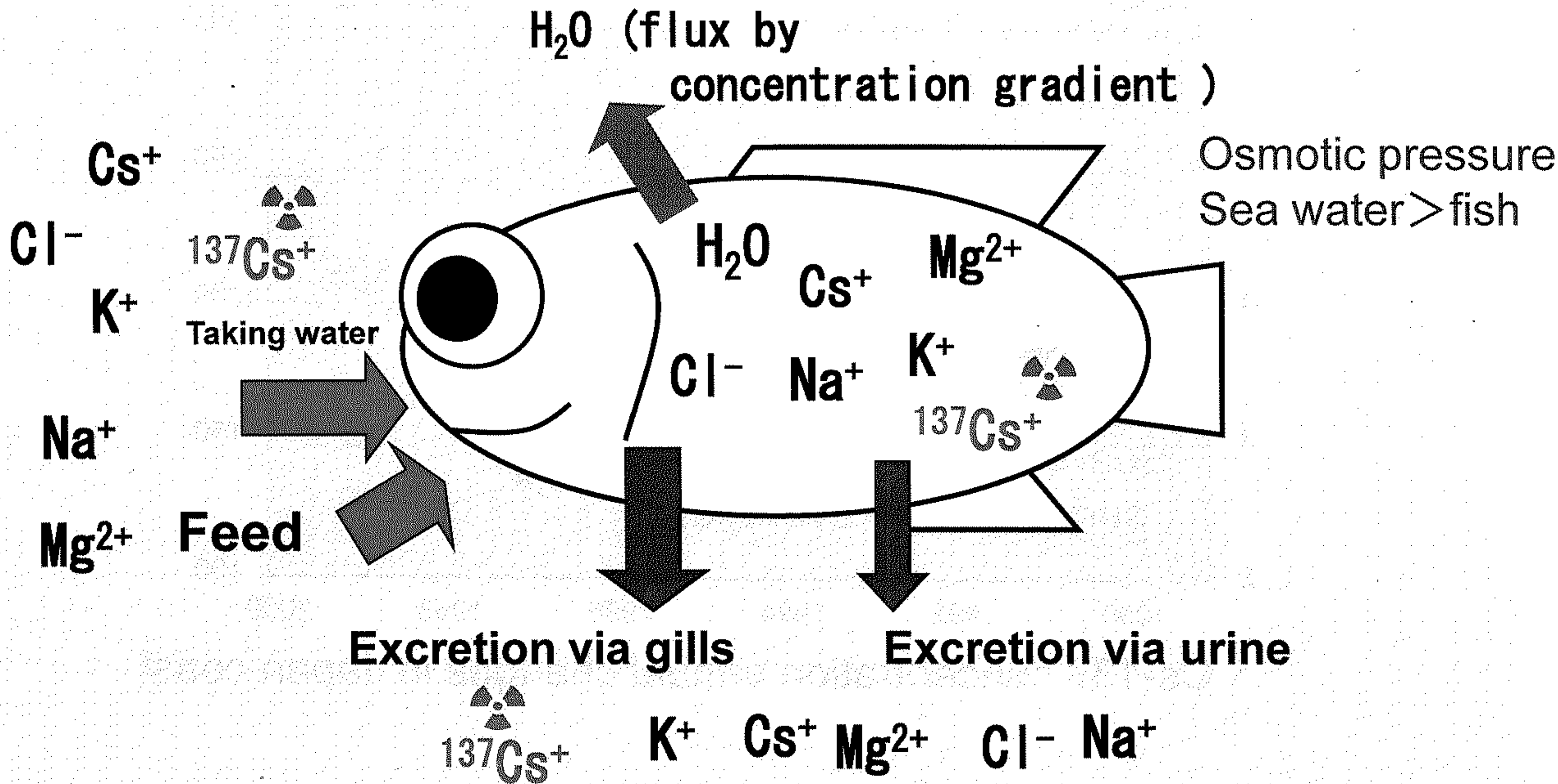
  Cs-137 (Half life time :30.1years),

  Cs-134 (Half life time: 2.07years)

Periodic table

	1A	2A	3A	4A	5A	6A	7A	8			1B	2B	3B	4B	5B	6B	7B	0
1	H																	He
2	Li	Be											B	C	N	O	F	Ne
3	Na	Mg											Al	Si	P	S	Cl	Ar
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
6	Cs	Ba	*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
7	Fr	Ra	**															
*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu			
**	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr			

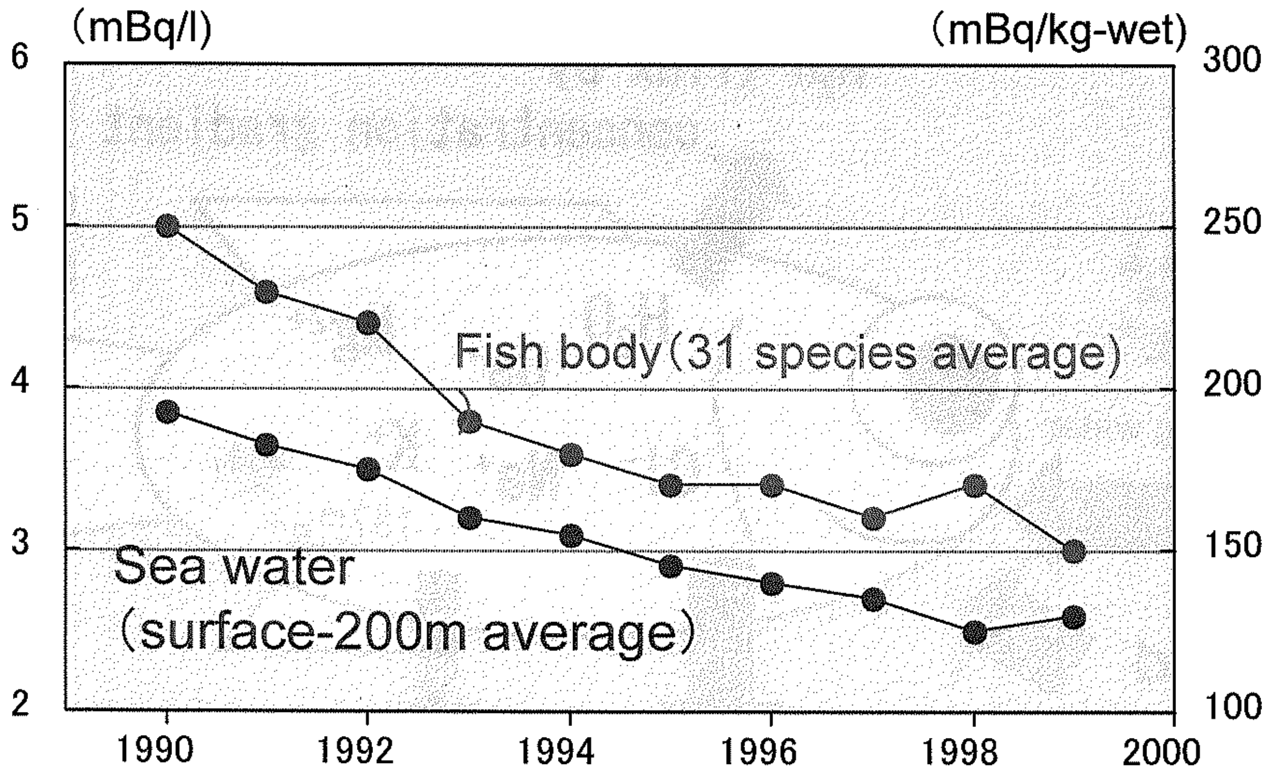
The flow of salts in marine fish body



- Radionucleotides excrete, not accumulate.
- The concentration in fish is depend on the concentration of environmental water .

(Ref: Fundamental physiology of fish Edit. K. Aida)

Comparison of Cs-137 concentration between sea water and fish body

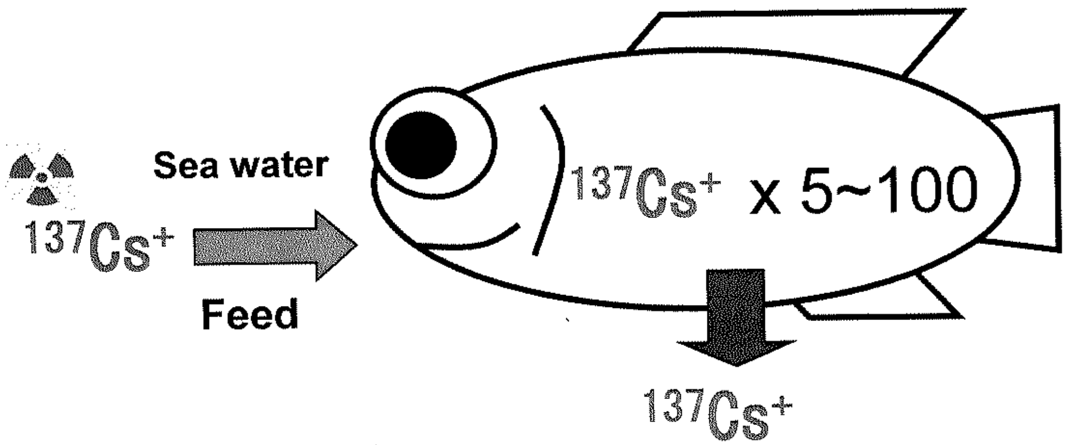


Cs-137 concentration annual changes in Japan coast

- Fish body concentration depends on sea water concentration

(Ref. : F. Kasamatsu Aquabiology 122, 1999)

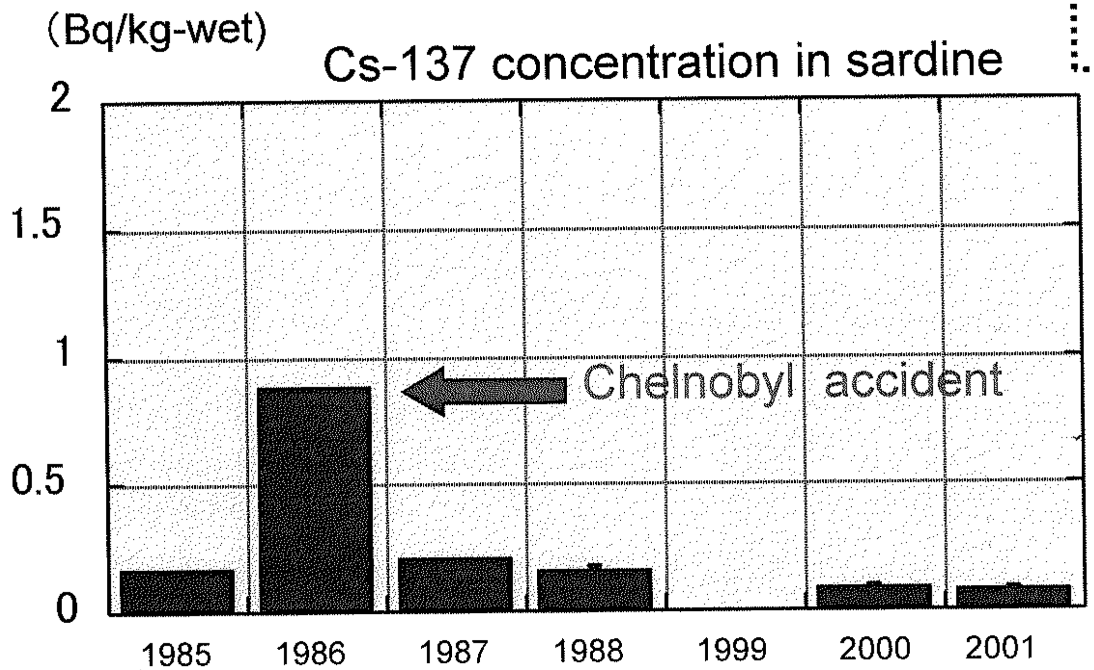
Excretion of radio nucleotides



Biological half time of

Cs-137＝50 days

The half of Cs-137 is excrete in 50days. (Laboratory work result)



- In natural condition Cs-137 excretes quickly.

Ref:
K. Yoshida 、JCAC 34, 1999.
F. Kasamatsu、Radioisotopes 48, 1999.

Young, Eric R HLTH:EX

From: Young, Eric R HLTH:EX
Sent: Tuesday, May 1, 2012 1:27 PM
To: Wright, Kristin J HLTH:EX
Subject: FW: recent radiation monitoring of the environment near Fukushima
Attachments: Fukushima USIE Summary status at 25-Apr-2012 (p 27-41).pdf

Please print attachment and message and add to Tsunami Debris folder.
Thx
Eric

From: François Thériault [mailto:francois.theriault@hc-sc.gc.ca]
Sent: Tuesday, May 1, 2012 12:37 PM
To: Brown, Kirsten HLTH:EX; randall.daley@INSPECTION.GC.CA; robin.brown@dfo-mpo.gc.ca; Victoria.Heron@phac-aspc.gc.ca; Caitlin Harrison; Young, Eric R HLTH:EX
Subject: recent radiation monitoring of the environment near Fukushima

Hi all,

For the Radiation Risk to the Environment One Pager - I'm sending you a pdf file which is a section I extracted from the latest status report from Fukushima that we received from the IAEA (released Apr 25, 2012) - I extracted the section related to the radiation monitoring in the environment which contains a lot of results from recent sampling analysis for fish, water, and other food collected near the Fukushima-Daiichi NPP. This could help for the one pager if we want to pick some of those results and do a comparison with the current Canadian Guidelines for food and water - in other words, maybe some of that data can be used to say that if Cs-134 and Cs-137 concentrations in fish and shellfish collected just a few km from Fukushima are below the Canadian guideline of 1000 Bq/kg, we can presume that concentrations 5000 km away are likely to only be lower, therefore safe to eat according to Canadian guidelines.

(1 pdf attached)

Table of HC Canadian Guidelines below (+ link to complete version of the document for those who don't already have a copy).

Reference values - Canadian Guidelines :

Recommended action [illegible] ingestion of [illegible]

Radionuclide	**Action Levels (Bq kg^{-1})[(1)]**		
	Fresh Liquid Milk	**Other Commercial Foods and Beverages**	**Public Drinking Water**
^{89}Sr	300	1 000	300
^{90}Sr	30	100	30
^{103}Ru	1 000	1 000	1 000
^{106}Ru	100	300	100
^{131}I	100	1 000	100

^{134}Cs, ^{137}Cs	300	1 000	100
^{238}Pu, ^{239}Pu, ^{240}Pu, ^{242}Pu, ^{241}Am	1	10	1

Source: Health Canada (2000) - Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency (PDF)

François Thériault
Scientific Information Officer | Agent d'information scientifique
Health Canada > Nuclear Emergency Preparedness and Response Division | **Santé Canada** > Division de la préparation et de l'intervention en cas d'urgence nucléaire
2720 Riverside Drive, A/L 6604G, Ottawa (Ontario) K1A OK9 | tel: (613) 941-4377 | francois.theriault@hc-sc.gc.ca

Health Canada Santé Canada

Radiation monitoring of the environment

Monitoring of the marine environment

Marine monitoring results

On 30 March 2012, TEPCO released results of marine soil sampling within the 20 km zone of the Fukushima Daiichi NPS for samples taken on 22 and 23 March 2012. Figure 30 shows the results.

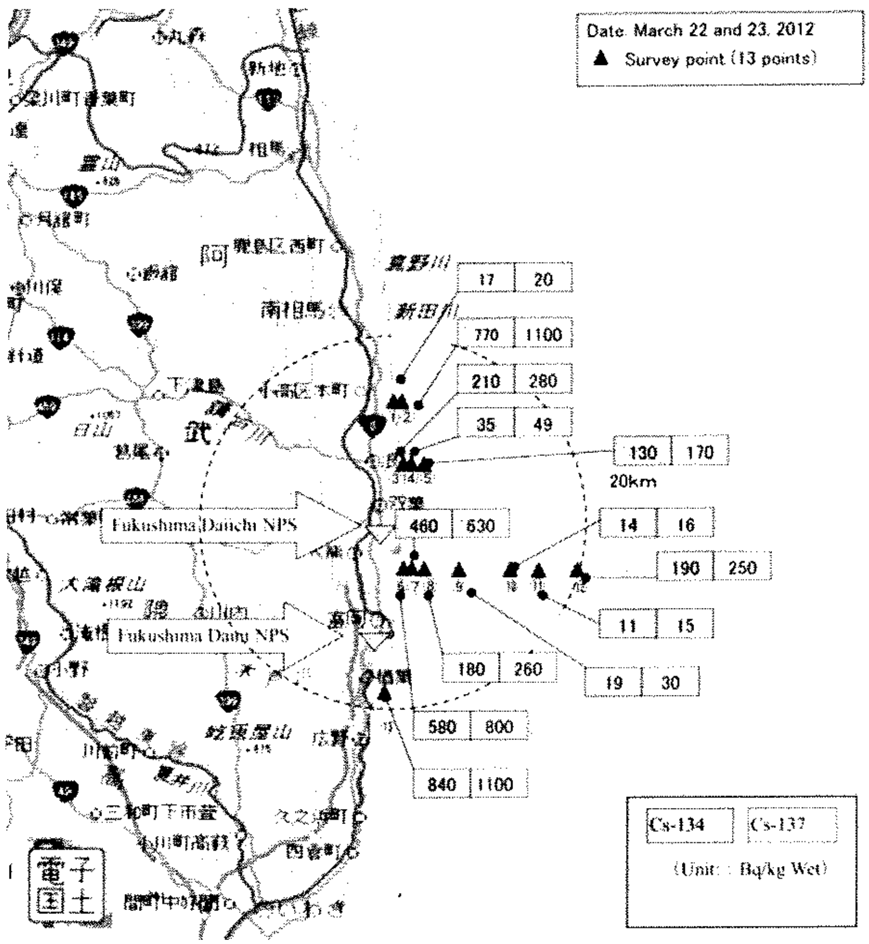


Figure 30: Results of soil sampling conducted on 22 and 23 March 2012

On 28 March TEPCO released sea water results for samples taken on 25 and 26 March. These results are available in Figure 31.

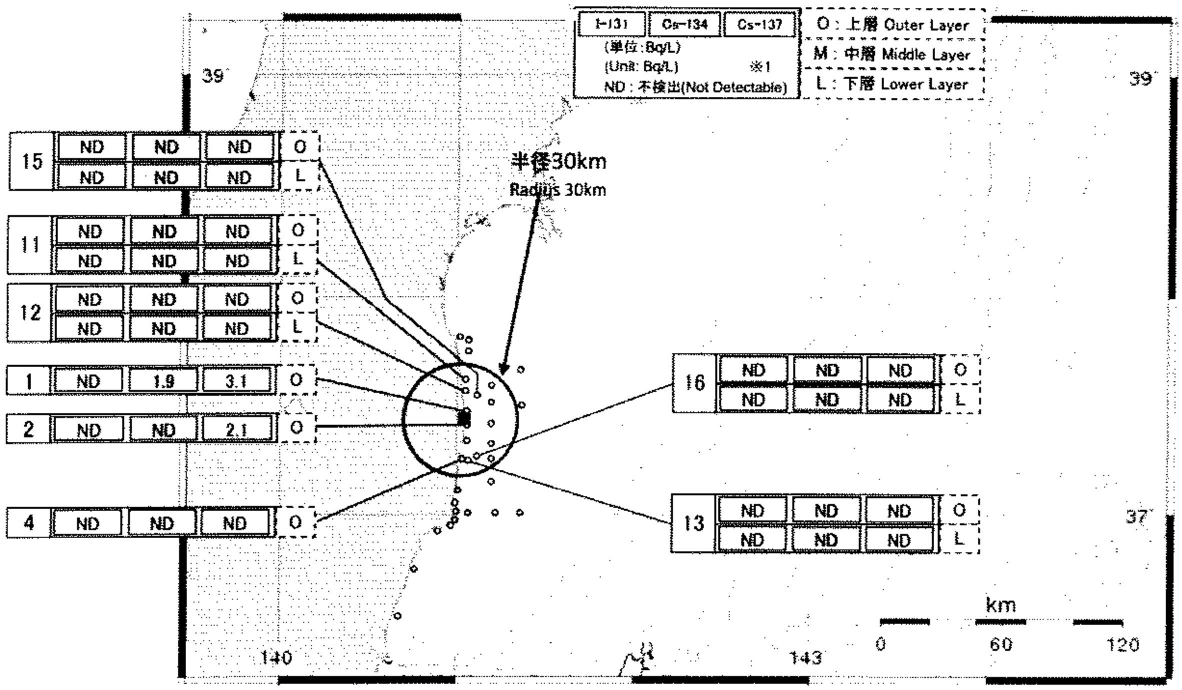


*Figure 31: Results of sea water monitoring conducted on 25 and 26 March 2012**

**This map was produced by MEXT, based on information contained in a press release provided by TEPCO.*

On 8 and 9 April TEPCO released results of marine soil samples taken on 6 and 7 April. These results were compiled by MEXT in and made available in Figure 32.

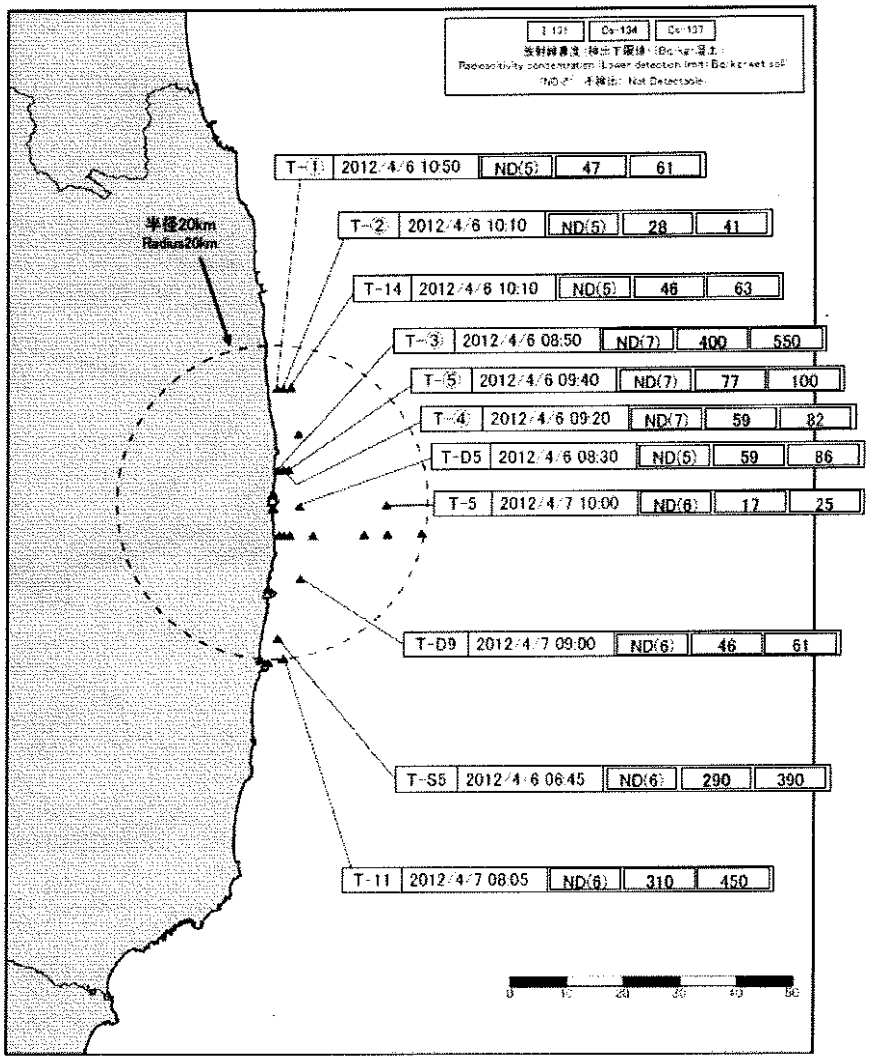


*Figure 32: Results of marine soil sampling conducted on 6 and 7 April 2012**

**This map was produced by MEXT, based on information contained in a press release provided by TEPCO.*

Protective measures for the public

Current status of evacuation areas

On 30 March the Nuclear Emergency Response Headquarters released a document outlining the reclassification of some restricted areas and area in which evacuation orders have been issued. The reclassification of these areas has been conducted on the basis outlined in this document. Figure 33 shows which areas have changed designation including which areas had their restrictions removed during the month of April.

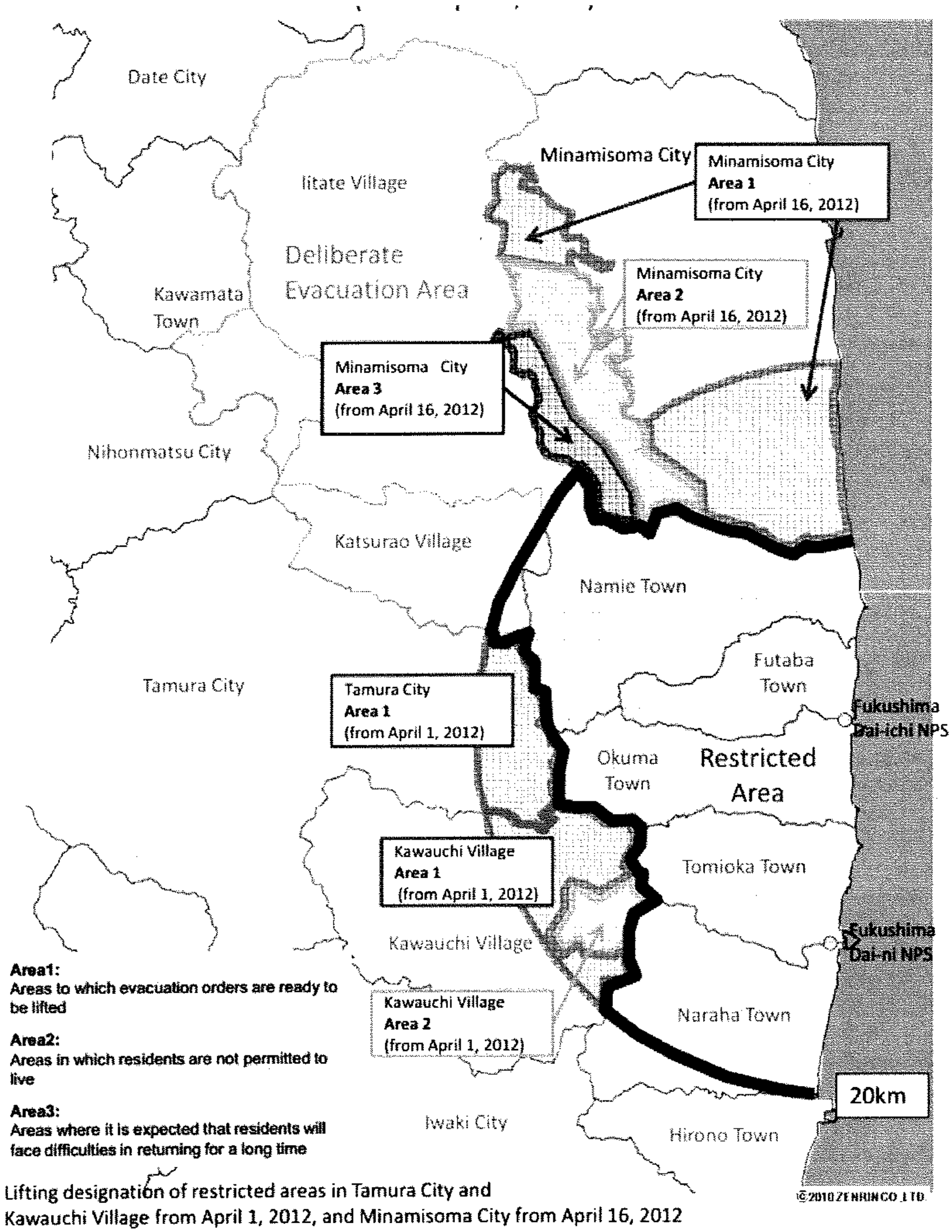


Figure 33: Current evacuation areas (as of 1 April)

The previous map of evacuation areas is available in previous reports and online.

Radiation monitoring of foodstuffs

Nuclide analysis of fish and shell fish

On 30 March 2012, TEPCO released images of workers sampling shell fish within the 20 km zone of the Fukushima Daiichi NPS. Figure 34 shows the images that were provided. A video of the collection process is also available online.

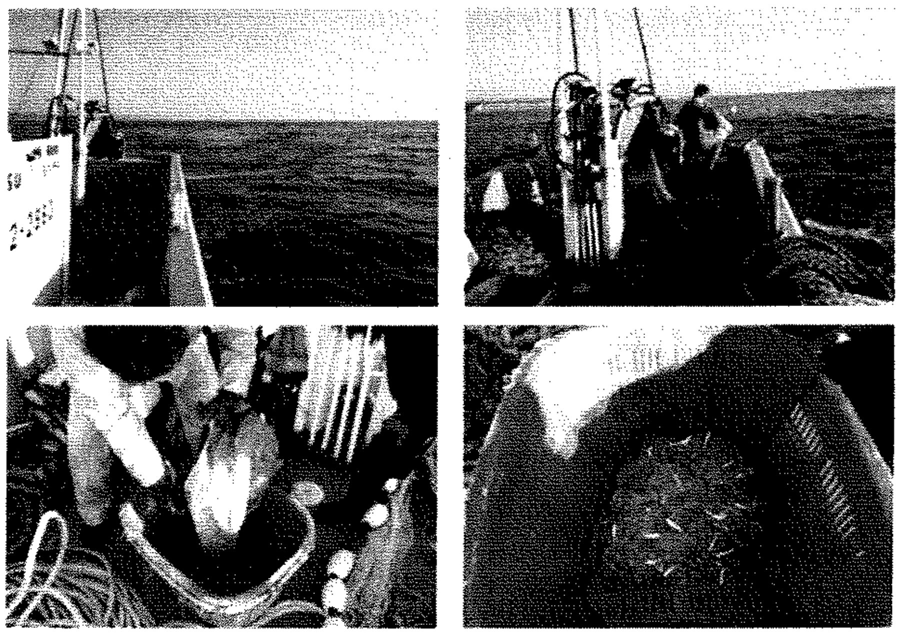


Figure 34: Workers sampling shell fish in the area around the Fukushima Daiichi NPS

On 12 April TEPCO released the first results of their sampling of fish and shell fish. These results are available in Table 5.

Table 5: Results from fish and shell fish measurements taken by TEPCO on 29 March

Sample	Location	Date of sample	Radioactiviity density (Bq/kg raw)		
			Cs-134	Cs-137	I-131
Ishikawasirauo (whole)	2km offshote of the Kido-gawa River	29 March 2012	11	12	ND
Kounago (whole)	2km offshote of the Kido-gawa River	29 March 2012	4.9	8.0	ND
Kounago (whole)	5km offshote of the Kido-gawa River	29 March 2012	ND	ND	ND

On 20 April TEPCO provided additional results of the sampling for fish and shellfish. They are provided in Table 6.

Table 6: Results from fish and shell fish measurements taken by TEPCO on 7 April

Sample	Location	Date of sample	Radioactiviity density (Bq/kg raw)		
			Cs-134	Cs-137	I-131
Sea bass (muscle)	2km offshote of the Kido-gawa River	7 April 2012	670	940	ND
Common skete (muscle)	2km offshote of the Kido-gawa River	7 April 2012	310	430	ND
Spotbelly rockfish (muscle)	2km offshote of the Kido-gawa River	7 April 2012	350	480	ND
Spiny dogfish (muscle)	2km offshote of the Kido-gawa River	7 April 2012	ND	ND	ND
Pacific cod (muscle)	2km offshote of the Kido-gawa River	7 April 2012	7.1	9.6	ND
Flounder (muscle)	2km offshote of the Kido-gawa River	7 April 2012	77	100	ND
Hiratsume-gani (all)	2km offshote of the Kido-gawa River	7 April 2012	12	14	ND
Flounder (muscle)	5km offshote of the Kido-gawa River	7 April 2012	130	170	ND
Marbled sole (muscle)	5km offshote of the Kido-gawa River	7 April 2012	210	280	ND
Pacific cod (muscle)	5km offshote of the Kido-gawa River	7 April 2012	14	28	ND
Sea raven (muscle)	5km offshote of the Kido-gawa River	7 April 2012	120	170	ND
Roughscale sole (muscle)	5km offshote of the Kido-gawa River	7 April 2012	7.0	10	ND
Spiny dogfish (muscle)	5km offshote of the Kido-gawa River	7 April 2012	ND	5.3	ND

Food monitoring

Food monitoring data were reported on 26 – 30 March and 2 – 6, 9 – 14 and 16 – 21 April 2012 by the Ministry of Health, Labour and Welfare (MHLW) for a total of 15792 samples collected from 46 different prefectures in Japan (Table 7).

Analytical results for 15554 (over 98%) of the 15792 samples indicated that Cs-134 and Cs-137 or I-131 were either not detected or were below the provisional regulation values or new standard limits for radionuclides (effective from 1 April 2012) set by the Japanese authorities. However, 13 samples were above the provisional regulation values (Table 8, between 24 March and 4 April 2012), and 225 samples were above the new standard limits (Table 9, between 2 and 21 April 2012) for radionuclides Cs-134 and Cs-137.

Food restrictions

Updated information was reported by the MHLW on 29 March and on 5, 6, 9, 10, 11, 12, 13, 16, 17, 18, 19, 20 and 23 April 2012 placing restrictions on the distribution of:

- Outdoor cultivated, log-grown shiitake mushrooms produced in certain areas of Chiba, Ibaraki, Iwate, Miyagi, and Tochigi prefectures.
- Hothouse cultivated, log-grown shiitake mushrooms produced in certain areas of Tochigi prefecture.
- Bamboo shoots produced in certain areas of Chiba, Fukushima and Ibaraki prefectures.
- Rice (produced in 2012), hatakewasabi, wild Japanese butterbur scape and fishery products (land-locked salmon, Japanese dace and white-spotted char) from certain areas of Fukushima prefecture.
- Fishery products (rock fish, Japanese sea bass, nibe croaker and olive flounder - all taken offshore), channel catfish (excluding farmed fish) and silver crucian carp (excluding farmed fish) taken from the Kasumigaura basin of Ibaraki prefecture.
- Sea bass (from Sendai bay) and land-locked salmon and Japanese dace from Abukuma river (including its branches but excluding upper reaches from Shichigashuku dam) in Miyagi prefecture.

Restrictions on the distribution and consumption of land-locked salmon (excluding farmed fish) were also enacted in Fukushima prefecture (Niida River, including its branches), while restrictions on the distribution of tea leaves in a specific area of Ibaraki prefecture were lifted.

A summary of the status of food restrictions reported since March 2011 is attached at Annex A.

Table 7: Samples Collected by Prefecture as Reported by the Ministry of Health, Labour and Welfare between 24 March and 21 April 2012

Prefecture	Number of Samples
Aichi	34
Akita	384
Aomori	103
Chiba	500
Ehime	17
Fukui	4
Fukuoka	1
Fukushima	2078
Gifu	20
Gunma	1950
Hiroshima	2
Hokkaido	404
Hyogo	99
Ibaraki	1699
Ishikawa	5
Iwate	1077
Kagawa	12
Kagoshima	192
Kanagawa	77
Kochi	9
Kumamoto	1
Kyoto	168
Mie	17
Miyagi	1730

Prefecture	Number of Samples
Miyazaki	63
Nagano	1156
Nagasaki	27
Nara	3
Niigata	238
Oita	3
Okayama	32
Okinawa	1
Osaka	5
Saga	4
Saitama	185
Shiga	7
Shimane	382
Shizuoka	218
Tochigi	706
Tokushima	43
Tokyo	44
Tottori	569
Toyama	12
Wakayama	24
Yamagata	1251
Yamanashi	11
Not known	225
Total	**15792**

Table 8: Samples above the Japanese Provisional Regulation Values as Reported by the Ministry of Health, Labour and Welfare between 24 March and 4 April 2012

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
26-Mar-12	Fukushima	26-Feb-12	boar meat	527
26-Mar-12	Fukushima	26-Feb-12	boar meat	555
26-Mar-12	Fukushima	27-Feb-12	boar meat	617
26-Mar-12	Fukushima	28-Feb-12	boar meat	1730
26-Mar-12	Fukushima	04-Mar-12	boar meat	844
26-Mar-12	Fukushima	04-Mar-12	boar meat	890
28-Mar-12	Ibaraki	-	bamboo shoots	730
28-Mar-12	Fukushima	23-Mar-12	Japanese dace	570
28-Mar-12	Fukushima	18-Mar-12	land-locked salmon	18700
28-Mar-12	Fukushima	18-Mar-12	land-locked salmon	2070
30-Mar-12	Iwate	26-Mar-12	log-grown shiitake	512
04-Apr-12	Fukushima	29-Mar-12	Char	840
04-Apr-12	Fukushima	29-Mar-12	land-locked salmon	810

Table 9: Samples above the Standard Limits for Radionuclides in Food as Reported by the Ministry of Health, Labour and Welfare between 2 and 21 April 2012

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
04-Apr-12	Miyagi	02-Apr-12	log-grown shiitake	350
04-Apr-12	Chiba	03-Apr-12	bamboo shoots	110
04-Apr-12	Chiba	03-Apr-12	bamboo shoots	120
04-Apr-12	Fukushima	-	greenling	350
04-Apr-12	Fukushima	-	brown hakeling	290
04-Apr-12	Fukushima	-	common skate	640
04-Apr-12	Fukushima	-	common skate	140
04-Apr-12	Fukushima	-	rock fish	430
04-Apr-12	Fukushima	-	lefteye flounder	120
04-Apr-12	Fukushima	-	lefteye flounder	110
04-Apr-12	Fukushima	-	righteye flounder	120
04-Apr-12	Fukushima	-	righteye flounder	140
04-Apr-12	Fukushima	-	pacific cod	120
04-Apr-12	Fukushima	-	spotbelly rock fish	560
04-Apr-12	Fukushima	-	righteye flounder	120

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
04-Apr-12	Fukushima	-	greenling	210
04-Apr-12	Fukushima	-	rock fish	580
04-Apr-12	Fukushima	-	land-locked salmon	250
05-Apr-12	Ibaraki	03-Apr-12	log-grown shiitake	160
05-Apr-12	Ibaraki	03-Apr-12	log-grown shiitake	340
05-Apr-12	Ibaraki	03-Apr-12	log-grown shiitake	960
05-Apr-12	Ibaraki	03-Apr-12	log-grown shiitake	170
05-Apr-12	Ibaraki	2 to 4-Apr-12	bamboo shoots	170
05-Apr-12	Ibaraki	2 to 4-Apr-12	bamboo shoots	240
05-Apr-12	Ibaraki	2 to 4-Apr-12	bamboo shoots	140
05-Apr-12	Chiba	03-Apr-12	bamboo shoots	130
05-Apr-12	Chiba	03-Apr-12	bamboo shoots	170
05-Apr-12	Ibaraki	03-Apr-12	dried shiitake	1400
06-Apr-12	Ibaraki	01-Apr-12	white spotted char (wild)	330
06-Apr-12	Ibaraki	01-Apr-12	land-locked salmon (wild)	240
06-Apr-12	Kanagawa	05-Apr-12	log-grown shiitake	140
06-Apr-12	Ibaraki	05-Apr-12	dried shiitake	620
06-Apr-12	Ibaraki	05-Apr-12	dried shiitake	1400
06-Apr-12	Ibaraki	05-Apr-12	dried shiitake	570
06-Apr-12	Ibaraki	05-Apr-12	dried shiitake	130
06-Apr-12	Fukushima	03-Apr-12	Japanese butterbur scape	210
06-Apr-12	Fukushima	03-Apr-12	Japanese butterbur scape	200
06-Apr-12	Fukushima	03-Apr-12	Japanese butterbur scape	110
06-Apr-12	Fukushima	03-Apr-12	Japanese butterbur scape	110
06-Apr-12	Fukushima	03-Apr-12	Japanese butterbur scape	150
06-Apr-12	Fukushima	04-Apr-12	bamboo shoots	290
06-Apr-12	Fukushima	04-Apr-12	bamboo shoots	920
06-Apr-12	Fukushima	05-Apr-12	bamboo shoots	400
09-Apr-12	Ibaraki	05-Apr-12	rockfish	170
09-Apr-12	Tochigi	05-Apr-12	log-grown shiitake	190
09-Apr-12	Tochigi	05-Apr-12	log-grown shiitake	520
09-Apr-12	Tochigi	05-Apr-12	log-grown shiitake	110
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	210
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	210
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	420
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	520
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	530
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	350

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	240
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	660
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	640
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	950
09-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	190
09-Apr-12	Gunma	01-Apr-12	Japanese butterbur scape	290
09-Apr-12	Chiba	06-Apr-12	log-grown shiitake	740
10-Apr-12	Miyagi	05-Apr-12	sea bass	140
10-Apr-12	Miyagi	05-Apr-12	log-grown shiitake	170
10-Apr-12	Miyagi	05-Apr-12	log-grown shiitake	200
10-Apr-12	Miyagi	05-Apr-12	log-grown shiitake	210
10-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	270
10-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	280
10-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	490
10-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	170
10-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	300
10-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	280
10-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	1000
10-Apr-12	Chiba	09-Apr-12	bamboo shoots	130
10-Apr-12	Chiba	09-Apr-12	bamboo shoots	170
10-Apr-12	Chiba	09-Apr-12	bamboo shoots	120
11-Apr-12	Miyagi	09-Apr-12	log-grown shiitake	150
11-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	170
11-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	390
11-Apr-12	Tochigi	06-Apr-12	log-grown shiitake	290
11-Apr-12	Tochigi	10-Apr-12	log-grown shiitake	630
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	330
11-Apr-12	Tochigi	10-Apr-12	log-grown shiitake	290
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	490
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	410
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	200
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	200
11-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	170
11-Apr-12	Tochigi	10-Apr-12	log-grown shiitake	190
11-Apr-12	Tochigi	10-Apr-12	log-grown shiitake	120
11-Apr-12	Chiba	09-Apr-12	bamboo shoots	110
11-Apr-12	Fukushima	09-Apr-12	fat greenling	600
11-Apr-12	Fukushima	09-Apr-12	fat greenling	360

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
11-Apr-12	Fukushima	09-Apr-12	ocellate spot skate	630
11-Apr-12	Fukushima	08-Apr-12	rockfish	460
11-Apr-12	Fukushima	09-Apr-12	rockfish	550
11-Apr-12	Fukushima	09-Apr-12	sea bass	170
11-Apr-12	Fukushima	08-Apr-12	slime flounder	190
11-Apr-12	Fukushima	08-Apr-12	olive flounder	170
11-Apr-12	Fukushima	09-Apr-12	olive flounder	160
11-Apr-12	Fukushima	09-Apr-12	marbled flounder	150
11-Apr-12	Fukushima	09-Apr-12	marbled flounder	120
11-Apr-12	Fukushima	09-Apr-12	ridged-eye flounder	140
11-Apr-12	Fukushima	06-Apr-12	fat greenling	1150
11-Apr-12	Fukushima	08-Apr-12	fat greenling	270
11-Apr-12	Fukushima	06-Apr-12	stone flounder	110
11-Apr-12	Fukushima	06-Apr-12	brown hakeling	120
11-Apr-12	Fukushima	08-Apr-12	fox jacopever	410
11-Apr-12	Fukushima	08-Apr-12	black rockfish	160
11-Apr-12	Fukushima	02-Apr-12	sea raven	110
11-Apr-12	Fukushima	06-Apr-12	ocellate spot skate	410
11-Apr-12	Fukushima	02-Apr-12	cherry salmon	130
11-Apr-12	Fukushima	02-Apr-12	sea bass	120
11-Apr-12	Fukushima	09-Apr-12	sea bass	540
11-Apr-12	Fukushima	02-Apr-12	olive flounder	130
11-Apr-12	Fukushima	09-Apr-12	olive flounder	130
11-Apr-12	Fukushima	09-Apr-12	conger eel	360
11-Apr-12	Fukushima	06-Apr-12	marbled flounder	240
11-Apr-12	Fukushima	09-Apr-12	marbled flounder	230
11-Apr-12	Fukushima	08-Apr-12	Pacific cod	100
11-Apr-12	Fukushima	07-Apr-12	white spotted char	110
11-Apr-12	Fukushima	03-Apr-12	white spotted char	140
11-Apr-12	Fukushima	03-Apr-12	white spotted char	170
11-Apr-12	Fukushima	06-Apr-12	spinach	520
12-Apr-12	Iwate	09-Apr-12	log-grown shiitake	300
12-Apr-12	Iwate	09-Apr-12	log-grown shiitake	110
12-Apr-12	Ibaraki	09-Apr-12	log-grown shiitake	810
12-Apr-12	Ibaraki	09-Apr-12	log-grown shiitake	410
12-Apr-12	Ibaraki	-	bamboo shoots	140
12-Apr-12	Ibaraki	-	bamboo shoots	140
12-Apr-12	Ibaraki	-	bamboo shoots	130

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
12-Apr-12	Ibaraki	-	bamboo shoots	140
12-Apr-12	Ibaraki	-	bamboo shoots	110
12-Apr-12	Ibaraki	-	bamboo shoots	200
12-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	260
12-Apr-12	Tochigi	10-Apr-12	log-grown shiitake	120
12-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	160
12-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	170
12-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	180
12-Apr-12	Tochigi	09-Apr-12	log-grown shiitake	240
13-Apr-12	Miyagi	08-Apr-12	sea bass	250
13-Apr-12	Ibaraki	12-Apr-12	ostrich fern	110
13-Apr-12	Tochigi	12-Apr-12	log-grown shiitake	460
13-Apr-12	Fukushima	10-Apr-12	hana wasabi	1500
13-Apr-12	Fukushima	10-Apr-12	Japanese butterbur scape	230
13-Apr-12	Fukushima	11-Apr-12	Japanese butterbur scape	490
13-Apr-12	Fukushima	10-Apr-12	Japanese butterbur scape	130
13-Apr-12	Fukushima	11-Apr-12	bamboo shoots	310
13-Apr-12	Fukushima	11-Apr-12	bamboo shoots	400
13-Apr-12	Fukushima	12-Apr-12	bamboo shoots	290
13-Apr-12	Fukushima	11-Apr-12	bamboo shoots	150
14-Apr-12	Miyagi	13-Apr-12	yacon tea (powder)	18260
14-Apr-12	Miyagi	13-Apr-12	yacon tea (powder)	20290
14-Apr-12	Miyagi	13-Apr-12	yacon tea (powder)	16210
14-Apr-12	Miyagi	13-Apr-12	yacon tea (powder)	14970
14-Apr-12	Ibaraki	08-Apr-12	sea bass	120
14-Apr-12	Ibaraki	06-Apr-12	nibe croaker	110
14-Apr-12	Ibaraki	06-Apr-12	olive flounder	160
14-Apr-12	Ibaraki	09-Apr-12	channel catfish	180
14-Apr-12	Ibaraki	10-Apr-12	silver crucian carp	130
14-Apr-12	Ibaraki	09-Apr-12	silver crucian carp	110
17-Apr-12	Ibaraki	10-Apr-12	channel catfish	160
17-Apr-12	Ibaraki	10-Apr-12	Japanese eel	180
17-Apr-12	Chiba	-	shiitake	110
17-Apr-12	Chiba	-	shiitake	190
17-Apr-12	Chiba	-	bamboo shoots	110
18-Apr-12	Miyagi	17-Apr-12	log-grown shiitake	190
18-Apr-12	Ibaraki	17,18-April-12	bamboo shoots	160
18-Apr-12	Ibaraki	17,18-April-12	bamboo shoots	260

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
18-Apr-12	Ibaraki	17,18-April-12	bamboo shoots	190
18-Apr-12	Fukushima	15-Apr-12	fat greenling	190
18-Apr-12	Fukushima	16-Apr-12	stone flounder	220
18-Apr-12	Fukushima	16-Apr-12	ocellate spot skate	160
18-Apr-12	Fukushima	15-Apr-12	rockfish	530
18-Apr-12	Fukushima	15-Apr-12	sea bass	180
18-Apr-12	Fukushima	16-Apr-12	sea bass	240
18-Apr-12	Fukushima	16-Apr-12	slime flounder	250
18-Apr-12	Fukushima	16-Apr-12	olive flounder	210
18-Apr-12	Fukushima	16-Apr-12	little mouth flounder	150
18-Apr-12	Fukushima	15-Apr-12	marbled flounder	160
18-Apr-12	Fukushima	16-Apr-12	marbled flounder	220
18-Apr-12	Fukushima	16-Apr-12	spotted halibut	160
18-Apr-12	Fukushima	08-Apr-12	northern sea urchin	270
18-Apr-12	Fukushima	10-Apr-12	fat greenling	200
18-Apr-12	Fukushima	10-Apr-12	stone flounder	180
18-Apr-12	Fukushima	15-Apr-12	goldeye rockfish	570
18-Apr-12	Fukushima	10-Apr-12	brown hakeling	460
18-Apr-12	Fukushima	10-Apr-12	sea raven	510
18-Apr-12	Fukushima	10-Apr-12	ocellate spot skate	130
18-Apr-12	Fukushima	10-Apr-12	rockfish	280
18-Apr-12	Fukushima	13-Apr-12	rockfish	130
18-Apr-12	Fukushima	15-Apr-12	rockfish	460
18-Apr-12	Fukushima	13-Apr-12	sea bass	170
18-Apr-12	Fukushima	10-Apr-12	slime flounder	170
18-Apr-12	Fukushima	10-Apr-12	olive flounder	170
18-Apr-12	Fukushima	13-Apr-12	olive flounder	130
18-Apr-12	Fukushima	10-Apr-12	marbled flounder	110
18-Apr-12	Fukushima	09-Apr-12	white spotted char	150
18-Apr-12	Fukushima	11-Apr-12	Japanese dace	190
18-Apr-12	Fukushima	11-Apr-12	Japanese dace	250
18-Apr-12	Fukushima	15-Apr-12	kokanee	200
18-Apr-12	Fukushima	02-Apr-12	land-locked salmon	1400
18-Apr-12	Fukushima	16-Apr-12	land-locked salmon	390
19-Apr-12	Iwate	18-Apr-12	log-grown shiitake	140
19-Apr-12	Iwate	18-Apr-12	log-grown shiitake	450
19-Apr-12	Iwate	18-Apr-12	log-grown shiitake	310
19-Apr-12	Miyagi	14-Apr-12	white spotted char	200

Date Reported	Prefecture	Date Sampled	Food Product	Cs-137 + Cs-134 (Bq/kg)
19-Apr-12	Miyagi	15-Apr-12	land-locked salmon	270
19-Apr-12	Miyagi	14-Apr-12	Japanese dace	410
19-Apr-12	Miyagi	18-Apr-12	log-grown shiitake	680
19-Apr-12	Ibaraki	16-Apr-12	channel catfish	150
20-Apr-12	Miyagi	18-Apr-12	sea bass	160
20-Apr-12	Miyagi	17-Apr-12	panther puffer	150
20-Apr-12	Ibaraki	17-Apr-12	channel catfish	210
20-Apr-12	Ibaraki	17-Apr-12	silver crucian carp	130
20-Apr-12	Tochigi	18-Apr-12	*Pteridium aquilinum* (common bracken)	110
20-Apr-12	Tochigi	19-Apr-12	rainbow trout	150
20-Apr-12	Tochigi	18-Apr-12	kokanee	170
20-Apr-12	Tochigi	18-Apr-12	brown trout	160
20-Apr-12	Gunma	01-Apr-12	land-locked salmon	260
20-Apr-12	Fukushima	18-Apr-12	bamboo shoots	1300
20-Apr-12	Fukushima	19-Apr-12	deep fried stone moroko	130
21-Apr-12	Ibaraki	13 to 20-Apr-12	dried shiitake	1300
21-Apr-12	Ibaraki	13 to 20-Apr-12	dried shiitake	560
21-Apr-12	Ibaraki	13 to 20-Apr-12	dried shiitake	1400
21-Apr-12	Ibaraki	13 to 20-Apr-12	dried shiitake	2200
21-Apr-12	Ibaraki	13 to 20-Apr-12	dried shiitake	1600

U.S. Seafood Safe and Unaffected by Radiation Contamination from Japanese Nuclear Power Plant Incident; U.S. Monitoring Control Strategy Explained

Based on both the information currently available about radiation contamination from the Japanese nuclear power plant incident and on the control measures in place and monitoring efforts by the U.S. Environmental Protection Agency (EPA), the U.S. Food and Drug Administration (FDA) and the National Oceanic and Atmospheric Administration (NOAA) have high confidence in the safety of seafood products in the U.S. marketplace or exported U.S. seafood products.

The U.S. government's measures to monitor and control the three potential routes by which seafood contaminated with radionuclides from the Japanese nuclear power plant incident might enter the U.S. food supply are described below.

Monitoring the Risk of Contamination to Migratory Fish

The only Japanese fish with levels of radiation exceeding standards is the Japanese sand lance, which does not migrate away from the Japanese coast.

Juvenile North Pacific albacore tuna (2-5 years old) typically begin an annual transoceanic migration in the spring and early summer in waters off Japan, continue migrating throughout the late summer into inshore waters off the U.S. Pacific coast, and end their migration in the late fall and winter in the western Pacific ocean. Migratory patterns of North American Pacific salmon most commonly do not reach the coastal or offshore waters of Japan. The majority of Alaska salmon spend most of their ocean residence in the Gulf of Alaska.

The migration of tuna and other species of fish from the coast of Japan to U.S. waters would take days or months under the best of circumstances, and vessels fishing beyond U.S. waters must also travel several days to return to port. During that time needed for a fish contaminated by radiation in Japan to migrate, be caught and reach the market, the level of short-lived radionuclides such as I-131 would drop significantly through natural radioactive decay. To date, no significantly elevated radiation levels have been detected in migratory species, including North Pacific albacore.

FDA has not detected any longer-lived radionuclides, such as Cs-137, in any fish imported from Japan. The longer-lived radionuclides found by Japanese tests have been at levels below the FDA threshold known as the Derived Intervention Level (DIL), and these have been detected in only the sand lance samples.

Monitoring Fish in Japanese Waters and Seafood Shipments to the U.S.

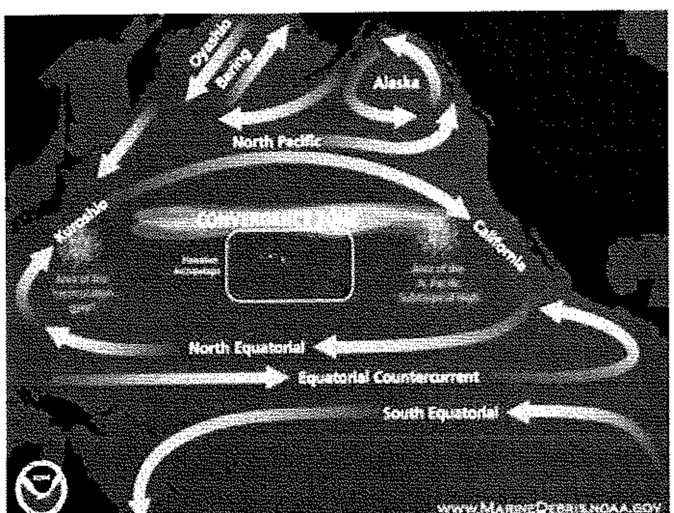
FDA is in close contact with Japanese regulatory authorities, who are monitoring fish caught in the prefectures surrounding the damaged nuclear power plant. Currently, they have found only one seafood species, the Japanese sand lance, with levels of radiation exceeding standards. The Japanese sand lance is principally consumed in Japan, with some product normally making its way to the United States through fish meal and as a traditional Asian food item. However, no shipments of the Japanese sand lance have been offered for entry into the U.S. since this incident began.

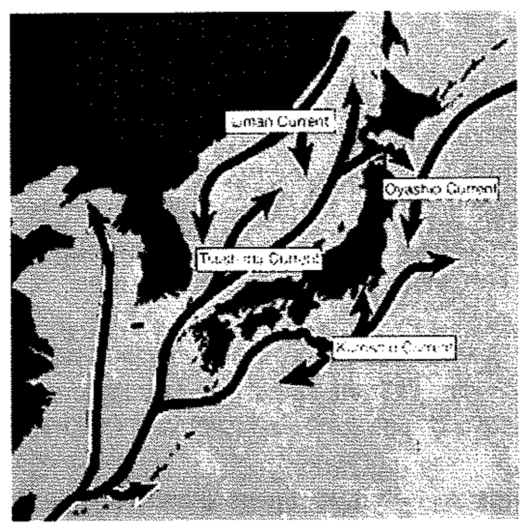
FDA is performing field examinations for gamma-ray emitting radionuclides on approximately 40% of the seafood products that are being shipped to the United States During the period from March 21, 2011 to April 25, 2011, 3,496 examinations were performed. To date, no field examinations have shown levels above background. FDA is also randomly sampling selected entries and subjecting them to laboratory analysis. To date, no gamma-ray emitting radionuclides of concern have been detected. Seafood imports from Japan represent less than one percent by volume of the seafood consumed in the United States.

Monitoring U.S. Air and Water for Radiation Contamination
EPA's nationwide radiation monitoring system, RadNet, continuously monitors the nation's air and periodically monitors precipitation for environmental radiation. These instruments have not indicated any radiation levels that warrant concern. The RadNet system consists of both fixed and deployable air monitors[1] located throughout the U.S. and its territories, including at present in Alaska, Hawaii, Guam and Saipan. The detection instruments for airborne contamination are extremely sensitive and serve as an effective early warning for potential airborne contamination from the Japanese incident.

The great quantity of water in the Pacific Ocean rapidly and effectively dilutes radioactive material. Currently, testing of waters approximately 30km (18 miles) off the coast of Japan has shown that the radiation levels have dissipated rapidly, reaching drinking water standards by the 30 km test location. This means that seafood harvested in areas distant from the damaged reactor are unlikely to be affected.

FDA and NOAA do not anticipate contamination of living marine resources in U.S. waters at this time. For this reason, sampling of U.S. harvested seafood is not currently planned. Should radioactive material be deposited into the Kuroshio Current (see images below), FDA and NOAA would be quick to respond to the potential for its transport to U.S. waters. In that event, concentration values in the Kuroshio Current would be compared to known values from previous incidents to assess the potential impact. Radionuclide values are available for seawater, sediment, and various plant and animal species in many regions, including the Japan Sea, the Alaska Aleutian Islands, and Europe. Using the best scientific data available, U.S. federal agencies will continue to revisit whether testing fish for radionuclides would be appropriate.





Left: Simplified overview of dominant ocean currents in the northern Pacific Ocean (http://marinedebris.noaa.gov).
Right: Prevailing currents off Japan (http://www.jamstec.go.jp/jamstec-e/earth/p2/index.html).

To screen for longer term impacts, NOAA's National Ocean Service and, the Environmental Protection Agency are exploring approaches to monitor seawater and sediment in areas along the western U.S. coast, with sampling stations co-located with sites in NOAA's Mussel Watch program. These sites are located in coastal waters from near shore to three miles from the coast.

1. http://www.epa.gov/japan2011/japan-faqs.html#what

Fisheries and Oceans Canada Pêches et Océans Canada Canada

Science Response 2012/006

Transport of marine debris from the 2011 Tōhoku tsunami to the west coast of Canada

Context

On December 9, 2011, Fisheries and Oceans Canada's (DFO) Ocean Sciences Division (OSD) in Pacific Region requested that DFO Science, Pacific Region, provide information and advice regarding the transport of debris to the west coast of Canada from the March 2011 earthquake and tsunami in Japan. This request arose because the OSD has received multiple requests from other federal government departments and agencies, the Province of British Columbia, and the media for information on the timing, location and quantity of debris generated by the earthquake and tsunami that might reach Canadian waters and shorelines. The OSD requested responses to the following:

1. **When and where is debris from the 2011 Tōhoku tsunami expected to reach Canadian waters and shorelines?**
2. **What types of material are expected in the debris and what is the estimated quantity of material likely to enter Canadian waters and/or reach shorelines?**
3. **What monitoring of the debris is occurring while it drifts at sea from a Canadian/international perspective?**
4. **What risks, if any, does this debris pose for species, habitats, and ecosystems in Canadian waters? and,**
5. **What are the potential navigational impacts in Canadian waters?**

This Science Special Response Process (SSRP) was based on existing information on the debris and two independent ocean circulation models of simulating debris movements and drift rates in the North Pacific Ocean, both of which are subject to considerable uncertainty due to the minimal observation and tracking of debris, the diffuse nature of the debris field, and the absence of formal testing of the models. A SSRP was used because DFO Science was asked only to review the information available on the issue rather than data collection methods or the simulation models and their results.

The responses/conclusions of the SSRP are:

1. **When and where is debris from the 2011 Tōhoku tsunami expected to reach Canadian waters and shorelines?** Based on model forecasts, debris from the March 2011 tsunami is expected to begin arriving in waters off North America in 2013 and will likely continue to arrive over a large spatial area from Alaska to California for several years. * However, high windage objects may be driven by the prevailing westerly winds and move more quickly towards the North American coast than the surface waters that are likely transporting most of the debris. Thus, high windage objects may begin arriving along the coast of British Columbia earlier than the bulk of the debris, which is forecasted to begin arriving in the first half of 2013. Most of this debris will consist of small pieces rather than large objects or debris fields owing to the effects of surface currents, winds, and waves. It is important to note that the debris generated by the tsunami will be an addition to the existing debris load floating into Canadian waters and washing ashore in British Columbia every day. Existing patterns of debris deposition on shorelines are not expected to change when debris from the tsunami begins arriving. Since the origin of the most debris washing ashore is not identifiable, the only indicator of tsunami debris may be an

increase in the quantity of debris (by weight) washing ashore relative to the long-term average. It is unlikely that debris from the tsunami will enter the Strait of Georgia due to surface water properties and currents at the mouth of the Strait of Juan de Fuca.

2. **What types of material are expected in the debris and what is the estimated quantity of material likely to enter Canadian waters and/or reach shorelines?** Both the quantity and composition of tsunami debris expected to reach North America are highly uncertain. Initial estimates of the mass of debris swept into the ocean ranged between 20 and 25 million tonnes. However, an updated estimate from the Government of Japan is that 1.54 million tonnes of tsunami-generated debris remains afloat as of March 2012. Independent confirmation of these figures is lacking at present and the composition of the debris is poorly known. Based on existing knowledge of oceanographic processes and marine debris transport, only the most buoyant and durable objects will survive the trans-Pacific crossing and reach North America. Models used to forecast debris movements show that most of the tsunami debris will remain in the ocean for many years and collect in the North Pacific Garbage Patch. It is unlikely that debris caught in the Garbage Patch will subsequently reach the coast of British Columbia.

3. **What monitoring of the debris is occurring while it drifts at sea from a Canadian/international perspective?** Debris swept into the Pacific Ocean was tracked by satellite for about one month after the tsunami. An attempt to locate debris with high resolution satellite imagery in December 2011 was unsuccessful. In the absence of systematic monitoring of debris by satellites, opportunistic sightings by passing vessels have been compiled and catalogued by the Government of Japan. Shoreline monitoring to collect baseline data on the quantity and composition of marine debris washing ashore in Washington is occurring and may expand to Oregon and California. At present, there is no formal systematic shoreline monitoring program in British Columbia, although some baseline data may be available from annual beach clean-up days coordinated by environmental non-governmental organizations.

4. **What risks, if any, does this debris pose for species, habitats, and ecosystems in Canadian waters?** It is impossible to quantify the risk to marine species, habitats or ecosystems in British Columbia associated with tsunami debris and whether this risk surpasses any thresholds for effects. The baseline risks to marine habitats, species and ecosystems in Canadian waters from the existing marine debris load are poorly understood and documented and as a result the expected incremental increase in risks associated with the arrival of tsunami debris cannot be estimated at present. However, the risks from radioactivity on the debris associated with 131I and 137Cs originating from the Fukushima nuclear plant are believed to be low. Limited testing of tsunami debris collected by a Russian research vessel in September 2011 found that radioactivity levels were below detection limits.

5. **What are the potential navigational impacts in Canadian waters?** Navigational impacts in Canadian waters associated with marine debris are poorly known. The highest risk to navigation is likely related to large objects (e.g., shipping containers, houses, etc.) arriving in coastal waters, but the probability of these objects surviving a trans-Pacific crossing intact is believed to be low. Although drifting nets, ropes and other entangling debris from the tsunami pose a risk, this risk and the resulting impacts are likely incremental increases on the current navigational risks associated with entangling debris. Small objects (e.g., logs or small pieces of wood) are not believed to pose any additional risk to vessel traffic off the west coast of Vancouver Island. Tsunami debris, when it arrives, is unlikely to pose a risk to vessel traffic in the Straits of Juan de Fuca or Georgia since water properties and current patterns will inhibit the movement of debris into these water bodies.

Although some of the debris from the 2011 Japanese tsunami will eventually reach North America, there remains considerable uncertainty with respect to the quantity and composition of debris still floating, the location of the debris, the pathway of the debris, and the timing and quantity of debris that will arrive. To address these uncertainties, recommendations to update this advice as new information becomes available from other Government agencies and to coordinate monitoring and surveillance are provided.

This Science Response report is from the Fisheries and Oceans Canada, Canadian Science Advisory Secretariat, Regional Science Special Response Process (SSRP) of March 6, 2012 on the Transport of Marine Debris from the 2011 Tōhoku Tsunami to the west coast of Canada.

* Updated: June 2012

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Date Modified: 2012-06-18

TRANSPORT OF MARINE DEBRIS FROM THE 2011 TŌHOKU TSUNAMI TO THE WEST COAST OF CANADA

Context

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Background

The magnitude 9.0 mega-thrust earthquake that occurred under the ocean about 70 km off the east coast of Japan on 11 March 2011 generated a tsunami that caused widespread destruction and loss of life in Japan. The tsunami inundated low lying coastal areas of the Tōhoku region of northeast Honshu Island and, in several instances, entire villages were swept away by the surging waters. A large quantity of debris was produced by the tsunami, much of which was swept into the ocean by the retreating waters. This marine debris is presently being transported and dispersed by ocean currents and some of this debris is expected to enter Canadian waters. The following report provides a brief overview of present knowledge regarding the transport of marine debris from the Tōhoku tsunami.

Analysis

Marine debris

The debris that was swept to sea by the tsunami is composed of a very wide variety of objects of different materials and sizes, some as large as entire houses. The actual mass or volume of this material is not known accurately. The Ministry of the Environment of Japan initially estimated that the tsunami produced some 25 million tons of debris, which included both material that remained on land and material that was transported out to sea (NOAA 2012a). The most recent estimates from the Government of Japan (GoJ) are that the tsunami swept approximately 4.8 million tonnes of debris into the ocean, of which 70% of the debris, consisting of the heavier objects, sank to the bottom within a relatively short distance of its point of entry, and that 1.54 million tonnes remains afloat in the north Pacific Ocean as of March 2012 (GoJ 2012). These figures have not been independently confirmed, nor is the composition of the floating debris known with certainty. However, lighter materials that float at or close to the surface such as plastic, wood, metal containers, and as well as fishing gear (nets, lines, buoys, etc.), can be expected to remain afloat for a long time. Wind and waves will exert forces on these floating objects, with the relative effects determined by the degree of windage (fraction of the area of an object that protrudes above the water surface). Larger objects, such as houses, are expected to break up into many smaller pieces.

The Tōhoku tsunami inundated the Fukushima nuclear power plant, damaging reactors and stored spent fuel rods, and subsequently leading to leaks of radioactive material, specifically iodine-131 (^{131}I, half-life 8.02 days) and cesium-137 (^{137}Cs, half-life 30.17 years) into the atmosphere and ocean. The discharge of radioactive water into the ocean occurred well after the vast bulk of the debris had been transported seaward by the ocean currents. Plumes of radioactive material escaped from the reactors into the atmosphere shortly after the tsunami, and some of this material may have been deposited onto floating debris. Since ^{131}I has a short-half life and ^{137}Cs is water soluble, radioactivity deposited on the debris is likely to either have degraded below detection limits or have washed off during the prolonged exposure in the ocean. Given these considerations, there is only a remote possibility that the marine debris is contaminated by radioactive materials (NOAA 2012a).

Transport and dispersal by ocean currents

Marine debris is subject to transport and dispersal by ocean currents and by oceanic winds and their attendant waves. Large-scale ocean currents are responsible for transport over large distances. The ocean is also a very turbulent environment, and smaller scale motions and eddies will gradually disperse an initially compact debris cluster into a diffuse cloud of objects spread over a large area.

The Tōhoku tsunami deposited debris into the ocean along the northern coast of Honshu Island. The Oyashio and Kuroshio Currents merge together in this region to form the Kuroshio Extension, a swift eastward-flowing current which will have carried some of the debris away from the coast of Japan towards the central North Pacific (see Figure 1). In the central North Pacific, the flow becomes very broad and sluggish and is referred to as the North Pacific Current (or the West Wind Drift). It is expected that marine debris from the Tōhoku tsunami will be transported by this relatively slow moving current system across the Pacific Ocean towards the west coast of North America.

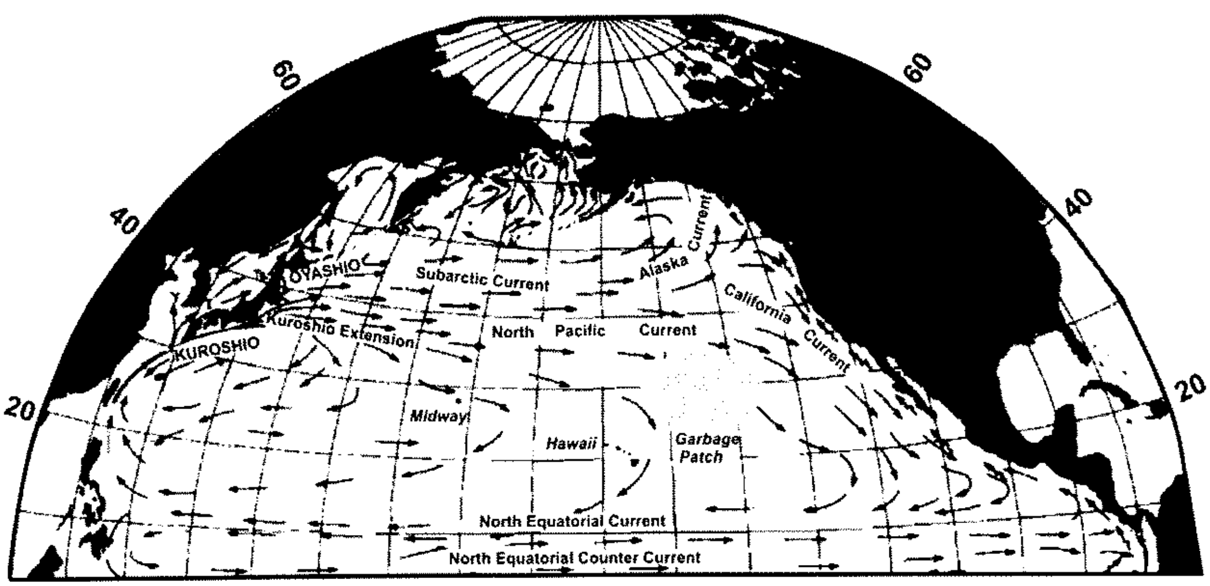

Figure 1. Schematic diagram showing major currents of the North Pacific. The red symbol indicates the approximate location where debris generated by March 2011 tsunami entered the ocean. The hatched blue area indicates the approximate location of the Great North Pacific Garbage Patch. Adapted from Figure 3 in Tabata (1975).

Near the North American coast, the North Pacific Current splits (bifurcates) into northeastward and southeastward flowing current systems, referred to as the Alaska Current and California Current, respectively. It is expected that the tsunami debris will be transported into both of these current systems as it approaches North America. Debris flowing northward into the Alaska Current is more likely to enter Canadian waters, while debris transported in the southward flowing branch is more likely to impact the U.S. west coast and Hawaii.

Studies of the motion of near-surface drifters have found that the latitude of bifurcation is about 50°N (Bograd et al. 1999), although there is some year-to-year variability in this latitude. To reach the British Columbia shoreline, debris must traverse a region of variable flow located eastward of the bifurcation zone. Here generally westerly winds will drive segments of the debris field onto the coast. Currents can only bring debris close to the shore. Debris is then deposited on the shoreline by the action of retreating tides, onshore winds, and waves.

The major currents depicted in Figure 1 represent an idealized view of the large-scale circulation in the North Pacific. Highly variable, energetic motions occurring over a range of smaller scales are also present at any given time. These motions, referred to as 'eddies', are ocean analogues to the atmospheric systems that produce familiar day-to-day weather patterns. The main effect of eddy variability on the marine debris is to spread the debris out over an increasingly large area. For example, consider the following estimate of dispersion in which the length scale of dispersion of a cluster is

$$d = \sqrt{2Kt} \ ,$$

where t is the elapsed time and K is the lateral eddy diffusivity based on single particle dispersion. Zhurbas and Oh (2003) reported that values of 5,000 - 10,000 $m^2 s^{-1}$ are representative of single particle diffusivity within the Kuroshio Extension. Taking a value at the lower end of the diffusivity range results in a dispersion scale of $d \approx 400$ km after 6 months. A circle with a radius of 400 km encompasses an area of about 500,000 km^2, which is comparable to the area of the province of Alberta (660,000 km^2) or the state of California (424,000 km^2). Thus, based on this simple calculation, tsunami debris is likely to be dispersed into a very diffuse cloud that extends over hundreds of thousands of square kilometers after only 6 months. Within this large expanse, the debris is not expected to be uniformly distributed. Rather patchy clumps and elongated filaments of debris are likely to be observed.

Present status

Offshore transport of the tsunami debris was observed very soon after deposition into the ocean. The debris was tracked for a short time by satellite (NOAA 2012b), and patches of debris could be seen in satellite imagery for about a month following the tsunami. However, by 14 April 2011 the cloud of debris had dispersed to the point that it ceased to be visible in satellite imagery (NOAA 2012b). In December 2011, researchers at the United States National Oceanic and Atmospheric Administration (NOAA) examined high resolution satellite imagery of a 50 km by 60 km patch of ocean where model simulations suggested debris would be located, but failed to detect any debris. This result means either that scale of the debris was smaller than the 1–2 meter resolution of the satellite imagery, or that debris was not in the forecasted location. Regardless of the explanation, this result underscores the limits of existing knowledge of the distribution of tsunami debris at this time (N. Barnea, NOAA Marine Debris Program, pers. comm.). Presently, there is no tracking of the tsunami debris by satellite and as a result, comprehensive monitoring of the movement of the tsunami debris has become essentially impossible.

Reports of direct observations of debris at sea are being collected by the GoJ and NOAA and sightings from commercial vessels have been compiled and catalogued (GoJ 2012b). This record now consists of some 97 sightings from April 2011 through November 2011. All of these sightings were from a region of the Pacific that is west of the dateline and south of 45°N and most of the sightings consist of small vessels and/or containers. The vessels are frequently reported to be either capsized or partially submerged. The last reported sighting occurred in November 2011.

NOAA has received to date only two reports of debris with origins that are confirmed to be from the tsunami. One of these reports consists of extensive observations made in the open ocean from the *STS Pallada*, a Russian sailing vessel that was travelling west across the Pacific to Vladivostok (IPRC 2011a). As it was heading past Midway Atoll, the crew of the *Pallada* noticed many floating objects in the water. On 22 September 2011, about 800 km northwest of Midway Atoll, the *Pallada* encountered a small fishing boat, registered in Fukushima, Japan. Tests of the boat found that radiation levels were below detection limits. Observations of additional debris were made from the *Pallada* as it continued on a north-westward course towards Japan.

Forecasts of debris location

Forecasts of the future movement of the tsunami debris depend on models predictions and carry a considerable degree of uncertainty. Results from model simulations conducted at NOAA (NOAA 2012a) and at the University of Hawaii (IPRC 2011b) are in the public domain. It is not clear how much confidence can be placed in the models since they have not been well tested against observations, particularly for a once-in-a-lifetime event such as the March 2011 tsunami. Nevertheless, it is somewhat encouraging that these two differently formulated models yield results that are generally consistent with each other. Figure 2 shows the distribution of the tsunami debris at a series of different times as predicted by the University of Hawaii model.

The following are some of the salient results from this simulation.

- As anticipated, the simulation shows dispersion of the debris over a large area as it is being transported across the Pacific toward the west coast of North America.
- The leading edge of the debris cloud is predicted to reach the North American continent about two years after deposition into the ocean. Based on this prediction, the debris can be expected to start arriving along the coast by spring 2013 or shortly afterwards.
- Following its initial appearance, the rate at which debris arrives along the coast should increase gradually. Tsunami debris will continue to be transported by ocean currents close to the coast for a number of years, and it is possible that debris will continue to be deposited along the British Columbia shoreline during this time.
- In the simulation, most of the debris is transported south into the California Current system, with a much smaller amount entering the Alaska Current. Based on this finding, the U.S. west coast can expect to receive a larger fraction of the debris than the west coast of Canada.
- The simulation shows most of the debris (> 90%) remaining in the ocean after 5 years. In particular, the simulation shows a large fraction of the debris accumulating in a region known as the Great North Pacific Garbage Patch (Figure 1). This is a large expanse of ocean northeast of Hawaii where floating debris, especially plastics, has accumulated over time due to the convergence of surface wind-driven currents (Ekman transport)

(Maximenko et al. 2012). The simulation shows debris remaining trapped within the Garbage Patch for many years.

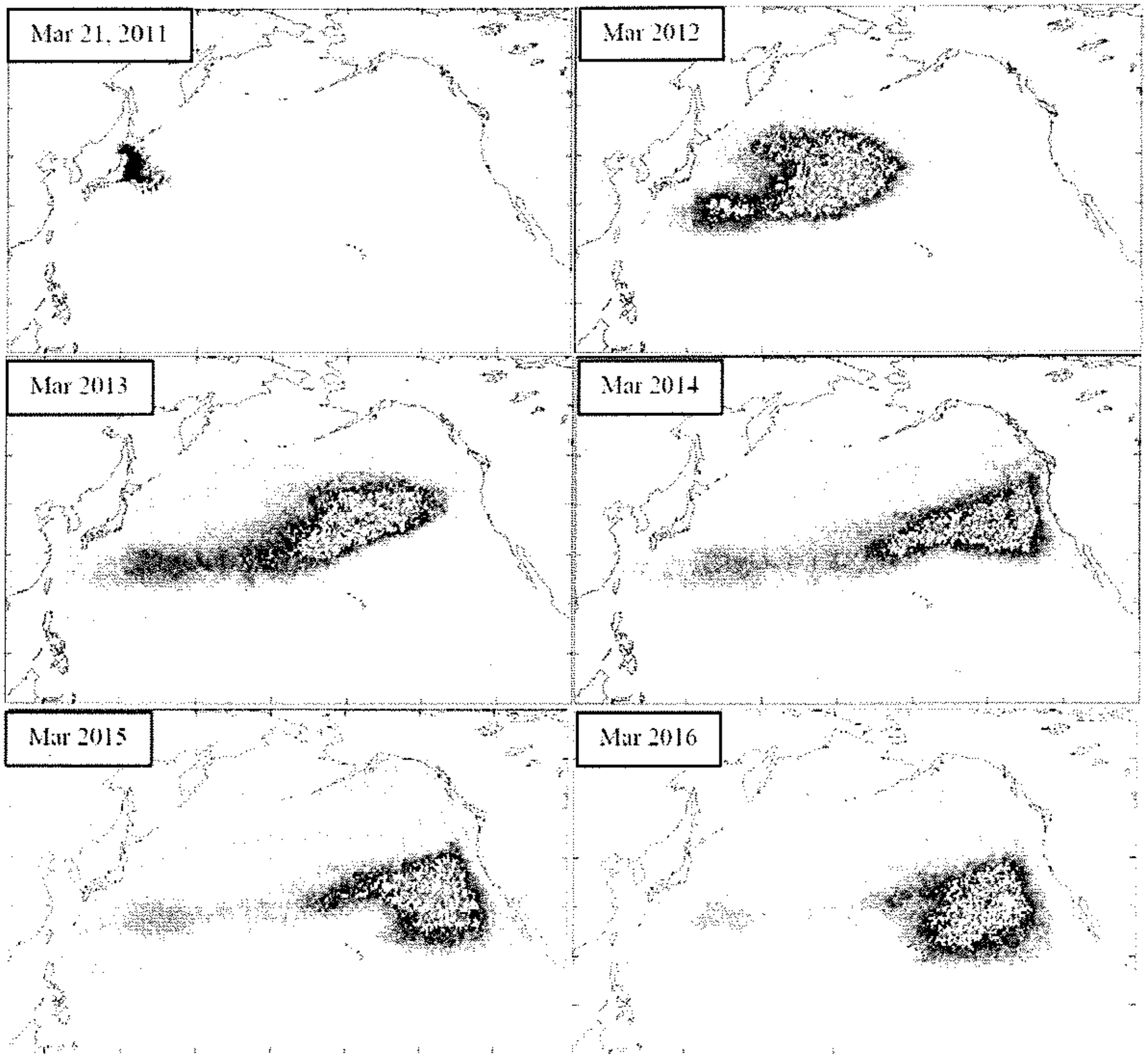

Figure 2. Distribution of the tsunami debris at yearly intervals in a model simulation by N. Maximenko and J. Hafner of the University of Hawaii. In this simulation, the concentration of debris found in proximity to the coast of British Columbia peaks by about March 2014, some three years after its release into the ocean. Debris remains present along the British Columbia coast for at least five years, albeit at reduced level. This figure is drawn from (IPRC 2012b).

Results from this model simulation are derived from the trajectories of a large number of drifters deployed in the ocean over a 30 year period (Maximenko et al. 2012). These trajectories are representative of the motion of objects that move with the top layer of the water column. They may be less representative of the motion of high windage objects that float well above the water surface and are directly exposed to wind forcing. High windage objects may be driven by the prevailing westerly winds and move more quickly towards the North American coast than the surface waters that are likely transporting most of the debris. Thus, high windage objects may begin arriving along the coast of British Columbia earlier than the bulk of the debris, which is forecasted to begin arriving in the first half of 2013.

Environmental impacts and hazards to navigation

The potential environmental impacts of the tsunami debris on the coastal waters and shoreline of British Columbia are difficult to ascertain with confidence. Presently, the volume of debris likely to reach the coast cannot be estimated, and the composition of the debris is poorly known. Consequently, the risks to habitat, species and ecosystems cannot be identified at this time.

Likewise the possible hazards to navigation presented by the debris are difficult to determine. There may be a few large objects amidst the debris that arrives in British Columbia waters (e.g., containers from shipping), and it is at least conceivable that there is a risk of collision at sea. However, perhaps the greatest navigation risk presented by the debris may be due to entanglement in floating fishing gear, ropes and nets, but the magnitude of this risk is unknown relative to existing risks which are poorly documented.

Conclusions

While many relevant questions can be posed regarding the marine debris produced by the Tōhoku tsunami, only tentative answers can be given, amid considerable uncertainty. What is known is that a large mass of debris was swept into the Pacific Ocean and was transported offshore by ocean currents. The spatial extent and composition of this debris field is not well known, although it is likely to be highly diffuse, with the debris dispersed into numerous small patches over a large expanse of ocean. There have been a few isolated reports indicating that, as expected, debris is being transported across the Pacific and has reached the central Pacific. No systematic monitoring of the motion of the debris is occurring at this time.

Projections for the future must depend on the use of inadequately tested models. These models produce qualitatively similar results forecasting that the bulk of the debris will begin to arrive along the west coast of North America during the first half of 2013, although some high-windage objects may arrive sooner. Most of the debris that reaches North America will move south into the California Current where some of it may wash ashore in Washington, Oregon, and California before moving towards the Hawaiian Islands. A smaller portion of the debris will move north into the Alaska Current and it is from this load that debris is most likely to wash ashore in British Columbia. The models also show the great bulk of tsunami debris remaining in the ocean for many years and collecting in the North Pacific Garbage Patch. It is unlikely that much of the debris caught in the Garbage Patch will subsequently reach the coast of British Columbia.

It is important to note that marine debris from a variety of domestic and foreign sources floats into Canadian waters and is deposited on British Columbia shorelines every day and that most of this debris consists small pieces with no identifiable markings. Identifying specific shoreline locations in British Columbia for tsunami debris deposition is not possible because the models used to forecast debris movement do not consider factors such as tides, wind/waves, and local geography which are important for washing debris onto a shoreline. However, existing patterns of marine debris deposition on shorelines are not expected to change when debris from the tsunami begins arriving. Therefore, shorelines that receive debris at present (e.g., collector beaches) are also likely to receive tsunami debris.

It is unlikely that marine debris from the tsunami will enter the Strait of Georgia due to a strong surface outflow of fresher water through the Strait of Juan de Fuca and a counter-clockwise eddy at the mouth that traps surface debris and moves it back into coastal areas off the west coast of Vancouver Island.

Although the March 2011 tsunami was probably one of the largest single-source loadings of marine debris to the north Pacific Ocean, the significance of this addition is uncertain because the existing load of marine debris is not well quantified. The Government of Japan estimates that about 70% of the debris swept into the ocean sank on the continental shelf and that 1.54 million tonnes of debris remains afloat in the north Pacific Ocean as of March 2012 (GoJ 2012a), although these figures have not been independently verified yet. Based on existing knowledge of oceanographic processes and marine debris transport, only the most buoyant and durable objects will survive the trans-Pacific crossing and reach North America and this pattern is unlikely to change with the tsunami debris. Most large objects swept into the ocean by the tsunami (e.g., shipping containers, houses, small vessels) are not expected to survive a crossing of the North Pacific intact.

Movements of tsunami debris fields were tracked by satellite for approximately one month, after which the debris field was too widely dispersed and debris pieces too small to be resolved in satellite imagery. An attempt to verify the University of Hawaii model forecast of debris location in December 2011 was unsuccessful. Opportunistic sightings of debris recorded by passing vessels have been compiled and catalogued by both NOAA and the Government of Japan. Since there is no tracking of the tsunami debris by satellite, reliable data on the location, pathways, and drift rates of tsunami debris in the North Pacific Ocean are currently lacking.

Shoreline monitoring has been conducted for several years in the Olympic Coast National Marine Sanctuary of Washington using a well documented protocol established by the NOAA Marine Debris Program (http://marinedebris.noaa.gov/). There is no formal systematic shoreline monitoring program in British Columbia. Some baseline information on debris may be available from annual beach clean-up days coordinated by environmental non-governmental organizations, but follow-up is needed to assess the quality of these data.

Neither the existing risks to habitats, species and ecosystems in British Columbia from marine debris nor the incremental increase in risks associated with the arrival of tsunami debris are quantifiable because existing risk from marine debris loads in Canadian waters are poorly understood and documented. Although there may be an increased risk to species in British Columbia associated with entanglement in drifting nets, ropes, and plastics, the magnitude of this increase relative to the existing entangling risk from marine debris is unknown at present. The risks from radioactivity associated with ^{131}I and ^{137}Cs on the debris originating from the Fukushima nuclear power plant are believed to be very low. ^{131}I has a half-life of about 8-days and by March 2012 activity levels on debris would be well below the most sensitive detection limits and any known effect threshold and ^{137}Cs salts are water-soluble and can be washed off debris during prolonged exposure while at sea. Testing of tsunami debris collected by a Russian research vessel in September 2011 found that radioactivity levels were below detection limits. There is some potential for bioaccumulation of ^{137}Cs in aquatic food webs, but the risk to marine species and ecosystems in British Columbia through biological transport is likely low because ^{137}Cs is rapidly eliminated from organisms, resulting in a short biological half-life of 2-3 months.

Baseline navigational impacts in Canadian waters associated with marine debris are poorly known and, therefore, the additional impacts associated with tsunami debris arriving in Canadian waters cannot be quantified at present. Although the highest risk to navigation is likely related to large objects (e.g., shipping containers, houses, etc.) arriving in coastal waters, the probability of these objects surviving a trans-Pacific crossing intact is believed to be very low and the number of large objects deposited in the sea off the coast of Japan may not have been high. Drifting nets and ropes and other entangling debris from the tsunami may incrementally increase the current risk of navigational impacts associated with entangling debris in Canadian waters. Small objects (e.g., logs or small pieces of wood) are not believed to pose any additional risk to vessel traffic off the west coast of Vancouver Island. Tsunami debris, when it arrives, is unlikely to pose a risk to navigation in the Straits of Juan de Fuca or Georgia since water properties and current patterns will ensure that little, if any, debris enters these areas.

Additional recommendations concerning further measures that could be considered to respond to the tsunami debris issue are listed below.

1. The Government of Japan released new estimates of the quantity and composition of debris that was swept into the sea and remains afloat in March 2012. Since these data were not available during the SSRP meeting, it may be prudent to re-evaluate the conclusions and advice in this SRR following independent confirmation of the new estimates.
2. DFO has the expertise to liaise with other science organizations dealing with marine debris and transfer information on debris movements, observations at sea, and other scientific issues to relevant agencies in Canada responsible for creating contingency plans to respond to tsunami debris when it begins arriving in Canadian waters and washes ashore on British Columbia shorelines.
3. Since large floating objects have a higher probability of detection and likely have a higher risk of navigational impacts, other opportunities for the early detection of large objects should be explored, including aerial surveillance flights for fisheries enforcement, commercial shipping, Radarsat, and land-based coastal radar installations.
4. There is no systematic shoreline monitoring program in British Columbia at present. If a formal shoreline monitoring program is contemplated, then the NOAA Marine Debris protocol used in Washington should be considered for consistency in data collection methods and analysis.

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Date March 23rd, 2012

Sources of information

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Canadian Food Inspection Agency Agence canadienne d'inspection des aliments Canada

Food > Japan Nuclear Crisis

Test Results for Imported Food Products from Japan

As part of the Government of Canada's response to the March 11, 2011 earthquake in Japan, the Canadian Food Inspection Agency (CFIA) tested imported food products from Japan for radioactivity. Import volumes from Japan are very low. As of June 15, 2011, **169 samples of imported food products from Japan were tested and all products were below Health Canada action levels.**

Sample	Product	Sample date	Country of Origin	Iodine - 131	Cesium - 134	Cesium - 137
1	Fish and Seafood	April 5, 2011	Japan	<MDC	<MDC	<MDC
2	Fish and Seafood	April 5, 2011	Japan	<MDC	<MDC	<MDC
3	Fruit and vegetables	April 5, 2011	Japan	<MDC	<MDC	<MDC
4	Fish and Seafood	April 6, 2011	Japan	<MDC	<MDC	<MDC
5	Fish and Seafood	April 6, 2011	Japan	<MDC	<MDC	<MDC
6	Fish and Seafood	April 6, 2011	Japan	<MDC	<MDC	<MDC
7	Fish and Seafood	April 7, 2011	Japan	<MDC	<MDC	<MDC
8	Processed product	April 8, 2011	Japan	<MDC	<MDC	<MDC
9	Fish and Seafood	April 8, 2011	Japan	<MDC	<MDC	<MDC
10	Fish and Seafood	April 8, 2011	Japan	<MDC	<MDC	<MDC
11	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
12	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
13	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
14	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
15	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
16	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC

17	Processed product	April 11, 2011	Japan	<MDC	<MDC	<MDC
18	Processed product	April 12, 2011	Japan	<MDC	<MDC	<MDC
19	Processed product	April 13, 2011	Japan	<MDC	<MDC	<MDC
20	Processed product	April 13, 2011	Japan	<MDC	<MDC	<MDC
21	Processed product	April 13, 2011	Japan	<MDC	<MDC	<MDC
22	Processed product	April 13, 2011	Japan	<MDC	<MDC	<MDC
23	Fish and Seafood	April 15, 2011	Japan	<MDC	<MDC	<MDC
24	Fish and Seafood	April 15, 2011	Japan	<MDC	<MDC	<MDC
25	Fish and Seafood	April 15, 2011	Japan	<MDC	<MDC	<MDC
26	Fruit and vegetables	April 15, 2011	Japan	<MDC	<MDC	<MDC
27	Fruit and vegetables	April 15, 2011	Japan	<MDC	<MDC	<MDC
28	Fish and Seafood	April 18, 2011	Japan	<MDC	<MDC	<MDC
29	Processed product	April 19, 2011	Japan	<MDC	<MDC	<MDC
30	Processed product	April 19, 2011	Japan	<MDC	<MDC	<MDC
31	Processed product	April 19, 2011	Japan	<MDC	<MDC	<MDC
32	Fish and Seafood	April 19, 2011	Japan	<MDC	3.56 Bq/Kg*	4.1 Bq/Kg*
33	Processed product	April 19, 2011	Japan	<MDC	<MDC	<MDC
34	Processed product	April 19, 2011	Japan	<MDC	<MDC	<MDC
35	Processed product	April 20, 2011	Japan	<MDC	<MDC	<MDC
36	Fish and Seafood	April 20, 2011	Japan	<MDC	<MDC	<MDC
37	Processed product	April 26, 2011	Japan	<MDC	<MDC	<MDC
38	Processed product	April 26, 2011	Japan	<MDC	<MDC	<MDC
39	Fish and Seafood	April 26, 2011	Japan	<MDC	<MDC	<MDC

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41	Fish and Seafood	April 26, 2011	Japan	<MDC	<MDC	<MDC
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44	Processed product	April 26, 2011	Japan	<MDC	<MDC	<MDC
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46	Fish and Seafood	April 26, 2011	Japan	<MDC	<MDC	<MDC
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54	Processed Product	April 27, 2011	Japan	<MDC	<MDC	<MDC
55	Processed Product	April 27, 2011	Japan	<MDC	<MDC	<MDC
56	Fish and Seafood	April 28, 2011	Japan	<MDC	<MDC	<MDC
57	Fruit and Vegetables	April 29, 2011	Japan	<MDC	<MDC	<MDC
58	Processed Product	April 29, 2011	Japan	<MDC	<MDC	<MDC
59	Processed Product	April 29, 2011	Japan	<MDC	<MDC	<MDC
60	Processed Product	April 29, 2011	Japan	<MDC	<MDC	<MDC
61	Fish and Seafood	May 2, 2011	Japan	<MDC	<MDC	<MDC
62	Fish and Seafood	May 2, 2011	Japan	<MDC	<MDC	<MDC

63	Processed Product	May 2, 2011	Japan	<MDC	<MDC	<MDC
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65	Processed Product	May 2, 2011	Japan	<MDC	<MDC	<MDC
66	Grain Product	May 2, 2011	Japan	<MDC	<MDC	<MDC
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95	Processed Product	May 3, 2011	Japan	<MDC	<MDC	<MDC
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97	Processed Product	May 4, 2011	Japan	<MDC	<MDC	<MDC
98	Fish and Seafood	May 4, 2011	Japan	<MDC	<MDC	<MDC
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116	Processed Product	May 11, 2011	Japan	<MDC	<MDC	<MDC
117	Processed Product	May 16, 2011	Japan	<MDC	<MDC	<MDC
118	Fruit and Vegetables	May 17, 2011	Japan	<MDC	<MDC	<MDC
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129	Fish and Seafood	May 26, 2011	Japan	<MDC	<MDC	<MDC
130	Processed Product	May 26, 2011	Japan	<MDC	<MDC	<MDC
131	Fish and Seafood	May 27, 2011	Japan	<MDC	<MDC	<MDC

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141	Fish and Seafood	May 30, 2011	Japan	<MDC	<MDC	<MDC
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150	Fish and Seafood	June 6, 2011	Japan	<MDC	<MDC	<MDC
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164	Processed Product	June 7, 2011	Japan	<MDC	<MDC	<MDC
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168	Processed Product	June 8, 2011	Japan	<MDC	<MDC	<MDC
169	Processed Product	June 8, 2011	Japan	<MDC	<MDC	<MDC

MDC is defined as the Minimum Detectable Concentration and is typically around 2 Bq/Kg. The CODEX Limits for radioactive particles (Cs-134, Cs-137, and I-131) is 1000 Bq/Kg for general consumption. The sample size used for the test is generally around 120 g and the method used is High Resolution Gamma Spectroscopy.

*While this product is above the Minimum Detectable Concentration, it does not pose a health risk to consumers. Health Canada has determined that the action level for this product is 1000 Bq/Kg. Action levels are the food safety thresholds for which a specific radionuclide should not exceed. Should these levels be exceeded, appropriate risk management action would be taken depending on the exposure and the potential impact of the product on humans.

Date Modified: 2011-09-15

BRITISH
COLUMBIA
The Best Place on Earth

June 4, 2012

Robin Brown
Manager, Ocean Sciences Division
Institute of Ocean Sciences
PO Box 6000, Sidney BC V8L 4B2

Dear Robin:

As discussed British Columbia has considerable concerns about the CFIA/DFO decisions to do no further testing of pacific salmon or other migratory fish that return to British Columbia waters. There remains great public concern about the potential for radiation contamination in these fish species because of the emergency at the Fukishiima Diiachi nuclear power plant in Japan. I have received over a dozen messages from concerned citizens and there are repeated articles in local papers about this perceived risk. One of the more inflammatory articles quoted a US biologist as saying salmon will be unsafe by the winter of 2012.

We are aware that the scientific data show very low levels of radiation in the marine environment and these are mostly in the very near vicinity to the Fukishiima nuclear plant and that testing by DFO of water and by CFIA of a small number of fish last summer revealed no concerns. However recent reports of tuna off the coast of California with elevated Cesium levels has rekindled the concern in the public here. You are aware I am sure that the salmon fishery is a very important industry both financially and culturally in British Columbia and there has been concerns expressed to us from First Nations communities who depend on this industry that these scares may damage the industry. This is along with concerns that the fish are truly safe for consumption. Given this level of concern and potential for disastrous impact on the industry we officially request that CFIA and DFO revisit their decision to not test salmon or tuna returning to British Columbia shores this coming season. While it is unlikely we will detect radiation levels that are of concern it is critical that we can say with confidence that we are monitoring the safety of this important fish source and that people can consume it with confidence there will be no ill effects on health. This will also put us in alignment with our US neighbours where ongoing testing of migratory fish species continues.

.../2

Ministry of Health

Office of the
Provincial Health Officer

4-2, 1515 Blanshard Street
Victoria BC V8W 3C8
Tel: (250) 952-1330
Fax: (250) 952-1362

The initial public outcry after the nuclear emergency in Japan demonstrated how sensitive an issue this is for Canadians and people in British Columbia in particular and we feel it is essential for the federal government who has the jurisdiction over these issues to be proactive in reassuring the public that this is being monitored closely and their health is being protected. We are prepared to be supportive partners in this vital communications initiative and will provide what expertise we can but the resources and expertise for testing reside with you. We hope to hear from you as soon as possible that testing will be continued as this crisis evolves.

Yours truly,

P.R.W. Kendall
OBC, MBBS, MHSc, FRCPC
Provincial Health Officer

pc: Graham Whitmarsh
Deputy Minister
Ministry of Health

Canadian Food Inspection Agency | Agence canadienne d'inspection des aliments
Office of the President | Bureau du Président
Chief Veterinary Officer | Vétérinaire en chef
Chief Food Safety Officer | Chef de la salubrité des aliments
Ottawa, Ontario K1A 0Y9 | Ottawa (Ontario) K1A 0Y9

CVO 010348

Dr. P.R.W. Kendall
Provincial Health Officer
4-2 1515 Blanshard St.
Victoria, B.C.
V8W 3C8

Dear Dr. Kendall:

We are writing in response to your letter to Robin Brown, Institute of Ocean Sciences, which was forwarded to us as the Government of Canada departments and agencies responsible for the issues you raise in your letter. Thank you for sharing your concerns about the safety of the Canadian food supply following the March 11, 2011 nuclear incident in Japan. We appreciate the opportunity to advise you of our actions surrounding this issue.

In response to the nuclear incident at the Fukushima Daichi plant, the Government of Canada took several measures to assess and protect the Canadian food supply from potential effects of radiation. The Canadian Food Inspection Agency (CFIA), in coordination with the Canada Border Services Agency (CBSA) and other government and international partners, implemented enhanced import controls on products originating from Japan. These controls required food and animal feed products entering Canada from affected areas in Japan to have acceptable documentation or test results verifying their safety.

Also, during spring 2011, more than 200 food products imported from Japan were tested for radionuclides at Health Canada's laboratory facilities. All test results were below the minimum detectable concentration (MDC) of 2 Bq/Kg, with the exception of one sample of dried bonito (fish). The results from the dried bonito sample were slightly above the MDC, but, as they were well below the Canadian actionable limit of 1000 Bq/Kg, this product was not considered to pose a risk to human health. All results have been posted on the CFIA web site.

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In addition, domestic milk and fish samples collected in B.C. in the three months following the nuclear incident were tested for the presence of radionuclides. The test results were all below Canadian actionable limits. The results of the milk and fish testing can be found on the CFIA website.

Furthermore, in August 2011, and again in February 2012, the CFIA tested domestic migratory fish for the presence of radionuclides. All results were below the Canadian actionable limits and presented no risk to the Canadian public.

Beyond the measures taken in Canada, the Japanese authorities implemented export restrictions from the affected prefectures and began a strict sampling and testing regime to monitor and respond to any food safety risk. This sampling and testing of food, which is ongoing, includes vegetables, dairy products, meat, egg products, grains and fish & seafood products.

Japanese authorities have used the testing information to determine when foods are safe for consumption (including exports). The results have been shared with Japan's international trading partners, including Canada. Furthermore, all Japanese test results are available on their website, at *http://www.mhlw.go.jp/english/topics/2011eq/index.html.*

The CFIA has analyzed the data provided by the Japanese authorities regarding levels of radioactivity in food from different Japanese regions for the period of March 2011 to March 2012 (the year following the incident) and for the period of March 2012 to July 2012. A summary of this analysis is attached for your reference. The analysis has demonstrated that fish & seafood and other food products that exceeded the Japanese actionable levels were localized, as they were limited to Fukushima and a small number of adjoining regions. Most other regions in Japan, only a few kilometres away from Fukushima, have shown food products and fish & seafood test results that are well below the Japanese actionable levels.

With regard to the concerns raised in the California study published by Dr. Daniel Madigan in 2012, the levels of Cesium-137 and -134 reported in the study are well below the Guideline Level (1000 Bq/Kg) as defined by the CODEX Alimentarius Commission (CAC) and adopted by Health Canada. The CAC is the international food standard setting body reporting to the United Nations Food and Agriculture Organization (FAO) and the World Health Organisation (WHO). The levels that were detected are only slightly above those of background radionuclide levels generally detected (as is acknowledged by the authors of the study) and they pose no health risk to consumers.

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The Government of Canada continues to monitor events in Japan and assess any potential impacts on Canada's food supply. Canadian officials continue to collect and assess intelligence from Japanese officials, from regulatory authorities in other jurisdictions importing Japanese food products, and from Canada's mission abroad and international authorities. In addition, Health Canada and Environment Canada continue to monitor levels of radioactivity in the Canadian environment and have not reported significant increases in these levels. Continued monitoring of the food supply is also part of our plans. As such, and as part of the Total Diet Study (TDS)—an ongoing surveillance program designed to estimate dietary exposure to chemical contaminants and nutrients—Health Canada continues to monitor the levels of radionuclides in food sold in Canada.

To support our focus on the British Columbia region for radionuclide level monitoring in food, the Total Diet Study design has been amended to have this year's sampling conducted in Vancouver. Sampling includes food composites from both domestic and imported foods. Further details on the Study can be found on the Health Canada website, under "Canadian Total Diet Study".

Through the actions of the responsible departments and agencies, the Government of Canada is continuing to ensure the safety of the Canadian food supply following the Fukushima nuclear incident. We trust that the aforementioned evidence and the measures taken by Canada address the concerns you have raised. If the Government of Canada should become aware of any new information that changes our current assessment of the situation, we will of course advise the Canadian public of this information and undertake health protection measures as warranted at that time.

Sincerely,

Dr B R Evans

Brian Evans
Chief Veterinary Officer/
Chief Food Safety Officer
Canadian Food Inspection Agency

David Butler-Jones
Chief Public Health Officer

Public Health Agency of Canada

Paul Gully
Senior Medical Advisor
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cc: Robin Brown, Manager, Ocean Science Division