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RADIOACTIVITY SURVEY DATA in Japan

Part 2
= Dietary Materials =

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National Institute of Radiological Sciences
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Radioactivity Survey Data in Japan

Number 81

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Contents

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Environmental and Dietary Materials*

(Japan Chemical Analysis Center)

1. Collection and pretreatment of samples

(1) Rain and dry fallout

Rain and dry fallout was collected monthly on a sampling tray, approximately 5000 cm^2 in area, which was filled with water to a depth of 1 cm at the beginning of every month.

Strontium and cesium carrier solutions were added after the sample was filtered. The tray was washed with 5 of distilled water and the washing was combined to the filtrate.

The sample was passed through a cation exchange column (500 of Dowex 50W X8, 50～100 mesh, Na form) at a rate flow of 80 /min.

(2) Airborne dust

Airborne dust was collected by an electrostatic precipitator or a filter air sampler for every three months at a rate of more than 3000 m^3 per month. The sampling was done 1 to 1.5 meters above the ground.

(3) Service water and freshwater

Service water, 100 each, was collected at the intake of the water-treatment plant and at the tap after water was left running for five minutes. Strontium and cesium carriers were added to the filtered water sample. The subsequent process was the same as that described in the section (1). Freshwater was treated in the same way as the service water.

(4) Soil

Soil was collected from the location in the spacious and flat area without past surface disturbance caused by duststorms, inflow and outflow due to precipitation, etc.. Any places located under trees in a forest, in a stony area or inside of river banks were avoided. Soil was taken from two layers of different depths, 0-5cm and 5-20cm. The soil lumps were crushed by hands and dried in a drying oven regulated 105 . The soil was then passed through a 2 mm sieve to remove plant roots and pebbles.

(5) Sea water

Sea water was collected at the fixed stations where the effect of terrestrial fresh water from rivers was expected to be negligibly small. A special consideration was also given to weather conditions. The sampling was carried out when there was no rainfall for the last few days. To prevent contamination, water samples were collected at the bow of a sampling boat just before she stood still by scooping surface water using a polyethylene bucket. Immediately after the collection, the samples were acidified to a pH lower than 3 by adding concentrated hydrochloric acid in a ratio of 1 to 1 of sea water, and then stored in 20 polyethylene containers. The sampling equipments as well as containers were thoroughly rinsed with dilute hydrochloric acid and then with distilled water before use. Two hundred milliliters of sea water was also collected at the same stations for the determination of chlorinity.

(6) Sea sediments

Sediment was collected in the same area as that for the sea water sample, taking the following criteria into account:

a. The depth of water exceeds 1 m at low tide.
b. No significant sedimental movement is observed in the vicinity of concern.
c. Mud, silt and fine sand are preferable.

A conventional sediment sampling device was used for collecting the top few centimeters of surface sediment. Approximately 4kg of the sample in wet weight was spread on a stenless steel dish after removed of the pebbles, shells and other foreign materials, and dried in a drying oven regulated at 105 .

(7) Total diet

A full one day ordinary diet including three meals, water, tea and other in-between snacks for five persons was collected as a sample of "total diet". The sample in a large stainless steel pan was carbonized carefully by direct application of gas flame, and was transfered to a porcelain dish and then ashed at 450 in an electric muffle furnace.

(8) Rice

Polished rice was collected in producing districts at the harvest and in consuming areas when new crops were first put on sale. The sample was carbonized and ashed in a porcelain dish.

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* Samples were sent to the Center from 32 contracted prefectures.

(9) Milk

Raw milk was collected in producing districts and commercial milk was purchased in consuming districts. Milk in a stainless steel pan or a porcelain dish was evaporated to dryness followed by carbonization and ashing.

(10) Vegetables

Spinach and Japanese radish were selected as the representatives for leaf vegetables and for non-starch roots, respectively. After removing soil, the edible part of vegetable sample was dried and carbonized in a stainless steel pan or a porcelain dish.

(11) Tea

Five hundred grams of manufactured green tea was collected, carbonized and ashed in a stainless steel pan or a porcelain dish.

(12) Fish, shellfish and seaweeds

a. Sea fish and freshwater fish

Fish was rinsed with water and blotted with a filter paper. Only the edible part was used in case of larger sized fish, and the whole part was used in case of smaller ones. Each sample was weighed and placed in a stainless steel pan or a porcelain dish. After carbonized, the sample was ashed in an electric muffle furnace.

b. Shellfish

Approximately 4 kg of shellfish including the shells was collected or purchased. After removing the shells, it was treated in the same way as that for the sea fish.

c. Seaweeds

Edible seaweeds were collected and rinsed with water to remove sand and other adhering matters on the surface. These were removed of excess water, weighed dried and ashed.

Table 1 shows detailes of sample collection.

Table 1 Details of sample collection

Sample	Frequency of sampling	Quantity of sample
=Environmental materials=		
(1) Rain and dry fallout		
1. For domestic program	monthly	
2. For WHO program	monthly	
(2) Airborne dust	quarterly	>3000 m^3/month
(3) Service water and freshwater		
1. Service water (source water)	semiyearly	100
2. Service water (tap water)	semiyearly	100
3. Freshwater	yearly (fishing season)	100
(4) Soil		
1. 0～5 cm	yearly	4 kg
2. 5～20cm	yearly	4 kg
(5) Sea water	yearly	40
(6) Sea sediments	yearly	4 kg
=Dietary materials=		
(7) Total diet	semiyearly	daily amount for 5 persons
(8) Rice		
1. Producing districts	yearly (harvesting season)	5 kg (polished rice)
2. Consuming districts	yearly (harvesting season)	5 kg (polished rice)
(9) Milk		
1. Producing districts for WHO program	quarterly (February, May, August and November)	3
2. Producing districts for domestic program	semiyearly (February and August)	3

Sample	Frequency of sampling	Quantity of sample
3. Consuming districts	semiyearly (February and August)	3
4. Powdered milk	semiyearly (April and October)	2～3 kg
(10) Vegetables		
1. Producing districts	yearly (harvesting season)	4 kg
2. Consuming districts	yearly (harvesting season)	4 kg
(11) Tea	yearly (the first harvesting season)	500g (manufactured tea)
(12) Fish, shellfish and seaweeds		
1. Sea fish	yearly (fishing season)	4 kg
2. Freshwater fish	yearly (fishing season)	4 kg
3. Shellfish	yearly (fishing season)	4 kg
4. Seaweeds	yearly (fishing season)	2～3 kg

2. Preparation of samples for analysis

(1) Rain, service water and freshwater

Strontium and cesium were eluted with hydrochloric acid from the cation exchange column. The residue of rain sample on the filter paper was ashed in an electric muffle furnace and the ash was dissolved in hydrochloric acid. The insoluble part was filtered and washed. The filtrate and the washings were combined to the previous eluate and used for radiochemical analysis.

(2) Soil and Sea sediment

Dried soil was crushed to smaller ones than 0.25 mm in size by a crusher. The sieved sample was ashed in an electric muffle furnace regulated at 450 . The sample was then heated with hydrochloric acid, strontium and cesium carrier solutions and the mixture was heated. The insoluble constituent was filtered off and washed with water.

The dried sample was crushed to smaller ones than 0.25 mm by a crushing machine. The further preparation of the sample was the same as that described in the section 2-(2).

(3) Rice

The ashed sample was pulverized with a porcelain mortar and passed through a 0.35 mm sieve. The sieved sample to which both strontium and cesium carriers were added, was digested with nitric acid by heating. After the sample was heated again with nitric acid to dryness, strontium and cesium were extracted with hydrochloric acid and water. The insoluble constituent was filtered and washed. The filtrate and washings were combined for subsequent radiochemical analysis.

(4) Airborne dust, diet, milk, vegetables, fish and shellfish, seaweeds, tea and others

These ashed samples were treated with the same procedure as that described in the section 2-(4).

3. Separation of strontium-90 and cesium-137

(1) Strontium-90

Sample solutions, prepared as in the foregoing sections 2-(1) through 2-(4), were neutralized with sodium hydroxide. After sodium carbonate was added, the precipitate of strontium and calcium carbonates was separated. The supernatant solution was retained for cesium-137 determination. The carbonates were dissolved in hydrochloric acid and strontium and calcium were precipitated as oxalates. The precipitate was dissolved in nitric acid and strontium was separated from calcium by successive fuming nitric acid separation. Iron scavenge was made after addition of ferric iron carrier followed by barium chromate separation after addition of barium carrier to remove radium, its daughters and lead. Strontium was recovered as carbonate, and the precipitate was dried and weighed to determine strontium recovery. The strontium carbonate was dissolved in hydrochloric acid and iron carrier was added. The solution was allowed to stand for two weeks for strontium-90 and yttrium-90 to attain equilibrium. Yttrium-90 was coprecipitated with ferric hydroxide and the precipitate was filtered off, washed and counted.

(2) Cesium-137

The supernatant separated from the strontium fraction was acidified with hydrochloric acid. While stirring, cesium was adsorbed on the ammonium molyb-

dophosphate added.

After filtered off and washed with hydrochlotric acid the precipitate was dissolved in 2.5N sodium hydroxide solution. The solution was adjusted to pH 8.2 with hydrochloric acid and allowed to cool. Resultant molybdenum hydroxide which separated out in the solution, was filtered off and washed with water. EDTA was added to the filtrate and washings. Cesium and rubidium were adsorbed on a cation exchange column and cesium was separated from rubidium by eluting with hydrochloric acid.

The eluate was evaporated to dryness and was dissolved. The solution was filtered. Chloroplatinic acid was added to precipitate cesium. The precipitate was filtered onto a tared paper using a demountable filter and washed with water and then ethanol. After drying, the chemical yield of cesium was determined by weighing the precipitate. Cesium-137 radioactivity was measured for this precipitate.

4. Determination of stable strontium, calcium and potassium

A weighed amount of soil or sea sediment was heated in a electric muffle furnace at 450 and then treated with hydrochloric acid for extraction. A weighed aliquot of ashed samples of total diet, vegetables, milk, fish, shellfish or seaweeds was digested with hydrofluoric acid and nitric acid.
The extract was made up to an appropriate volume with dilute hydrochloric acid. The sample solution was analyzed for calcium by titration with standard potassium permanganate solution after separating calcium as oxalate. Atomic absorption spectroscopy was applied when appropriate. Stable strontium and potassium were determined by atomic absorption and flame emission spectrometry, respectively.

5. Counting

After the radiochemical separation the mounted precipitates were counted for activity using low background beta counters normally for 60 to 90 min. Net sample counting rates were corrected for counter efficiency, recovery, self-absorption and decay to obtain the content of strontium-90 and cesium-137 per sample aliquot. From the results, concentrations of these nuclides in the original samples were calculated.

6. Results

(1) Strontium-90 and Cesium-137 in Total Diet
(from Nov. 1986 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (1): Strontium-90 and Cesium-137 in Total Diet

Location	Ash	Ca	K	^{90}Sr		^{137}Cs	
	(g/p·d)	(mg/p·d)	(mg/p·d)	(pCi/p·d)	S.U.	(pCi/p·d)	C.U.
November, 1986							
Hiratsuka, KANAGAWA	17.7	831	2420	1.8±0.32	2.2±0.38	9.6±0.46	4.0±0.19
Nishikawa-machi, NIIGATA	20.3	593	2270	2.3±0.37	3.9±0.62	7.2±0.43	3.2±0.19
Nagasaki, NAGASAKI	15.8	440	2230	2.6±0.34	5.9±0.78	3.5±0.28	1.6±0.13
Ookuchi, KAGOSHIMA	9.80	391	1450	1.9±0.39	4.9±0.99	3.9±0.33	2.7±0.22
December, 1986							
Aomori, AOMORI	19.4	475	1900	2.2±0.39	4.6±0.82	1.9±0.26	1.0±0.14
Fukushima, FUKUSHIMA	15.3	895	1790	2.9±0.40	3.2±0.44	3.5±0.34	1.9±0.19
Mito, IBARAGI	16.9	549	2240	4.3±0.43	7.9±0.78	5.4±0.35	2.4±0.16
Shinjuku, TOKYO	12.0	414	1660	1.7±0.40	4.1±0.96	3.9±0.37	2.4±0.22
Nagano, NAGANO	18.6	743	2110	1.9±0.35	2.5±0.47	3.8±0.32	1.8±0.15
Kyoto, KYOTO	16.9	587	2280	2.3±0.33	4.0±0.57	3.3±0.28	1.5±0.12
Neyagawa, OSAKA	14.4	541	2180	1.9±0.49	3.6±0.91	5.0±0.45	2.3±0.21
Yamaguchi, YAMAGUCHI	15.2	382	2120	2.7±0.60	7 ±1.6	2.2±0.38	1.0±0.18
January, 1987							
Hiroshima, HIROSHIMA	12.9	824	1460	3.1±0.49	3.8±0.59	2.7±0.35	1.9±0.24
February, 1987							
Naha, OKINAWA	13.1	446	2010	2.4±0.53	5 ±1.2	2.1±0.31	1.0±0.16
May, 1987							
Wakayama, WAKAYAMA	12.5	439	1380	1.5±0.24	3.4±0.55	3.2±0.22	2.3±0.16
June, 1987							
Sapporo, HOKKAIDO	16.9	440	2210	3.2±0.36	7.3±0.81	4.8±0.30	2.2±0.14
Yamagata, YAMAGATA	16.9	602	1640	3.4±0.37	5.7±0.61	7.8±0.37	4.7±0.23
Fukushima, FUKUSHIMA	14.9	444	1980	1.9±0.27	4.2±0.60	3.1±0.30	1.6±0.15
Mito, IBARAGI	16.3	485	2390	2.0±0.31	4.1±0.63	5.0±0.30	2.1±0.12
Shinjuku, TOKYO	11.9	417	1510	1.7±0.22	4.1±0.53	3.2±0.24	2.1±0.16
Nishikawa-machi, NIIGATA	19.7	1050	2260	1.9±0.32	1.8±0.31	4.1±0.37	1.8±0.16
Fukui, FUKUI	15.8	1210	1800	2.0±0.30	1.6±0.24	2.6±0.24	1.5±0.13
Shizuoka, SHIZUOKA	18.2	994	2480	2.2±0.33	2.2±0.33	5.3±0.38	2.1±0.15
Nagoya, AICHI	15.6	438	1820	1.7±0.30	3.9±0.68	3.2±0.24	1.8±0.13
Kyoto, KYOTO	15.9	622	2110	1.6±0.26	2.5±0.43	2.8±0.29	1.3±0.14

Location	Ash	Ca	K	^{90}Sr		^{137}Cs	
	(g/p·d)	(mg/p·d)	(mg/p·d)	(pCi/p·d)	S.U.	(pCi/p·d)	C.U.
Neyagawa, OSAKA	15.3	425	1980	1.5±0.27	3.6±0.63	4.2±0.33	2.1±0.17
Kakogawa, HYOGO	14.1	707	1980	1.7±0.28	2.4±0.40	3.2±0.25	1.6±0.13
Fukube-mura, TOTTORI	13.9	409	1650	1.7±0.26	4.2±0.63	2.2±0.25	1.3±0.15
Okayama, OKAYAMA	17.2	457	2020	1.6±0.31	3.6±0.68	3.7±0.27	1.8±0.13
Matsuyama, EHIME	12.6	502	1850	1.5±0.24	2.9±0.47	3.1±0.25	1.7±0.14
Kochi, KOCHI	15.4	656	2140	2.4±0.31	3.6±0.47	4.4±0.29	2.1±0.13
Dazaifu, FUKUOKA	12.9	402	1890	1.5±0.24	3.7±0.60	2.9±0.22	1.6±0.11
Saga, SAGA	16.0	673	2060	1.4±0.27	2.2±0.40	1.7±0.20	0.8±0.09
Nagasaki, NAGASAKI	10.4	362	1280	1.5±0.35	4.2±0.96	3.2±0.30	2.5±0.23
Ookuchi, KAGOSHIMA	11.1	269	1260	1.8±0.25	6.5±0.94	1.4±0.16	1.1±0.12
Naha, OKINAWA	13.7	374	2060	1.5±0.26	4.1±0.71	2.6±0.21	1.3±0.10

(2)-1 Strontium-90 and Cesium-137 in Rice(producing districts) (from Dec. 1986 to Jan. 1987)

-continued from NO. 79 of this publication-

Table (2)-1: Strontium-90 and Cesium-137 in Rice

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
December, 1986 Yamaguchi, YAMAGUCHI	0.584	0.042	0.998	0.0 ±0.26	0± 6.1	1.2 ±0.23	1.2 ±0.23
January, 1987 Akashi, HYOGO	0.577	0.047	0.819	0.1 ±0.22	2± 4.8	0.0 ±0.18	0.0 ±0.23

(2)-2 Strontium-90 and Cesium-137 in Rice(consuming districts) (from Dec. 1986 to Jan. 1987)

-continued from NO. 79 of this publication-

Table (2)-2: Strontium-90 and Cesium-137 in Rice

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
December, 1986							
Tottori, TOTTORI	0.597	0.038	0.794	0.3 ±0.26	9± 6.8	1.2 ±0.22	1.5 ±0.27
Matsue, SHIMANE	0.630	0.042	0.875	0.1 ±0.22	1± 5.1	4.8 ±0.36	5.5 ±0.41
Seto-machi, OKAYAMA	0.566	0.043	1.23	0.0 ±0.22	0± 5.2	0.3 ±0.17	0.3 ±0.14
January, 1987							
Hirosaki, AOMORI	0.514	0.037	0.868	0.2 ±0.20	4± 5.4	0.3 ±0.17	0.4 ±0.19
Kobe, HYOGO	0.570	0.041	0.980	0.3 ±0.25	7± 6.1	1.3 ±0.24	1.4 ±0.24
Nagasaki, NAGASAKI	0.651	0.042	0.937	0.1 ±0.24	2± 5.8	0.2 ±0.17	0.2 ±0.18
Yonagusuku-mura, OKINAWA	0.599	0.033	0.844	0.6 ±0.32	19± 9.6	0.04±0.18	0.1 ±0.21

(3)-1 Strontium-90 and Cesium-137 in Milk(producing districts for domestic program)
(from Feb. 1987 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (3)-1: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/l)	Ca(g/l)	K(g/l)	pCi/l	S.U.	pCi/l	C.U.
February, 1987							
Aomori, AOMORI	7.24	1.12	1.54	1.7±0.29	1.5±0.25	15 ±0.5	9.4±0.35
Mito, IBARAGI	7.11	1.11	1.56	0.9±0.24	0.8±0.21	1.0±0.20	0.7±0.13
Oshimizu-machi, ISHIKAWA	7.32	1.16	1.57	2.1±0.33	1.8±0.29	10 ±0.5	6.6±0.32
Mihara-machi, HYOGO	7.22	1.08	1.58	1.0±0.28	0.9±0.26	2.4±0.26	1.5±0.16
Matsuyama, EHIME	7.79	1.22	1.51	0.4±0.20	0.3±0.16	2.7±0.24	1.8±0.16
June, 1987							
Yamato-machi, SAGA	7.01	1.04	1.30	1.2±0.21	1.2±0.20	1.7±0.20	1.3±0.15

(3)-2 Strontium-90 and Cesium-137 in Milk(producing districts for WHO program) (from Dec. 1986 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (3)-2: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/ℓ)	Ca(g/ℓ)	K(g/ℓ)	pCi/ℓ	S.U.	pCi/ℓ	C.U.
December, 1986							
Yakumo-mura, SHIMANE	7.31	1.11	1.56	1.0±0.30	0.9±0.27	2.1±0.24	1.3±0.15
January, 1987							
Nose-machi, OSAKA	7.51	1.10	1.53	0.5±0.27	0.5±0.24	1.6±0.22	1.0±0.14
February, 1987							
Sapporo, HOKKAIDO	7.24	1.20	1.56	1.4±0.25	1.2±0.21	7.6±0.39	4.9±0.25
Hachijo-Island, TOKYO	7.14	1.06	1.47	8.3±0.43	7.8±0.41	30 ±0.7	20 ±0.5
Nishikawa-machi, NIIGATA	7.40	1.22	1.34	1.0±0.21	0.8±0.17	1.2±0.19	0.9±0.14
Katsuyama, FUKUI	7.10	1.15	1.46	1.7±0.28	1.5±0.25	11 ±0.5	7.6±0.32
Takamiya-machi, HIROSHIMA	6.68	1.03	1.25	0.7±0.21	0.7±0.21	2.9±0.24	2.3±0.19
Kochi, KOCHI	7.23	1.10	1.63	1.3±0.30	1.2±0.27	2.8±0.26	1.8±0.16
Fukuma-machi, FUKUOKA	7.58	1.13	1.63	0.6±0.21	0.5±0.18	2.4±0.23	1.5±0.14
Kajiki-machi, KAGOSHIMA	6.99	1.10	1.33	0.7±0.21	0.6±0.19	1.7±0.19	1.3±0.14
April, 1987							
Yakumo-mura, SHIMANE	7.48	1.21	1.48	1.2±0.23	1.0±0.19	1.6±0.19	1.1±0.13
May, 1987							
Sapporo, HOKKAIDO	7.37	1.14	1.64	1.3±0.23	1.1±0.20	11 ±0.4	6.4±0.26
Hachijo-Island, TOKYO	6.76	1.06	1.35	2.3±0.26	2.2±0.25	6.3±0.30	4.6±0.22
Nishikawa-machi, NIIGATA	7.56	1.17	1.57	0.8±0.23	0.7±0.19	2.5±0.22	1.6±0.14
Katsuyama, FUKUI	7.02	1.10	1.42	1.5±0.25	1.4±0.22	3.8±0.24	2.7±0.17
Nose-machi, OSAKA	7.40	1.08	1.49	1.1±0.25	1.0±0.23	1.8±0.19	1.2±0.13
Takamiya-machi, HIROSHIMA	6.65	1.01	1.38	0.6±0.20	0.6±0.20	3.8±0.24	2.8±0.17
Kochi, KOCHI	7.53	1.15	1.48	2.0±0.30	1.8±0.26	3.4±0.26	2.3±0.17
Fukuma-machi, FUKUOKA	7.27	1.07	1.64	0.9±0.24	0.8±0.23	3.1±0.23	1.9±0.14
Kajiki-machi, KAGOSHIMA	7.41	1.11	1.56	0.8±0.24	0.7±0.22	2.0±0.20	1.3±0.13
June, 1987							
Yakumo-mura, SHIMANE	7.07	0.993	1.87	1.4±0.21	1.4±0.21	1.6±0.19	0.9±0.10

(3)-3 Strontium-90 and Cesium-137 in Milk(consuming districts)
(from Dec. 1986 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (3)-3: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(g/ℓ)	Ca(g/ℓ)	K(g/ℓ)	pCi/ℓ	S.U.	pCi/ℓ	C.U.
December, 1986							
Matsue, SHIMANE	7.17	1.12	1.44	1.2±0.22	1.0±0.19	6.3±0.34	4.3±0.23
January, 1987							
Osaka, OSAKA	7.47	1.16	1.57	0.7±0.28	0.6±0.24	3.8±0.31	2.4±0.19
February, 1987							
Sapporo, HOKKAIDO	6.93	0.999	1.56	1.8±0.29	1.8±0.29	13 ±0.5	8.3±0.34
Yamagata, YAMAGATA	7.00	1.11	1.33	0.9±0.19	0.9±0.17	4.6±0.29	3.5±0.22
Shinjuku, TOKYO	6.93	1.09	1.29	1.2±0.20	1.1±0.18	2.4±0.22	1.9±0.17
Yokohama, KANAGAWA	7.19	1.12	1.34	0.8±0.19	0.7±0.17	2.9±0.24	2.2±0.18
Niigata, NIIGATA	7.43	1.12	1.39	1.7±0.24	1.6±0.22	7.1±0.35	5.1±0.25
Fukui, FUKUI	6.71	1.02	1.42	2.0±0.32	2.0±0.31	7.2±0.40	5.1±0.28
Nagano, NAGANO	6.29	0.977	1.31	1.0±0.27	1.0±0.28	1.9±0.24	1.5±0.18
Shizuoka, SHIZUOKA	6.90	1.08	1.44	0.9±0.29	0.8±0.26	2.0±0.25	1.4±0.17
Nagoya, AICHI	6.70	1.01	1.42	0.5±0.27	0.5±0.26	2.7±0.27	1.9±0.19
Wakayama, WAKAYAMA	7.18	1.10	1.42	1.2±0.23	1.1±0.21	1.6±0.19	1.1±0.14
Yonago, TOTTORI	7.17	1.12	1.36	0.6±0.20	0.6±0.18	9.9±0.40	7.3±0.30
Okayama, OKAYAMA	7.12	1.10	1.38	1.4±0.24	1.2±0.22	13 ±0.5	9.6±0.33
Hiroshima, HIROSHIMA	6.62	1.03	1.24	0.4±0.20	0.4±0.20	5.1±0.30	4.1±0.24
Yamaguchi, YAMAGUCHI	7.43	1.16	1.42	0.8±0.26	0.7±0.23	5.4±0.33	3.8±0.23
Matsuyama, EHIME	7.44	1.12	1.46	1.0±0.23	0.9±0.20	3.0±0.24	2.1±0.17
Kochi, KOCHI	7.27	1.12	1.57	0.9±0.29	0.8±0.26	25 ±0.7	16 ±0.5
Chikushino, FUKUOKA	7.55	1.18	1.46	1.1±0.23	0.9±0.20	3.8±0.28	2.6±0.19
Nagasaki, NAGASAKI	6.84	1.08	1.29	0.6±0.22	0.6±0.21	1.3±0.18	1.0±0.14
Kagoshima, KAGOSHIMA	7.33	1.15	1.37	1.1±0.24	1.0±0.21	4.6±0.29	3.4±0.21
Yonagusuku-mura, OKINAWA	7.27	1.12	1.24	0.5±0.23	0.4±0.21	0.8±0.16	0.6±0.13
May, 1987							
Sendai, MIYAGI	7.38	1.12	1.69	0.3±0.19	0.3±0.17	2.6±0.23	1.5±0.14
Kyoto, KYOTO	7.30	1.11	1.57	0.9±0.22	0.8±0.20	4.1±0.27	2.6±0.17
June, 1987							
Fukushima, FUKUSHIMA	7.26	1.09	1.64	0.7±0.20	0.6±0.19	2.4±0.22	1.5±0.13
Matsue, SHIMANE	7.08	1.08	1.54	1.3±0.21	1.2±0.20	3.2±0.25	2.1±0.16

(3)-4 Strontium-90 and Cesium-137 in Milk(powderd milk)

-continued from NO. 79 of this publication-

Table (3)-4: Strontium-90 and Cesium-137 in Milk

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
June, 1987							
Sample A	2.56	3.84	5.96	2.6 ± 0.37	0.7 ± 0.10	21 ± 0.7	3.6 ± 0.11
Sample B	2.66	3.70	5.88	2.2 ± 0.37	0.6 ± 0.10	50 ± 1.0	8.5 ± 0.18
Sample C	2.56	4.02	5.20	2.8 ± 0.38	0.7 ± 0.09	16 ± 0.6	3.1 ± 0.11
Sample D	2.61	3.45	6.19	4.1 ± 0.42	1.2 ± 0.12	69 ± 1.2	11 ± 0.2
Sample *D	8.18	12.7	18.5	16 ± 0.8	1.2 ± 0.06	54 ± 1.1	2.9 ± 0.06
July, 1987							
Sample *A	8.14	12.4	18.4	19 ± 0.9	1.6 ± 0.07	110 ± 2	5.8 ± 0.08

*Skim milk

(4)-1 Strontium-90 and Cesium-137 in Vegetables(producing districts)
(from Nov. 1986 to Jan. 1987)

-continued from NO. 79 of this publication-

Table (4)-1: Strontium-90 and Cesium-137 in Vegetables

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
(Japanese radish)							
November, 1986							
Sannohe-machi, AOMORI	0.585	0.256	2.56	7.0±0.51	27 ±2.0	1.4 ±0.28	0.5 ±0.11
Shime-machi, FUKUOKA	0.561	0.228	2.57	6.4±0.35	28 ±1.5	0.2 ±0.11	0.1 ±0.04
Kaimon-machi, KAGOSHIMA	0.576	0.150	2.83	3.8±0.30	26 ±2.0	0.7 ±0.13	0.2 ±0.05
December, 1986							
Wakayama, WAKAYAMA	0.537	0.231	2.44	2.2±0.22	9.4±0.95	0.0 ±0.07	0.0 ±0.03
January, 1987							
Yuya-machi, YAMAGUCHI	0.761	0.242	3.03	5.9±0.47	24 ±1.9	0.0 ±0.15	0.0 ±0.05
Kubokawa-machi, KOCHI	0.617	0.291	2.63	2.1±0.35	7 ±1.2	0.5 ±0.18	0.2 ±0.07
(Cabbage)							
November, 1986							
Sannohe-machi, AOMORI	0.656	0.426	2.62	9.9±0.55	23 ±1.3	1.2 ±0.25	0.4 ±0.10
January, 1987							
Kumatori-machi, OSAKA	0.555	0.408	2.07	2.5±0.35	6.2±0.85	0.5 ±0.19	0.2 ±0.09
(Spinach)							
November, 1986							
Shime-machi, FUKUOKA	1.52	0.750	6.67	4.2±0.38	5.5±0.51	0.3 ±0.15	0.04±0.02
Kaimon-machi, KAGOSHIMA	1.52	0.613	6.51	1.8±0.27	2.9±0.45	17. ±0.6	2.5 ±0.09
January, 1987							
Yuya-machi, YAMAGUCHI	1.77	0.808	7.17	2.6±0.34	3.3±0.42	0.9 ±0.20	0.1 ±0.03
Kubokawa-machi, KOCHI	1.88	0.809	7.96	21 ±0.8	27 ±1.0	1.5 ±0.22	0.2 ±0.03
(Chinese cabbage)							
December, 1986							
Wakayama, WAKAYAMA	0.530	0.383	2.18	1.9±0.22	5.1±0.58	0.3 ±0.11	0.1 ±0.05

(4)-2 Strontium-90 and Cesium-137 in Vegetables(consuming districts) (from Oct. 1986 to Feb. 1987)

-continued from NO. 79 of this publication-

Table (4)-2: Strontium-90 and Cesium-137 in Vegetables

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
(Japanese radish)							
October, 1986							
Kyoto, KYOTO	0.494	0.150	2.29	6.1±0.32	41 ±2.2	4.2 ±0.23	1.8 ±0.10
November, 1986							
Niigata, NIIGATA	0.344	0.127	1.34	0.9±0.24	7 ±1.9	1.9 ±0.22	1.4 ±0.17
January, 1987							
Nagasaki, NAGASAKI	0.523	0.180	2.46	1.7±0.37	9 ±2.1	0.5 ±0.18	0.2 ±0.07
Yonagusuku-mura, OKINAWA	1.07	0.395	4.73	1.2±0.35	3.0±0.89	0.3 ±0.16	0.1 ±0.03
February, 1987							
Yokohama, KANAGAWA	0.432	0.200	1.72	0.2±0.22	1 ±1.1	0.4 ±0.17	0.2 ±0.10
(Spinach)							
November, 1986							
Kyoto, KYOTO	1.50	0.747	5.74	2.0±0.30	2.7±0.40	0.4 ±0.16	0.1 ±0.03
January, 1987							
Nagasaki, NAGASAKI	1.59	0.416	7.00	1.2±0.38	2.8±0.91	0.1 ±0.16	0.01±0.02
Yonagusuku-mura, OKINAWA	1.29	0.621	5.24	0.4±0.30	0.6±0.48	0.4 ±0.16	0.1 ±0.03
February, 1987							
Yokohama, KANAGAWA	1.47	0.423	6.72	1.9±0.35	4.6±0.82	0.5 ±0.20	0.1 ±0.03

(5) Strontium-90 and Cesium-137 in Tea(Japanese Tea)
(from May 1987 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (5): Strontium-90 and Cesium-137 in Tea(Japanese Tea)

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
May, 1987							
Shuzenji-machi, SHIZUOKA	4.88	2.64	18.9	59±3.4	22 ±1.3	310 ± 6	17 ±0.3
Iwata, SHIZUOKA	5.02	2.64	21.5	18±2.4	6.8±0.90	130 ± 4	5.8±0.17
Uji, KYOTO	5.20	2.64	19.5	47±3.5	18 ±1.3	40 ± 2.2	2.1±0.11
June, 1987							
Kaya-machi, KYOTO	5.28	4.87	16.6	41±3.4	8.4±0.69	120 ± 4	7.1±0.22
Miyanojou-machi, KAGOSHIMA	5.26	2.48	19.8	20±2.7	8 ±1.1	50 ± 2.5	2.5±0.12
Chiran-machi, KAGOSHIMA	4.59	2.02	17.5	13±2.2	6 ±1.1	77 ± 2.9	4.4±0.16

(6) Strontium-90 and Cesium-137 in Sea Fish
(from Nov. 1986 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (6): Strontium-90 and Cesium-137 in Sea Fish

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
(Branchiostegus sp.) November, 1986 Nagasaki, NAGASAKI	1.24	0.585	3.73	0.0±0.51	0.0 ±0.86	6.6±0.49	1.8 ±0.13
(Katsuwonus pelamis) May, 1987 Tosa, KOCHI	1.42	0.675	4.36	0.5±0.24	0.7 ±0.36	14 ±0.6	3.2 ±0.13
(Limanda herzensteini) February, 1987 Ootake, HIROSHIMA	3.00	6.98	3.28	0.6±0.26	0.1 ±0.04	4.5±0.37	1.4 ±0.11
June, 1987 Sendai, MIYAGI	2.87	6.60	3.46	0.2±0.21	0.03±0.03	3.7±0.29	1.1 ±0.08
(Spratelloides gracilis) December, 1986 Akune, KAGOSHIMA	2.88	5.98	3.35	0.4±0.25	0.1 ±0.04	6.7±0.42	2.0 ±0.13
(Scomber japonicus) November, 1986 Kyoto, KYOTO	1.10	0.340	2.40	0.2±0.18	0.5 ±0.54	10 ±0.5	4.2 ±0.19
January, 1987 Sakaiminato, TOTTORI	1.19	0.573	2.69	0.3±0.21	0.6 ±0.36	9.0±0.42	3.3 ±0.16
(Caesio chrysozonus cuvier) January, 1987 Yonagusuku-mura, OKINAWA	3.66	8.28	3.67	0.1±0.23	0.01±0.03	4.2±0.33	1.1 ±0.09
(Sebastes inermis) February, 1987 Yamaguchi-bay, YAMAGUCHI	5.28	14.1	3.28	1.2±0.29	0.1 ±0.02	6.3±0.40	1.9 ±0.12

Sea Fish

Japanese name	English name	Scientific name
Amadai	Tilefish	Branchiostegus sp.
Katsuo	Bonito	Katsuwonus pelamis
Karei	Flatfish	Limanda herzensteini
Kibinago	Banded blue-sprat	Spratelloides gracilis
Saba	Common mackerel	Scomber japonicus
Takasago	Black-tipped fusilier	Caesio chrysozonus cuvier
Mebaru	Black Rockfish	Sebastes inermis

(7) Strontium-90 and Cesium-137 in Shellfish
(from Feb. 1987 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (7): Strontium-90 and Cesium-137 in Shellfish

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
(Venerupis phillipinarum)							
May, 1987							
Takaki-machi, NAGASAKI	1.40	1.15	1.73	0.3±0.34	0.3 ±0.30	0.7±0.24	0.4 ±0.14
(Ostrea gigas)							
February, 1987							
Hiroshima, HIROSHIMA	1.91	0.604	2.11	2 ±1.5	3 ±2.4	1.0±0.72	0.5 ±0.34
(Turbo cornutus)							
May, 1987							
Ryotsu, NIIGATA	2.07	0.426	3.26	0.7±0.66	2 ±1.5	3.0±0.50	0.9 ±0.15
June, 1987							
Sakata, YAMAGATA	2.44	1.27	2.37	0.3±0.35	0.2 ±0.27	1.8±0.31	0.7 ±0.13

Shellfish

Japanese name	English name	Scientific name
Asari	Short-necked clam	Venerupis phillipinarum
Kaki	Oyster	Ostrea gigas
Sazae	Wreath shell	Turbo cornutus

(8) Strontium-90 and Cesium-137 in Seaweeds
(from Apr. 1986 to Jun. 1987)

-continued from NO. 79 of this publication-

Table (8): Strontium-90 and Cesium-137 in Seaweeds

Location	Component			^{90}Sr		^{137}Cs	
	Ash(%)	Ca(g/Kg)	K(g/Kg)	pCi/Kg	S.U.	pCi/Kg	C.U.
(Undaria pinnatifida)							
April, 1986							
Togi-machi, ISHIKAWA	3.55	0.740	5.70	0.8±0.24	1.0 ±0.32	0.9±0.18	0.1 ±0.03
February, 1987							
Minamichita-machi, AICHI	2.04	0.688	5.73	1.1±0.23	1.6 ±0.34	1.0±0.18	0.2 ±0.03
Hiroshima, HIROSHIMA	2.27	0.522	5.75	1.0±0.25	1.9 ±0.48	1.4±0.22	0.2 ±0.04
Shimabara, NAGASAKI	3.47	0.787	11.1	1.1±0.26	1.5 ±0.33	1.3±0.21	0.1 ±0.02
April, 1987							
Togi-machi, ISHIKAWA	3.70	0.879	5.27	1.2±0.28	1.3 ±0.32	1.8±0.21	0.3 ±0.04
May, 1987							
Ryotsu, NIIGATA	3.45	1.19	5.81	0.8±0.26	0.7 ±0.22	1.6±0.21	0.3 ±0.04
June, 1987							
Sakata, YAMAGATA	2.27	1.25	4.10	1.9±0.27	1.5 ±0.22	1.4±0.19	0.3 ±0.05

Seaweeds

Japanese name	English name	Scientific name
Wakame	Wakame seaweed	Undaria pinnatifida

＊＊＊　Total Diet　＊＊＊

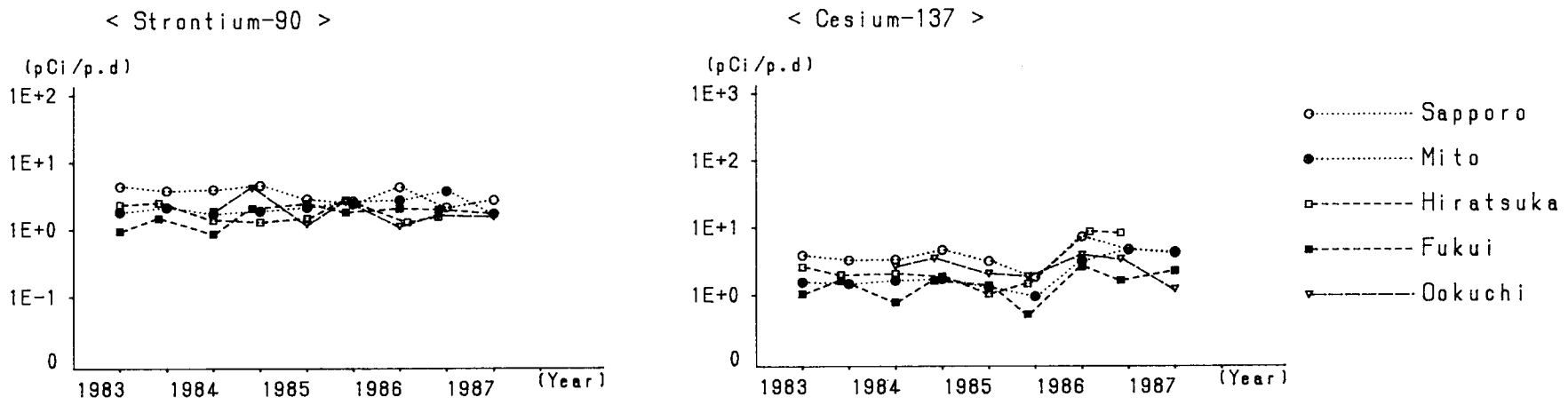

Fig. 1

＊＊＊　Rice(producing districts)　＊＊＊

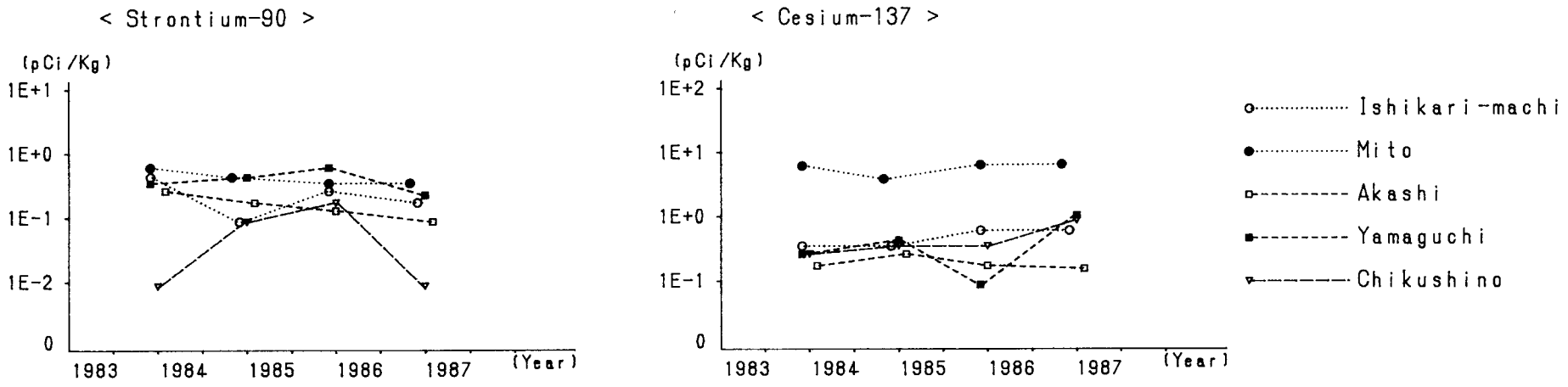

Fig.2-1

＊＊＊　Rice(consuming districts)　＊＊＊

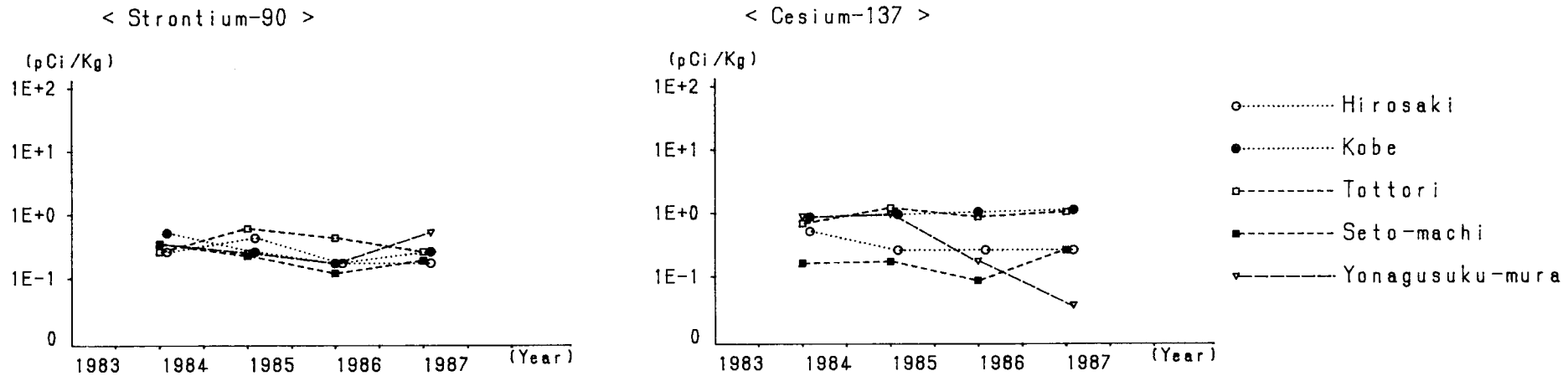

Fig.2-2

* * * Milk(producing districts for domestic program) * * *

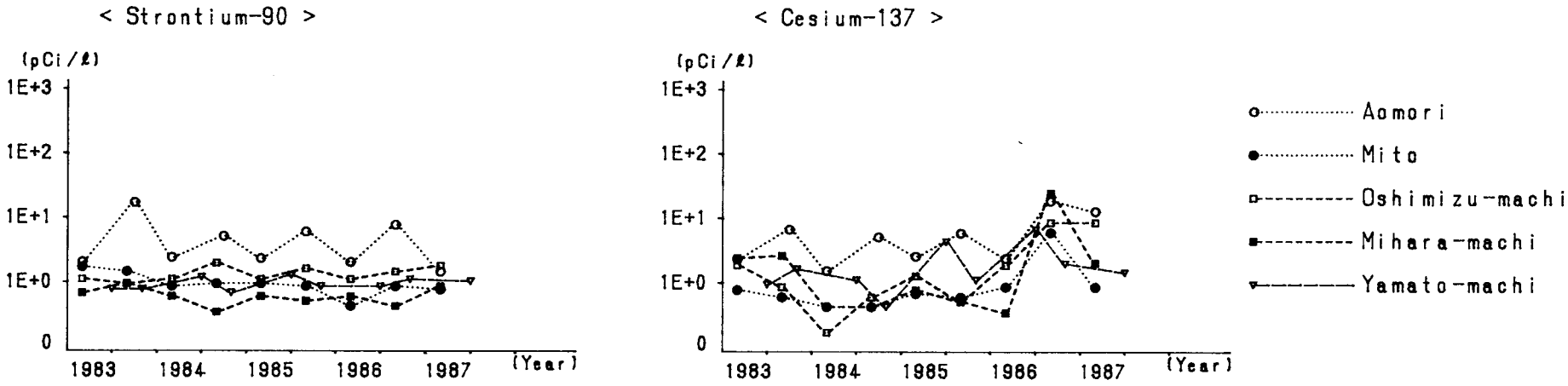

Fig.3-1

* * * Milk(producing districts for WHO program) * * *

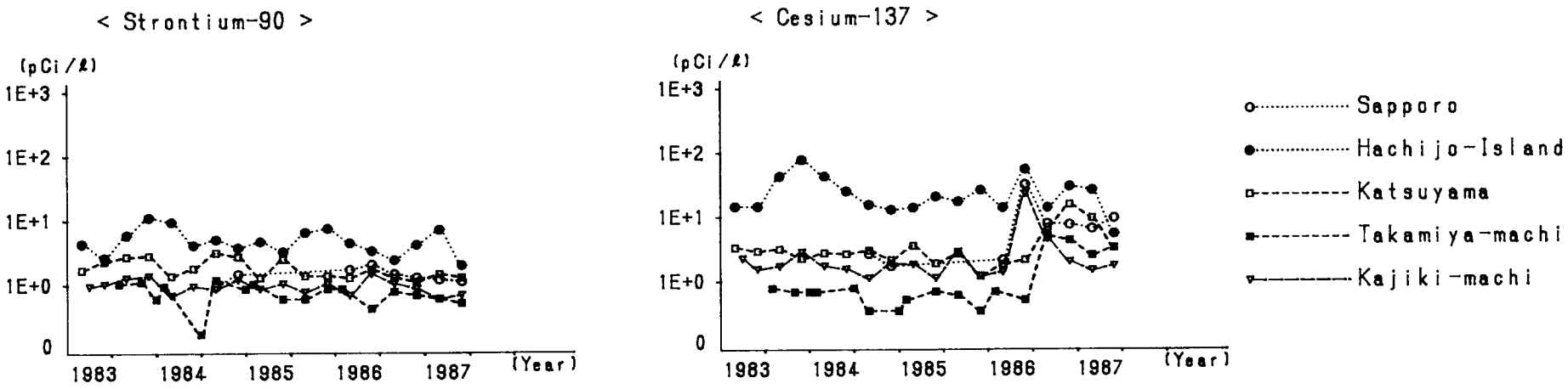

Fig.3-2

* * * Milk(consuming districts) * * *

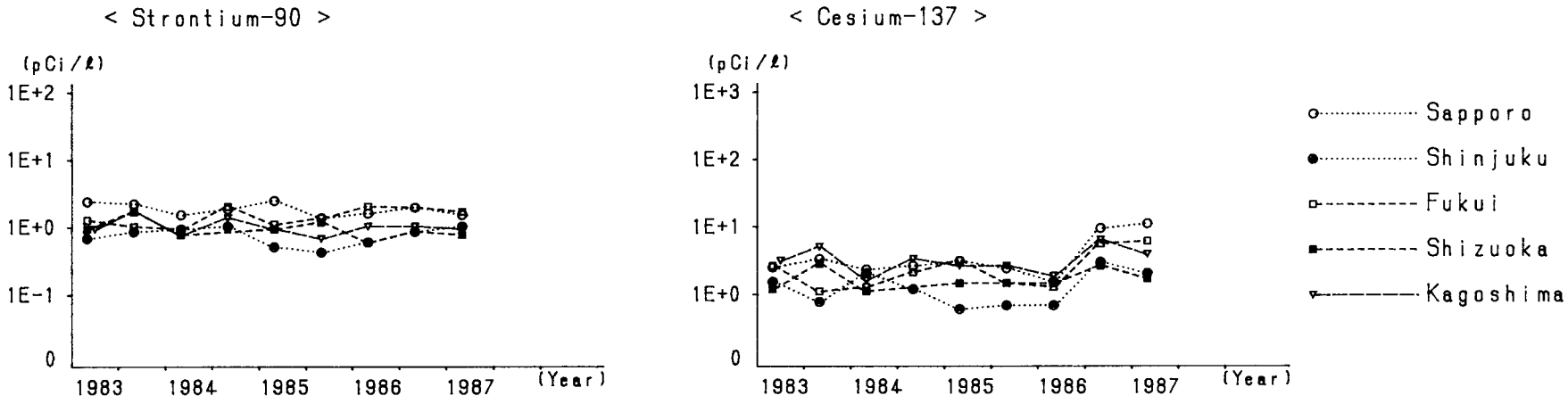

Fig.3-3

* * * Powdered Milk * * *

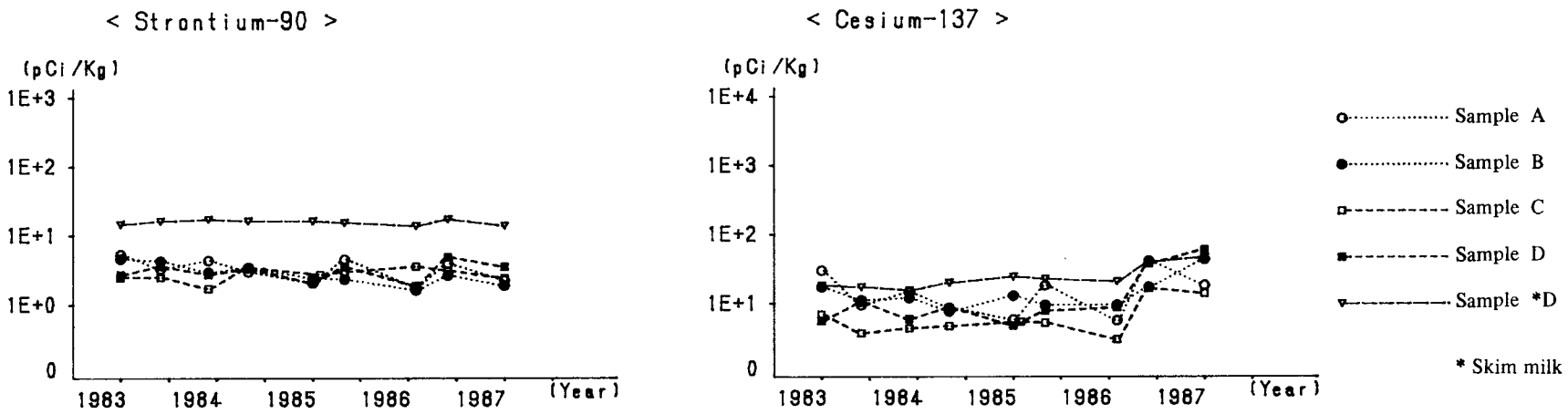

Fig.3-4

* * * Vegetables(producing districts) * * *

[Japanese radish]

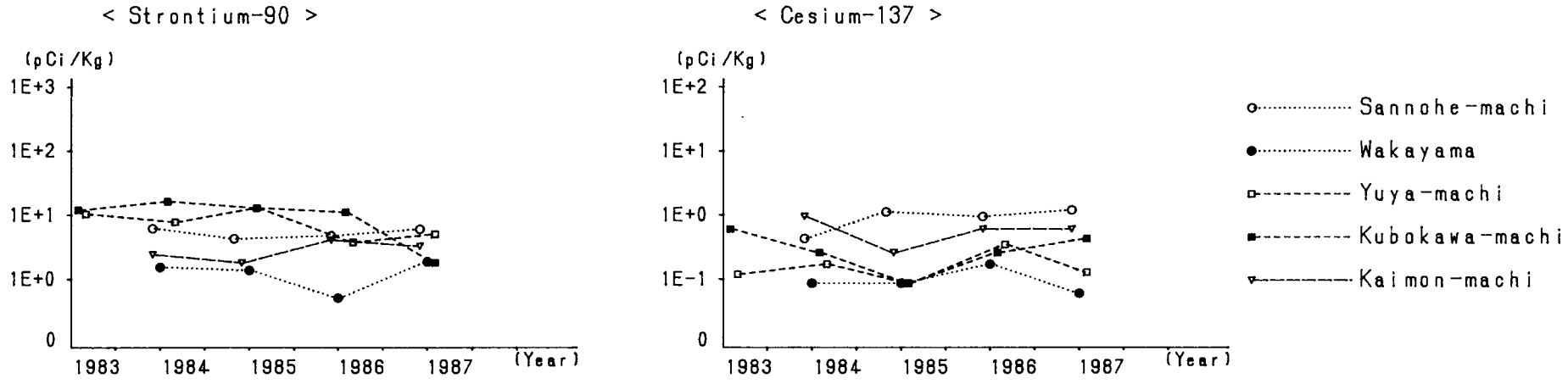

Fig.4-1

* * * Vegetables(consuming districts) * * *

[Japanese radish]

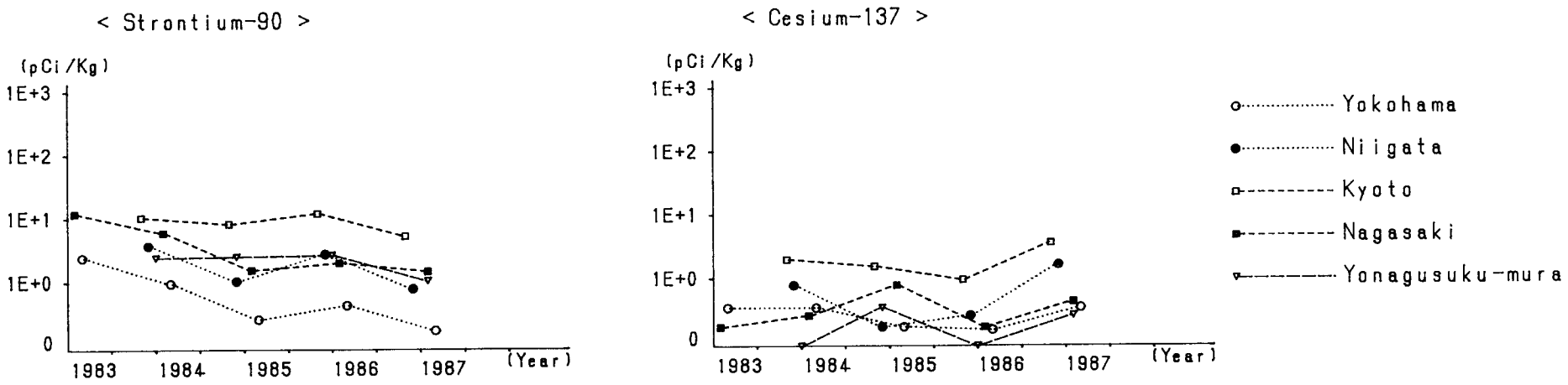

Fig.4-2

* * * Tea(Japanese Tea) * * *

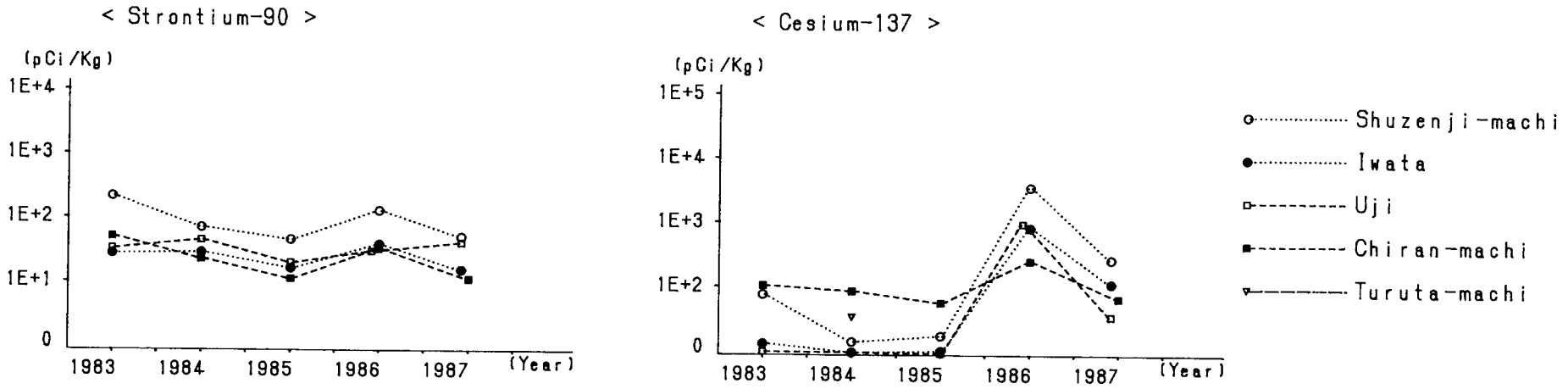

Fig.5

* * * Sea Fish * * *

[Scomber japonicus]

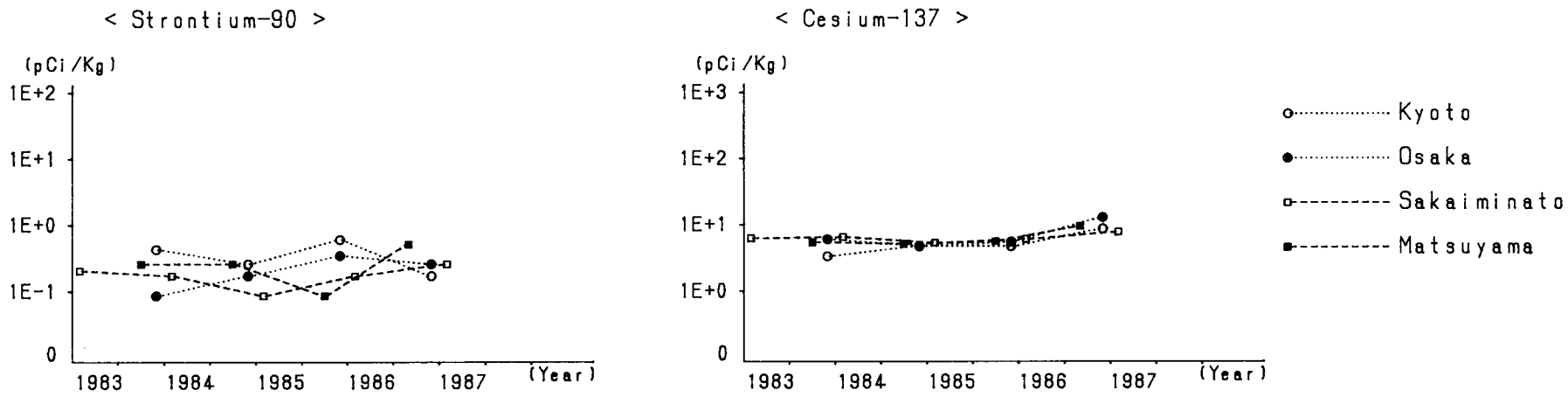

Fig.6

* * * Shellfish * * *

[Turbo cornutus]

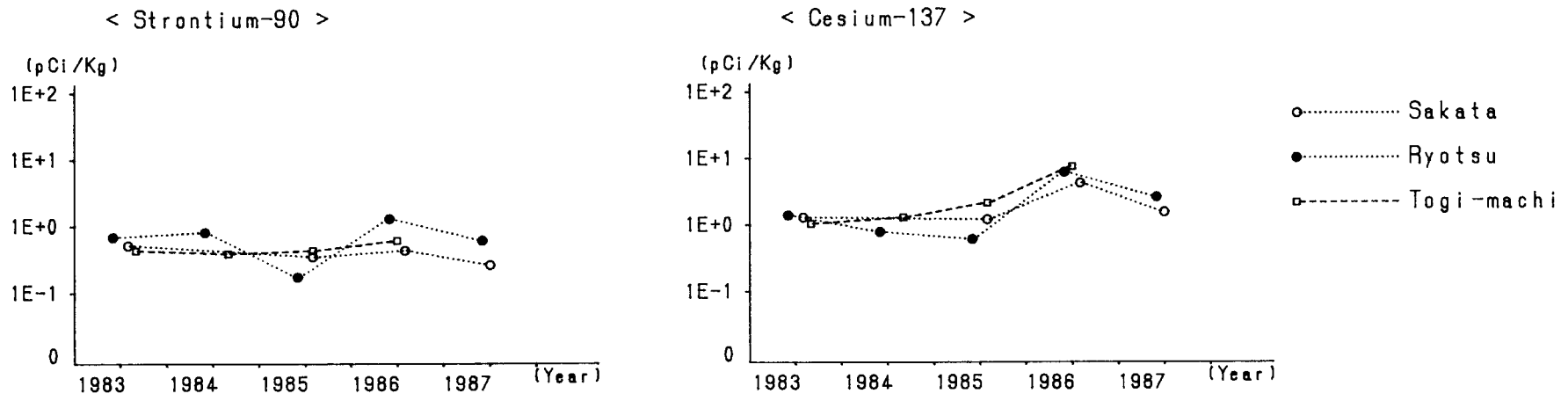

Fig.7

* * * Seaweeds * * *

[Undaria pinnatifida]

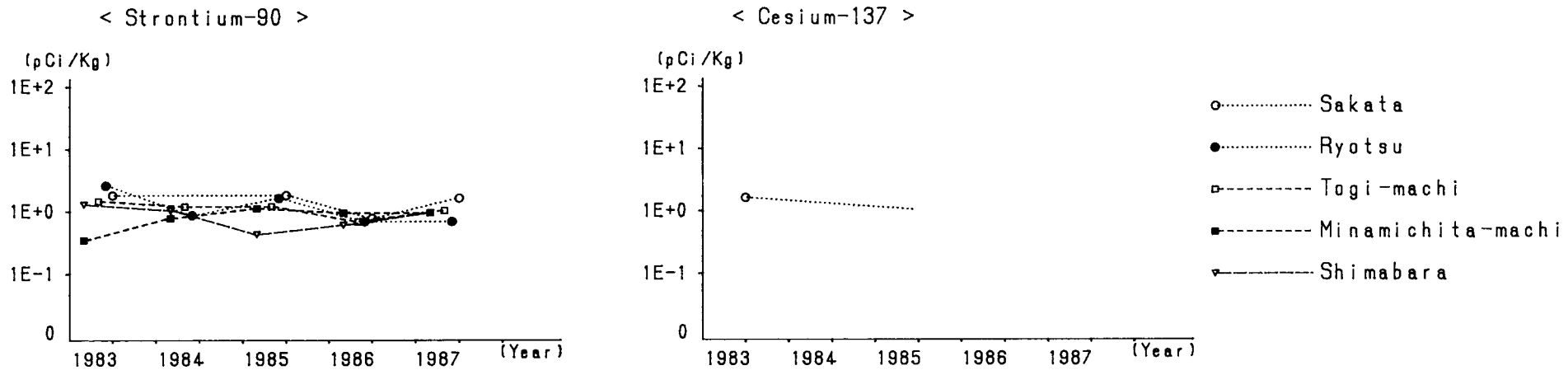

Fig.8

** Sampling Locations in Japan **

1 : Sapporo
2 : Aomori
3 : Akita
4 : Sendai
5 : Yamagata
6 : Fukushima
7 : Niigata
8 : Mito
9 : Chiba
10 : Shinjuku
11 : Nagano
12 : Yokohama
13 : Kanazawa
14 : Shizuoka
15 : Fukui
16 : Nagoya
17 : Kyoto
18 : Osaka
19 : Tottori
20 : Kobe
21 : Wakayama
22 : Okayama
23 : Matsue
24 : Hiroshima
25 : Kochi
26 : Matsuyama
27 : Yamaguchi
28 : Fukuoka
29 : Saga
30 : Nagasaki
31 : Kagoshima
32 : Naha