

Nuclide Analysis Results of Fish and Shellfish
(The Ocean Area Within 20km Radius of Fukushima Daiichi NPS)

[Categorized by the radioactive cesium level (by fish species, Since October 2012)]

- Total amount of radioactive cesium 134 and 137
Unit: Bq/kg (Raw)
- Sampling period: October 9, 2012 - February 7, 2013
- Guideline value (April 1, 2012 and later): 100Bq/kg

(20km Radius of Fukushima Daiichi NPS (exclude in the Port of Fukushima Daiichi NPS))

| Fish | Maximum | Minimum | Number of measurements (Measurement results exceeding the guideline value) | Fish | Maximum | Minimum | Number of measurements |
|------------------------------|---------|---------|---|---------------------------------|---------|---------|------------------------|
| Marbled sole | 1690 | 16 | 28 (11) | Balloonfish | 22.8 | 10 | 2 |
| Schlegel's black rockfish | 1470 | 29 | 8 (6) | Lophius litilon | 22.6 | ND | 4 |
| Common skate | 780 | 53 | 43 (37) | Gnathophis nystromi nystromi | 22.1 | 18.5 | 2 |
| Greenling | 450 | 15 | 24 (11) | Carcharhinus | 20.2 | 5.6 | 3 |
| Angel shark | 420 | 8.7 | 10 (7) | Common horse mackerel | 18.9 | ND | 4 |
| Microstomus achne | 420 | 16.5 | 16 (9) | Slippery sole | 17.9 | - | 1 |
| Sea raven | 410 | 31 | 8 (6) | Yellowtail | 16.3 | ND | 6 |
| Banded dogfish | 390 | 270 | 2 (2) | Pennahia argentata | 14.6 | 8.9 | 3 |
| Flatfish | 350 | 17.2 | 44 (14) | Lepidotrigla microptera | 13.6 | ND | 12 |
| Stone flounder | 212 | ND | 14 (1) | Crimson sea bream | 12.9 | ND | 10 |
| Stingray | 178 | 6.4 | 8 (2) | Striped jewfish | 12.1 | ND | 3 |
| Sea bass | 165 | 11.4 | 12 (1) | Oplegnathus punctatus | ND | - | 1 |
| Spotted halibut | 165 | - | 1 (1) | Black scraper | ND | - | 2 |
| Acanthopagrus schlegeli | 153 | 35 | 3 (1) | Snailfish | ND | - | 6 |
| Flathead (Platycephalus sp.) | 138 | 31.9 | 5 (3) | Southern mackerel | ND | - | 1 |
| Smooth dogfish | 121 | 5.8 | 14 (1) | Arothron hispidus | ND | - | 1 |
| Pacific cod | 89 | 4.4 | 10 | Chum salmon | ND | - | 3 |
| Sea robin | 76 | 4.5 | 13 | | | | |
| Roundnose flounder | 59 | ND | 6 | Squids | Maximum | Minimum | Number of measurements |
| Drumfish | 57 | 27.4 | 9 | Loliginid | ND | - | 6 |
| Takifugu snyderi | 48 | 21.9 | 3 | Loligo bleekeri | ND | - | 2 |
| Ridged-eye flounder | 46 | ND | 6 | | | | |
| Littlemouth flounder | 38 | ND | 8 | Octopuses | Maximum | Minimum | Number of measurements |
| Cynoglossus joyneri | 34 | - | 1 | Octopus (Enteroctopus dofleini) | ND | - | 4 |
| Dasyatis matsubarae | 34 | ND | 4 | | | | |
| Dory | 34 | 4.2 | 12 | Crustacea | Maximum | Minimum | Number of measurements |
| Common Japanese conger | 32 | 13.7 | 5 | Blue crab | 37 | ND | 18 |
| Pagrus major | 29 | ND | 7 | Ovalipes punctatus | 23.5 | ND | 11 |

(Remark) ND for Cs134: approx. 3.0Bq/kg, Cs137: approx. 3.1Bq/kg

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| Number of samples | 50 |
| Samples with cesium exceeding 100Bq/kg | 16 (32%) |
| Number of measurements | 426 |
| Number of measurement results exceeding 100Bq/kg | 113 (27%) |

* Figures in parenthesis are ratios over 100 Bq/kg.

[Categorized by the radioactive cesium level (by fish species, March - September 2012)]

- Total amount of radioactive cesium 134 and 137
Unit: Bq/kg (Raw)
- Sampling period: March 29 - September 19, 2012
- Guideline value (April 1, 2012 and later): 100Bq/kg

| Fish | Maximum | Minimum | Number of measurements (Measurement results exceeding the guideline value) | Fish | Maximum | Minimum | Number of measurements |
|------------------------------|---------|---------|---|---------------------------------|---------|---------|------------------------|
| Greenling | 25800 | ND | 86 (44) | Chub mackerel | 14.3 | ND | 2 |
| Sebastes cheni | 1880 | 540 | 6 (6) | Sand eel | 12.9 | ND | 4 |
| Barfin flounder | 1670 | 690 | 2 (2) | Balloonfish | 10.2 | ND | 2 |
| Sea bass | 1610 | 33 | 17 (11) | Pointhead flounder | 8.3 | 4.1 | 2 |
| Banded dogfish | 1430 | 4.4 | 9 (3) | Yellowtail | 6.5 | ND | 5 |
| Microstomus achne | 1260 | ND | 36 (22) | Pelagic thresher | 6 | - | 1 |
| Flatfish | 1190 | 5.6 | 51 (30) | Korean flounder | 4.8 | ND | 2 |
| Common skete | 1000 | 168 | 47 (47) | Flathead flounder | 4.1 | - | 1 |
| Marbled sole | 920 | 21.3 | 42 (23) | Zenopsis nebulosa | ND | - | 2 |
| Spotbelly rockfish | 830 | - | 1 (1) | Alaska pollack | ND | - | 1 |
| Starry flounder | 810 | 580 | 2 (2) | Japanese butterfish | ND | - | 1 |
| Sea raven | 670 | 25 | 7 (5) | | | | |
| Schlegel's black rockfish | 620 | 410 | 4 (4) | Squids | Maximum | Minimum | Number of measurements |
| Stingray | 460 | 55 | 7 (5) | Andrea cuttlefish | ND | - | 5 |
| Stone flounder | 390 | 29 | 10 (4) | Loliginid | ND | - | 9 |
| Angel shark | 222 | 66 | 4 (3) | Loligo bleekeri | ND | - | 3 |
| Dasyatis matsubarae | 205 | ND | 10 (2) | | | | |
| Flathead (Platycephalus sp.) | 187 | 140 | 3 (3) | Octopuses | Maximum | Minimum | Number of measurements |
| Smooth dogfish | 169 | 4.7 | 10 (2) | Chestnutoctopus | 9.1 | ND | 6 |
| Acanthopagrus schlegeli | 160 | 94 | 2 (1) | Octopus (Enteroctopus) dofleini | 7.7 | ND | 13 |
| Drumfish | 127 | 38 | 15 (4) | Common Octopus | ND | - | 1 |
| Sea robin | 107 | 19.9 | 6 (1) | | | | |
| Pacific cod | 107 | 16.7 | 11 (1) | Crustacea | Maximum | Minimum | Number of measurements |
| Littlemouth flounder | 103 | 10 | 8 (1) | Blue crab | 40 | ND | 16 |
| Carcharhinus | 93 | 4.6 | 8 | Ovalipes punctatus | 26 | ND | 16 |
| Pennahia argentata | 69 | 15 | 7 | | | | |
| Common Japanese conger | 66 | 21.4 | 2 | | | | |
| Dory | 63 | 12.5 | 11 | | | | |
| Roundnose flounder | 57 | 4.5 | 8 | | | | |
| Lepidotrigla microptera | 53 | 6.4 | 21 | | | | |
| Ridged-eye flounder | 53 | - | 1 | | | | |
| Northern dogfish | 50 | ND | 15 | | | | |
| Long shanny | 47 | 16.4 | 3 | | | | |
| Lophius litilon | 42 | ND | 17 | | | | |
| Common horse mackerel | 38 | 10.7 | 5 | | | | |
| Pagrus major | 38 | ND | 8 | | | | |
| Slippery sole | 36 | 21.6 | 4 | | | | |
| Crimson sea bream | 26 | ND | 4 | | | | |
| Salangichthys ishikawae | 23 | - | 1 | | | | |
| Shark-skin flounder | 17 | ND | 2 | | | | |

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| Number of samples | 59 |
| Samples with cesium exceeding 100Bq/kg | 24 (41%) |
| Number of measurements | 605 |
| Number of measurement results exceeding 100Bq/kg | 227 (38%) |

* Figures in parenthesis are ratios over 100 Bq/kg.

(Remark) ND for Cs134: approx. 3.1Bq/kg, Cs137: approx. 3.3Bq/kg

[Table 1 - 1. Results obtained at Each Measurement Point (1)]

| Measurement Point (Date of Sampling) | Samples (Sample names in blue letters: 100Bq/kg or less) |
|---|--|
| T1 (November 16) | Stone flounder, Common skete, Marbled sole, Flatfish, Sea robin, Littlemouth flounder, Lepidotrigla microptera, Crimson sea bream |
| T1 (November 30) | Common skete, Flatfish, Sea bass, Common Japanese conger, Greenling, Marbled sole, Littlemouth flounder, Dory, Lepidotrigla microptera, Crimson sea bream |
| T1 (December 21) | Stone flounder, Sea bass, Marbled sole, Microstomus achne, Greenling, Roundnose flounder, Littlemouth flounder, Gnathopis nystromi nystromi, Ridged-eye flounder, Flatfish, Common Japanese conger, Lepidotrigla microptera, Crimson sea bream, Black scraper, Yellowtail, Common horse mackerel |
| T1 (February 4) | Flatfish, Sea bass, Stone flounder, Greenling, Gnathopis nystromi nystromi, Microstomus achne, Lepidotrigla microptera, Pacific cod, Loliginid, Littlemouth flounder, Roundnose flounder Common skete, Marbled sole |
| T2 (November 16) | Stone flounder, Marbled sole, Flatfish, Greenling, Common Japanese conger, Dory, Lepidotrigla microptera, Common horse mackerel, Loliginid, Crimson sea bream, Octopus (Enteroctopus) dofieini, Loligo bleekeri |
| T2 (November 30) | Sea bass, Common skete, Greenling, Ridged-eye flounder, Flatfish, Marbled sole, Pagrus major, Littlemouth flounder, Crimson sea bream, Smooth dogfish, Dory, Lepidotrigla microptera, Common horse mackerel |
| T2 (December 21) | Common skete, Marbled sole, Microstomus achne, Ridged-eye flounder, Flatfish, Slippery sole, Common Japanese conger, Littlemouth flounder, Roundnose flounder, Striped jewfish, Blue crab, Lepidotrigla microptera, Loliginid, Crimson sea bream, Octopus (Enteroctopus) dofieini, Loligo bleekeri Sea bass |
| T2 (February 4) | Pacific cod, Stone flounder, Microstomus achne, Littlemouth flounder, Sea bass, Flatfish, Lepidotrigla microptera, Ridged-eye flounder Common skete |
| T3 (October 21) | Angel shark, Stone flounder, Stingray Common skete, Flatfish, Marbled sole |
| T3 (November 5) | Stone flounder, Marbled sole, Flatfish, Sea robin, Dasyatis matsubarae Common skete, Microstomus achne, Angel shark |
| T3 (December 14) | Microstomus achne, Stone flounder, Sea bass, Flatfish, Takifugu snyderi, Lepidotrigla microptera, Sea robin, Pagrus major, Crimson sea bream, Loliginid Common skete, Marbled sole |
| T3 (February 4) | Flatfish, Pacific cod, Sea bass, Sea raven, Marbled sole, Common Japanese conger, Balloonfish, Lepidotrigla microptera, Stone flounder, Octopus (Enteroctopus) dofieini Greenling, Common skete |
| T4 (October 21) | Marbled sole, Stone flounder, Sea robin, Stingray, Pagrus major Common skete, Flatfish, Angel shark |
| T4 (November 5) | Marbled sole, Ridged-eye flounder, Takifugu snyderi, Smooth dogfish, Dory, Stone flounder, Dasyatis matsubarae, Sea robin, Pagrus major Common skete, Flatfish |
| T4 (December 14) | Takifugu snyderi, Greenling, Flatfish, Crimson sea bream, Lepidotrigla microptera, Roundnose flounder, Sea robin, Loliginid Common skete, Microstomus achne |
| T4 (February 4) | Microstomus achne, Flatfish, Pacific cod, Marbled sole, Balloonfish, Roundnose flounder, Sea bass, Black scraper Common skete |
| G1 (November 8) | Blue crab, Ovalipes punctatus Common skete, Sea raven |
| G1 (December 20) | Flatfish, Ovalipes punctatus Schlegel's black rockfish, Common skete |
| G1 (January 31) | Ovalipes punctatus Greenling, Schlegel's black rockfish, Common skete |
| G1 (February 7) | Common skete, Schlegel's black rockfish, Pacific cod |

[Table 1 - 2. Results obtained at Each Measurement Point (2)]

| Measurement Point (Date of Sampling) | Samples (Sample names in blue letters: 100Bq/kg or less) |
|---|---|
| G2 (November 8) | Sea bass, Flatfish, Drumfish, Dory, Ovalipes punctatus, Smooth dogfish, Blue crab, Chum salmon Sea raven, Common skete |
| G2 (December 20) | Microstomus achne, Greenling, Marbled sole, Flatfish, Stingray, Lophius litilon, Snailfish Sea raven, Common skete |
| G2 (January 31) | Pacific cod, Marbled sole, Flatfish Common skete |
| G2 (February 7) | Common skete, Pacific cod |
| G3 (October 13) | Flathead (Platycephalus sp.) , Sea bass, Drumfish, Blue crab, Cynoglossus joyneri, Smooth dogfish, Pagrus major Common skete, Flatfish, Spotted halibut |
| G3 (November 21) | Smooth dogfish, Pennahia argentata, Yellowtail, Dory, Blue crab Common skete, Microstomus achne, Flatfish, Angel shark |
| G3 (December 13) | Flatfish, Smooth dogfish, Sea bass, Stingray, Sea robin, Ovalipes punctatus, Blue crab, Snailfish, Yellowtail Marbled sole, Common skete, Sea raven |
| G3 (January 29) | Flatfish, Sea raven, Pacific cod, Snailfish Schlegel's black rockfish, Common skete, Microstomus achne, Greenling |
| G4 (October 13) | Flatfish, Drumfish, Pagrus major, Common horse mackerel, Angel shark, Dasyatis matsubarae, Carcarhinus, Ovalipes punctatus, Yellowtail, Blue crab, Chum salmon Marbled sole, Greenling, Common skete |
| G4 (November 21) | Flatfish, Stone flounder, Marbled sole, Pagrus major, Sea robin, Yellowtail, Smooth dogfish, Blue crab Microstomus achne, Common skete, Greenling |
| G4 (December 13) | Flatfish, Smooth dogfish, Schlegel's black rockfish, Lophius litilon, Blue crab, Snailfish Marbled sole, Greenling, Common skete, Microstomus achne |
| G4 (January 29) | Flatfish, Pacific cod, Snailfish Schlegel's black rockfish, Microstomus achne, Marbled sole, Common skete |
| G5 (October 15) | Drumfish, Blue crab Common skete, Flatfish, Banded dogfish |
| G5 (November 15) | Pennahia argentata Common skete, Flatfish, Marbled sole |
| G5 (December 9) | Angel shark, Dory Marbled sole, Common skete, Banded dogfish, Microstomus achne, Greenling, Flatfish |
| G5 (January 20) | Sea robin Common skete, Marbled sole, Acanthopagrus schlegeli, Flatfish, Schlegel's black rockfish |
| G6 (March 29) | Sand eel |
| G6 (April 7) | Northern dogfish, Pacific cod, Shark-skin flounder Flatfish, Marbled sole, Sea raven |
| G6 (April 11) | Northern dogfish Marbled sole, Microstomus achne, Common skete, Pacific cod |
| G7 (October 15) | Acanthopagrus schlegeli, Drumfish, Smooth dogfish, Dory, Blue crab Schlegel's black rockfish, Common skete, Greenling, Flatfish |
| G7 (November 15) | Flatfish, Stingray, Blue crab Common skete, Greenling, Angel shark |
| G7 (December 9) | Lophius litilon, Dory Common skete, Flatfish, Angel shark |
| G7 (January 20) | Flatfish, Pacific cod, Acanthopagrus schlegeli, Stone flounder Common skete, Microstomus achne, Marbled sole |
| G8 (October 14) | Stingray, Flatfish, Drumfish, Flathead (Platycephalus sp.) , Ovalipes punctatus, Pennahia argentata, Blue crab Common skete, Smooth dogfish |
| G8 (November 10) | Flatfish, Smooth dogfish, Drumfish, Blue crab, Ovalipes punctatus Sea raven, Common skete, Stingray, Flathead (Platycephalus sp.) , Angel shark |
| G8 (November 19) | Sea robin, Smooth dogfish, Dory, Blue crab, Southern mackerel, Chum salmon Sea raven, Flatfish, Flathead (Platycephalus sp.) |
| G8 (December 17) | Roundnose flounder, Sea robin, Marbled sole, Smooth dogfish, Lophius litilon, Blue crab, Snailfish, Octopus (Enteroctopus) dofleini Common skete, Angel shark, Flatfish |

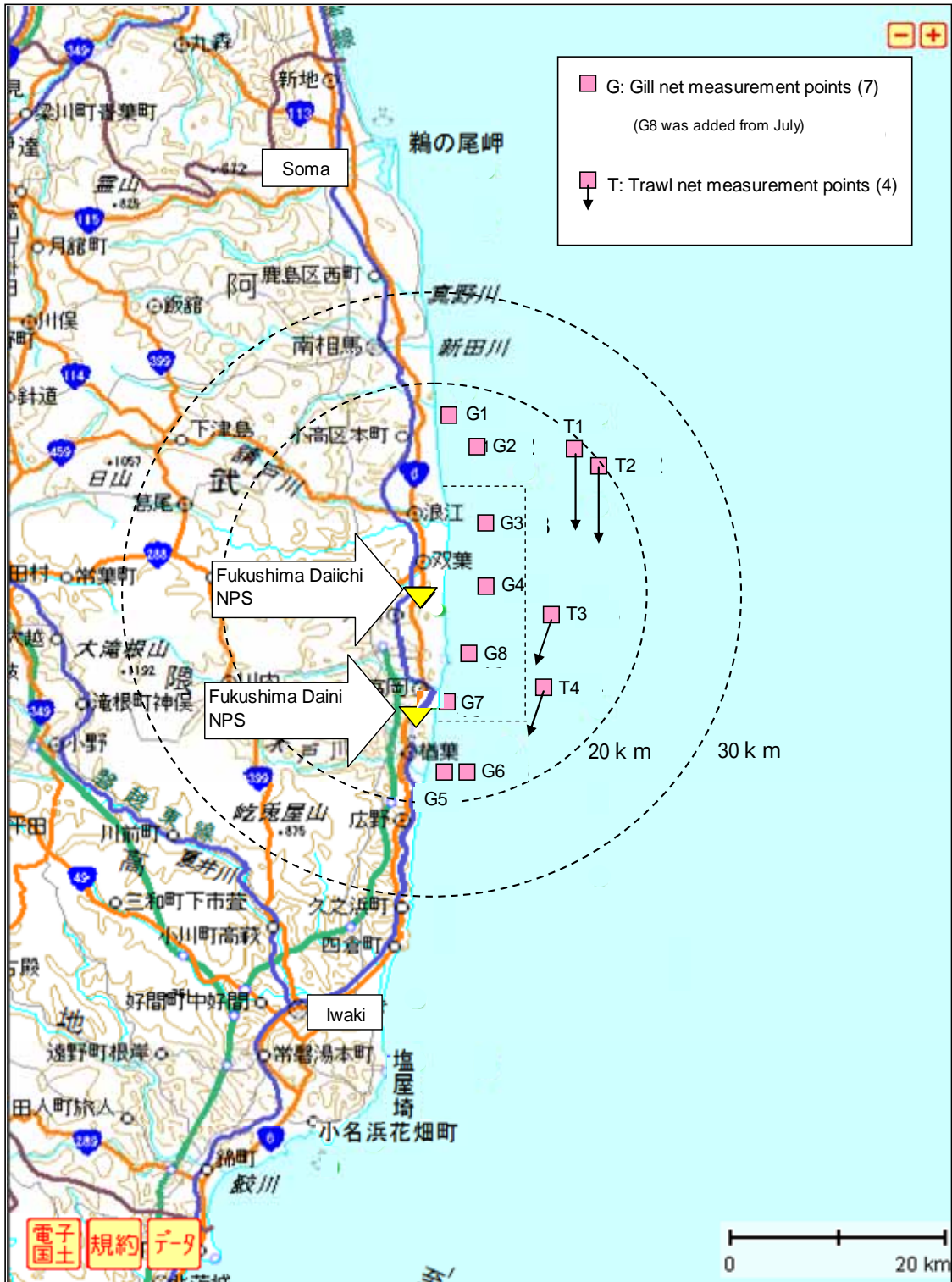
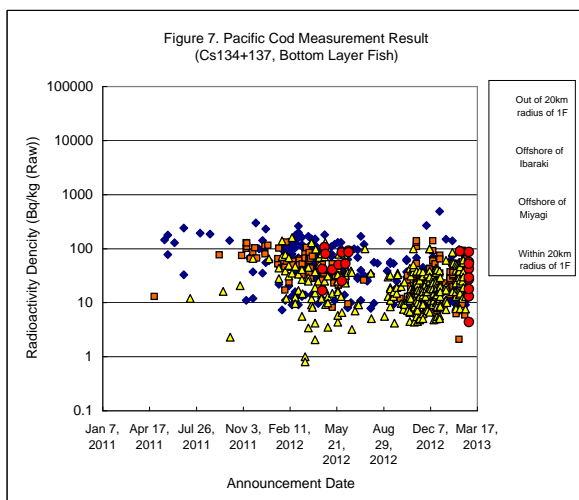
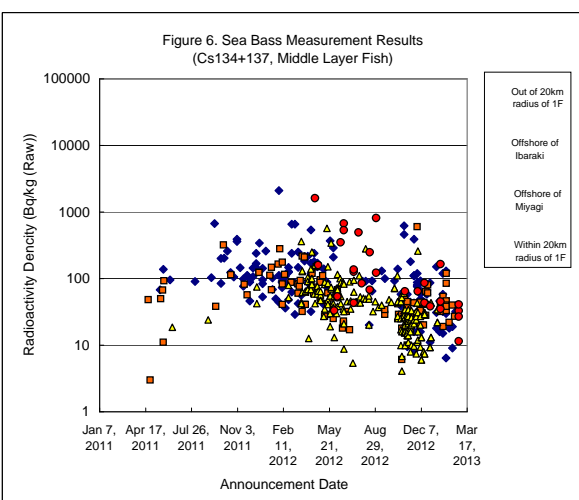
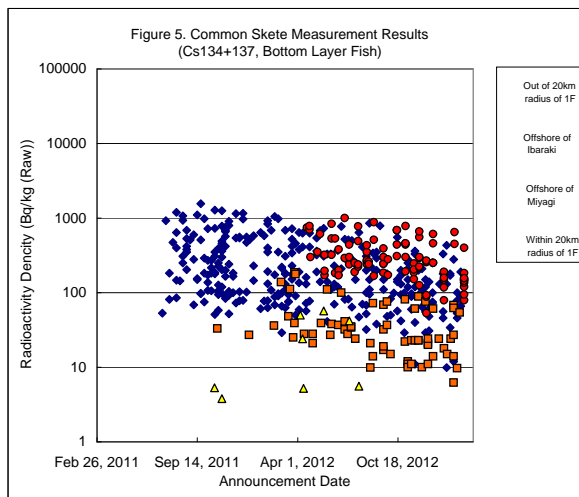
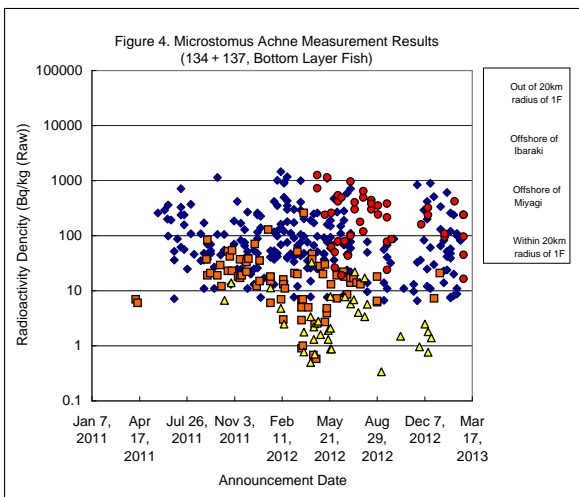
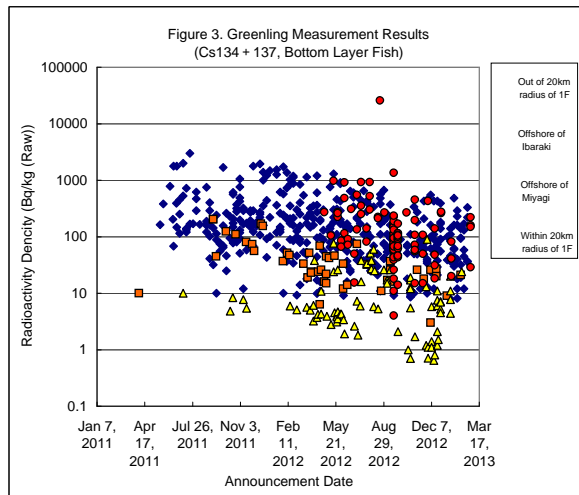
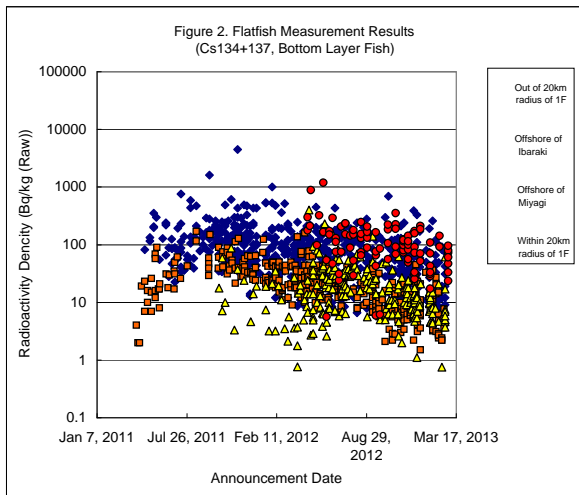


Figure 1. Fish and Shell Fish Measurement Points (As of February 2013)



(Remark) The measurement results of "Out of 20km radius of 1F", "Offshore of Ibaraki" and "Offshore of Miyagi" was obtained from the Japan Meteorological Agency website.

Sampling (extermination) using fishing baskets in the port of Fukushima Daiichi NPS

As of February 22, 2013

1. Basket fishing

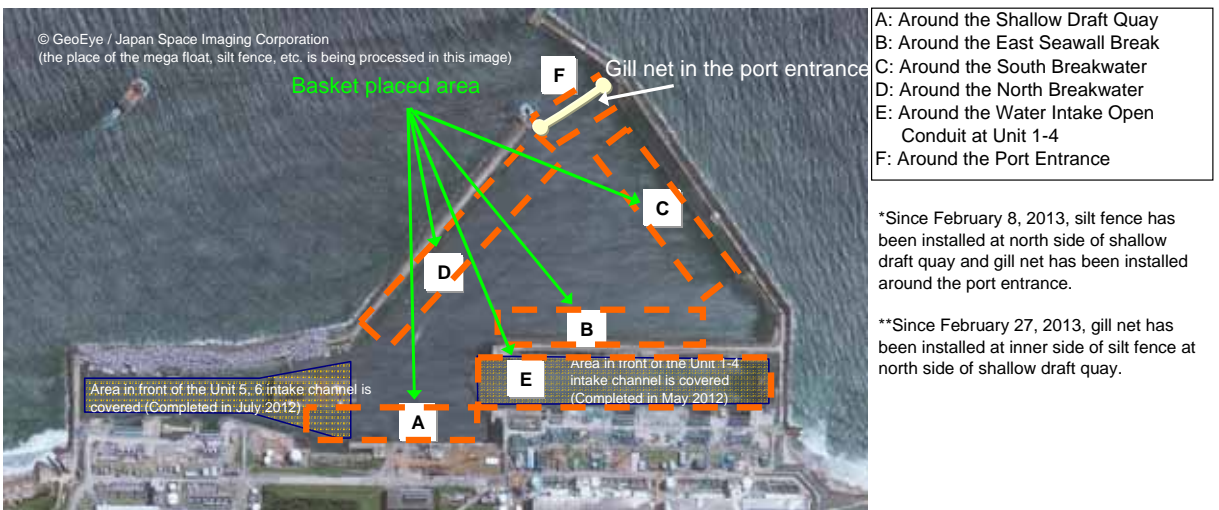
| Date of Sampling | Number of sampling | Sampling of Highest Cesium Density (Place of Sampling) | Cesium Density (Unit: Bq/kg (Raw)) | | |
|-------------------|--------------------|--|------------------------------------|---------|---------------|
| | | | Cs-134 | Cs-137 | Cesium Amount |
| October 10, 2012 | 4 | Common Japanese conger (A) | 5,900 | 9,600 | 15,500 |
| December 20, 2012 | 29 | Spotbelly rockfish (A) | 94,000 | 160,000 | 254,000 |
| January 18, 2013 | 42 | Spotbelly rockfish (B) | 51,000 | 90,000 | 141,000 |
| January 30, 2013 | 28 | Spotbelly rockfish (B) | 75,000 | 130,000 | 205,000 |
| February 15, 2013 | 21 | Spotbelly rockfish (A*) | 97,000 | 180,000 | 277,000 |
| February 21, 2013 | 6 | The samples are currently under radioactivity density measurements | | | |

* Sampled at inner side of Silt Fence

2. Gill net in the port entrance

| Date of Sampling | Number of sampling | Sampling of Highest Cesium Density (Place of Sampling) | Cesium Density (Unit: Bq/kg (Raw)) | | |
|-------------------|--------------------|--|------------------------------------|---------|---------------|
| | | | Cs-134 | Cs-137 | Cesium Amount |
| February 12, 2013 | 154 | Greenling (F) | 86,000 | 160,000 | 246,000 |
| February 13, 2013 | 47 | Spotbelly rockfish (F) | 55,000 | 99,000 | 154,000 |
| February 15, 2013 | 17 | Greenling (F) | 50,000 | 90,000 | 140,000 |
| February 16, 2013 | 8 | Sebastes cheni (F) | 30,000 | 55,000 | 85,000 |
| February 17, 2013 | 6 | Greenling (F) | 180,000 | 330,000 | 510,000 |
| February 19, 2013 | 2 | The samples are currently under radioactivity density measurements | | | |
| February 20, 2013 | 5 | | | | |
| February 21, 2013 | 3 | | | | |
| February 22, 2013 | 44 | | | | |

| | |
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| Total amount of sampling | 416 |
|--------------------------|-----|



A: Around the Shallow Draft Quay
 B: Around the East Seawall Break
 C: Around the South Breakwater
 D: Around the North Breakwater
 E: Around the Water Intake Open Conduit at Unit 1-4
 F: Around the Port Entrance

*Since February 8, 2013, silt fence has been installed at north side of shallow draft quay and gill net has been installed around the port entrance.

**Since February 27, 2013, gill net has been installed at inner side of silt fence at north side of shallow draft quay.

Figure. Place of Sampling

Outline Process (Draft) of the Countermeasures for Fish in the Port at Fukushima Daiichi NPS



- ① Preventing fish from moving out
- ② Sampling (extermination) of fish
 - ②-1: Basket fishing (yellow box) ②-2: Gill net in the port entrance (*includes tentative plan) (green line)
- ③ Improving environment of the marine soil in the port (dredging)

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| | FY 2012 | | | | | | FY 2013 | | | | | | | | |
|---|--|----|----|---|---|---|---------|---|---|---|---|---|----|----|----|
| | 10 | 11 | 12 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Overall Schedule | Sampling (extermination) of fish, Preventing fish from moving to outside the port of Fukushima Daiichi NPS, etc. (Trend monitoring the number and the radioactivity level of fish and review the countermeasures accordingly.) | | | | | | | | | | | | | | |
| 1 Preventing fish from moving out | | | | | | | | | | | | | | | |
| <Placement of gill net at the port entrance of Fukushima Daiichi NPS> | Ongoing since February 8 | | | | | | | | | | | | | | |
| <Placement of block fence at port entrance (permanent installation)> | Construction of block fence Installation of fence scheduled in mid-July | | | | | | | | | | | | | | |
| <Placement of partition net inside the embankment> | Arrangement of the net Construction to place the net Preventing fish from moving by partition net | | | | | | | | | | | | | | |
| <Placement of silt fence and gill net at shallow draft quay> | Installation of silt fence since February 8 Installation of gill net since February 27 | | | | | | | | | | | | | | |
| 2 Sampling (extermination) of fish | | | | | | | | | | | | | | | |
| <Basket fishing- ②-1 5 sampling points (Shallow draft quay, south and north breakwater, east seawall bank, in the Water Intake Open Conduit at Unit 1-4)> | ● (1 point) ● (7 points) Around 3 times a month | | | | | | | | | | | | | | |
| <Gill net fishing- ②-2 In the port of Fukushima Daiichi NPS> | Ongoing sequentially since February 27 | | | | | | | | | | | | | | |
| <Gill net fishing- 2 points in north and south sea area outside the port of Fukushima Daiichi NPS> | (Under discussion toward implement) | | | | | | | | | | | | | | |
| 3 Improving environment of the marine soil in the port | | | | | | | | | | | | | | | |
| <Dredging the ocean lane and the anchorage> | * Under consideration toward early launch | | | | | | | | | | | | | | |