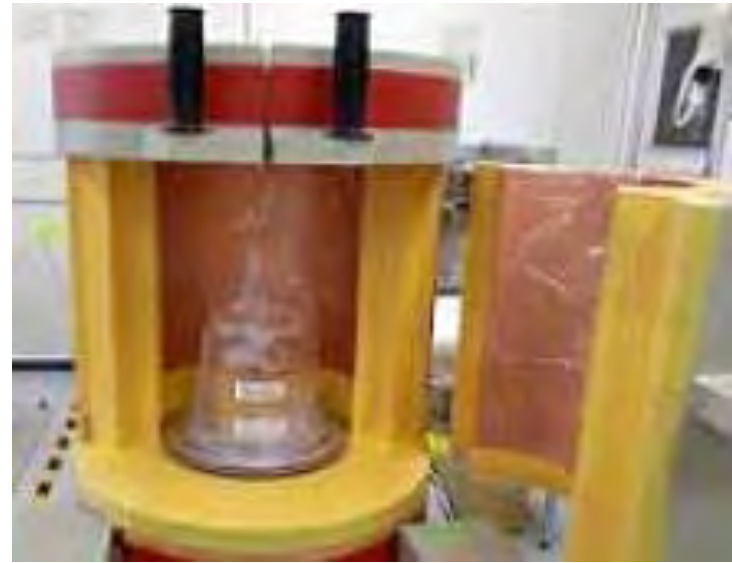


Repercussions on fishery products and recovery from the nuclear disaster in Fukushima

Fukushima Prefectural Fisheries Experimental Station

Tsuneo Fujita

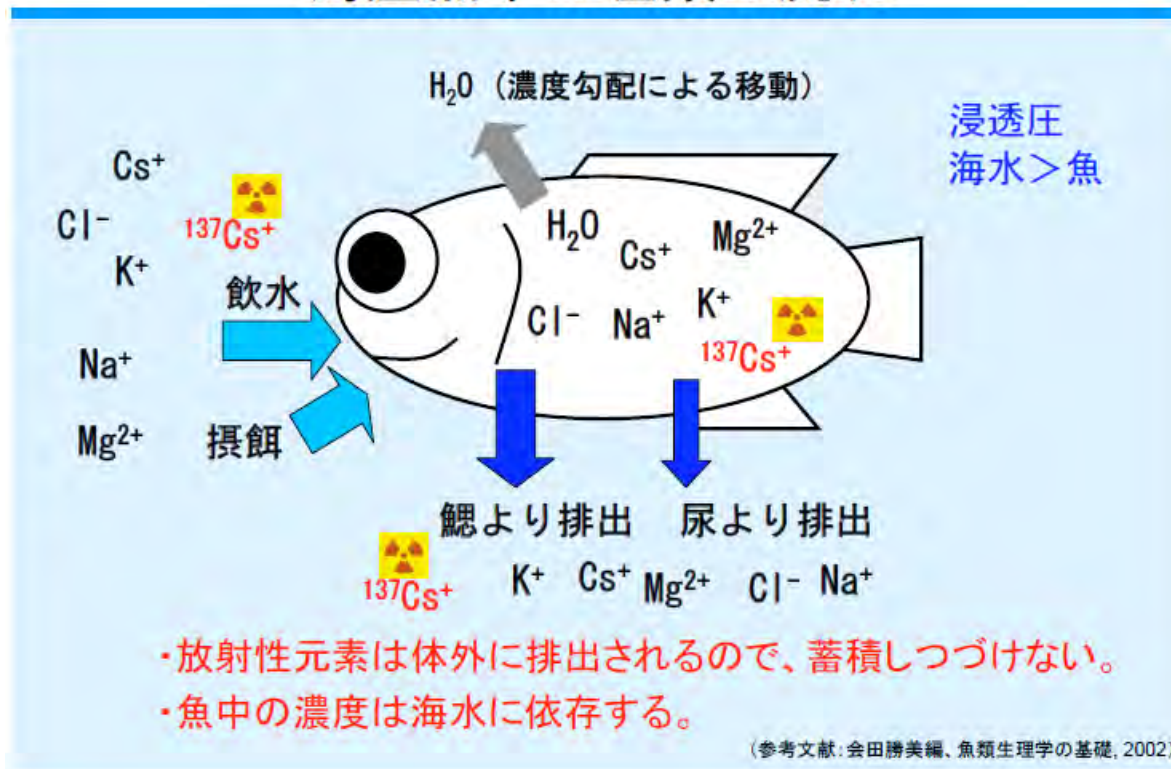


Radioactive cesium contamination of marine fishes

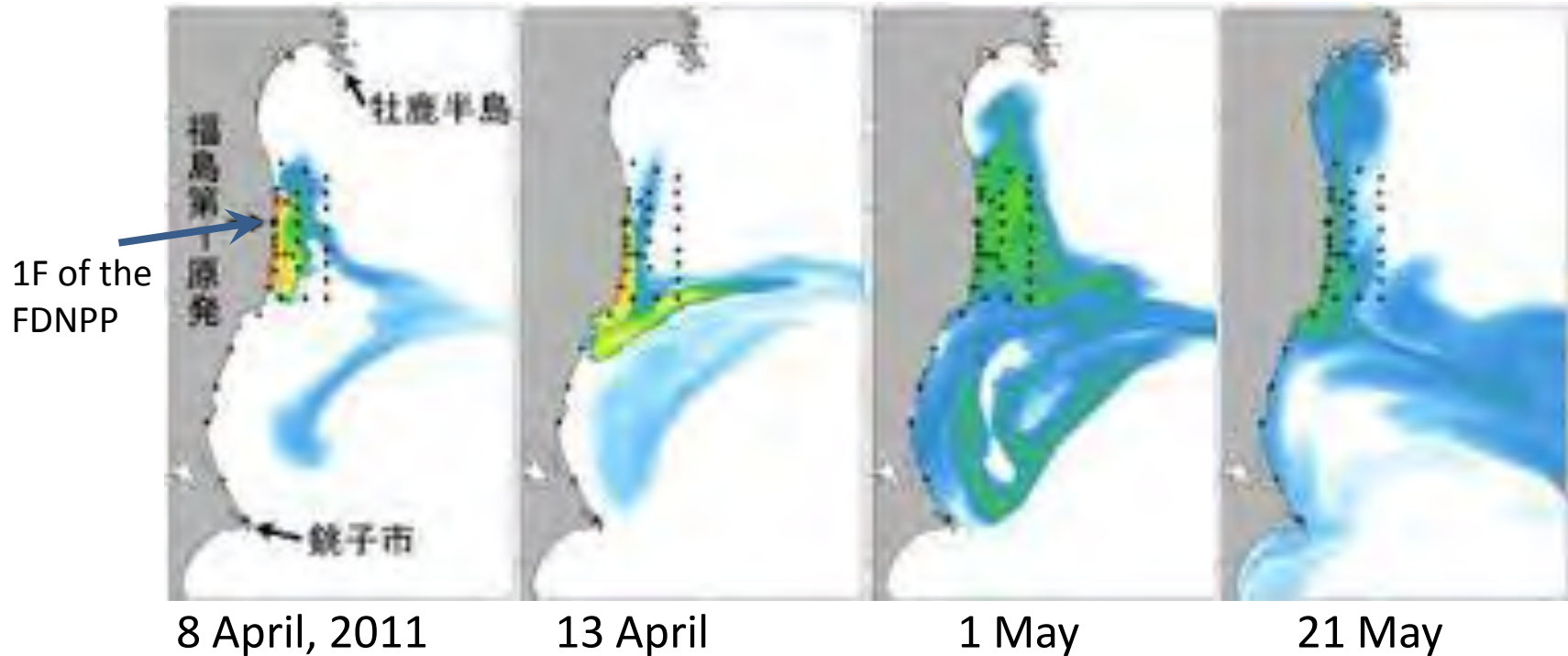
1 From seawater

2 From food organisms

海産魚中の塩類の流れ



Dispersion process of ^{137}Cs in surface seawater simulated by Dr. Tsumune et al. (CRIEPI)

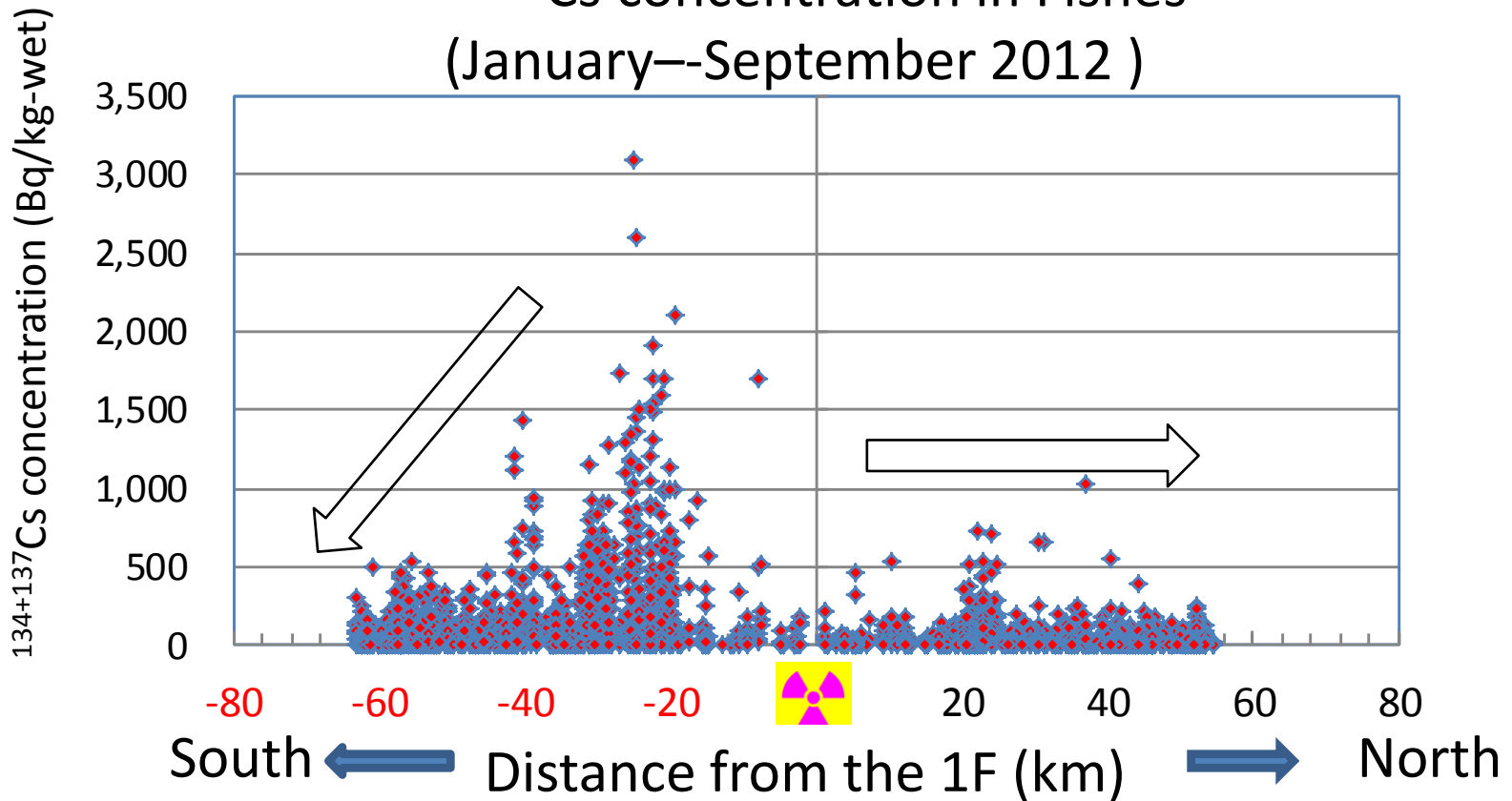


Highly contaminated seawater leaked from 1F of FDNPP flowed along the southern coastline, and then gradually dispersed over offshore waters



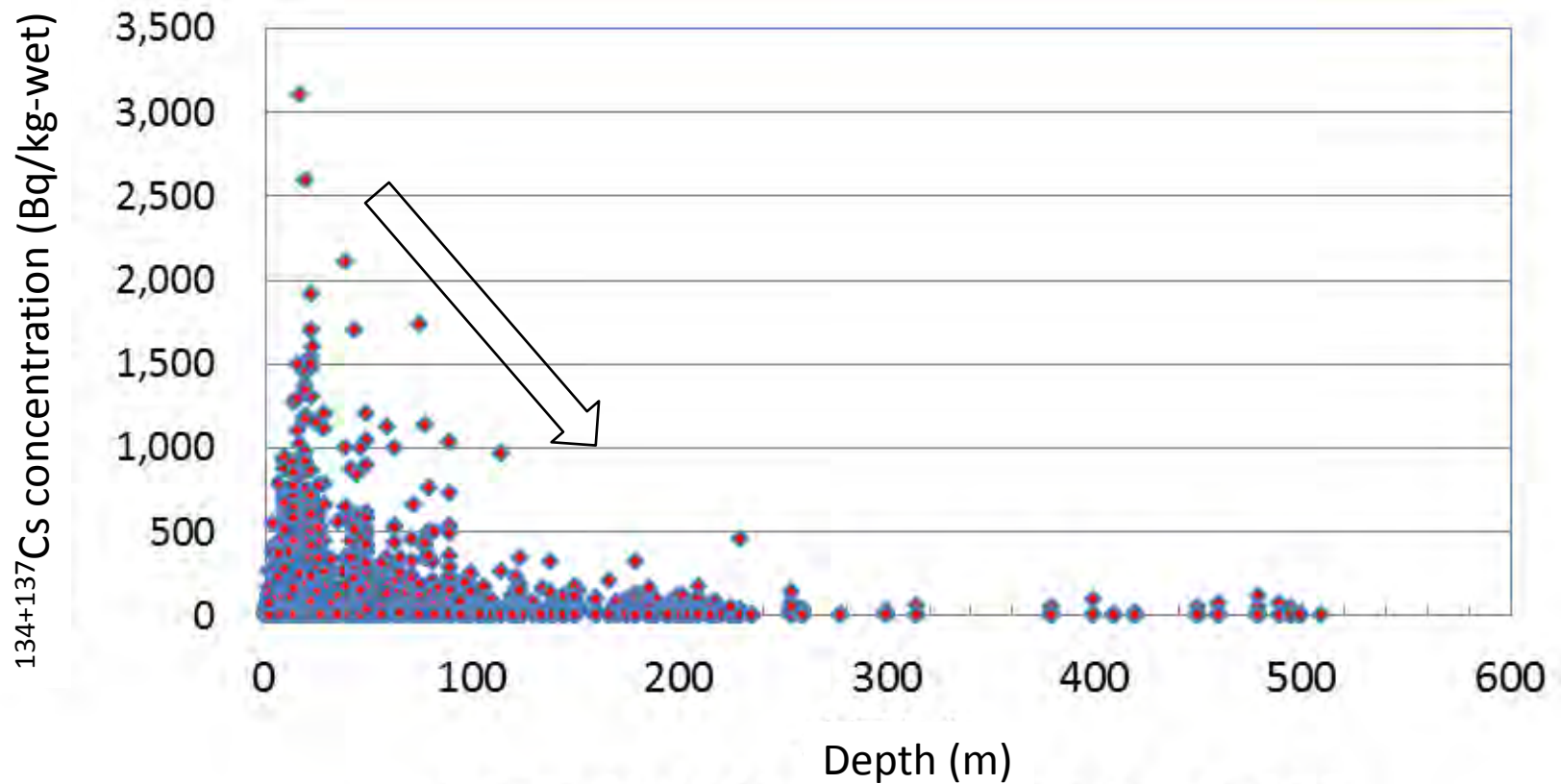
The fish in the shallower waters south of the 1F were highly contaminated by drinking contaminated seawater. The declining trend of radioactive Cs in the remained fish were much more gradual because of the continued intake of contaminated foods.

The relation between the distance from the 1F and $^{134+137}\text{Cs}$ concentration in Fishes (January--September 2012)



Detection limits in our study ranged 7–10 Bq/kg-wet.

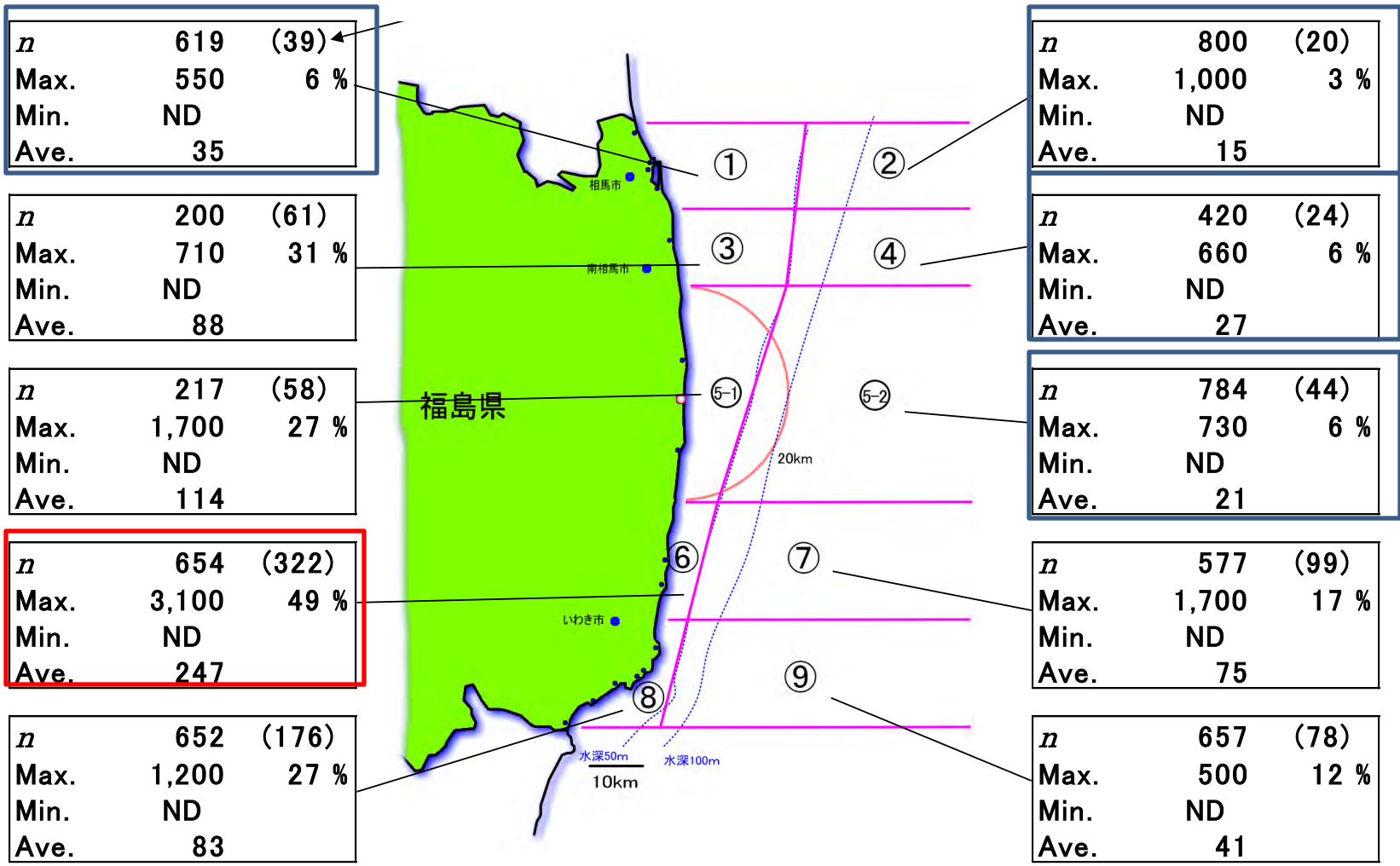
ND (not detected) data are expediently plotted on the X-axis.



The relation between the collected depth and $^{134+137}\text{Cs}$ concentration in Fishes (January--September 2012)

2012

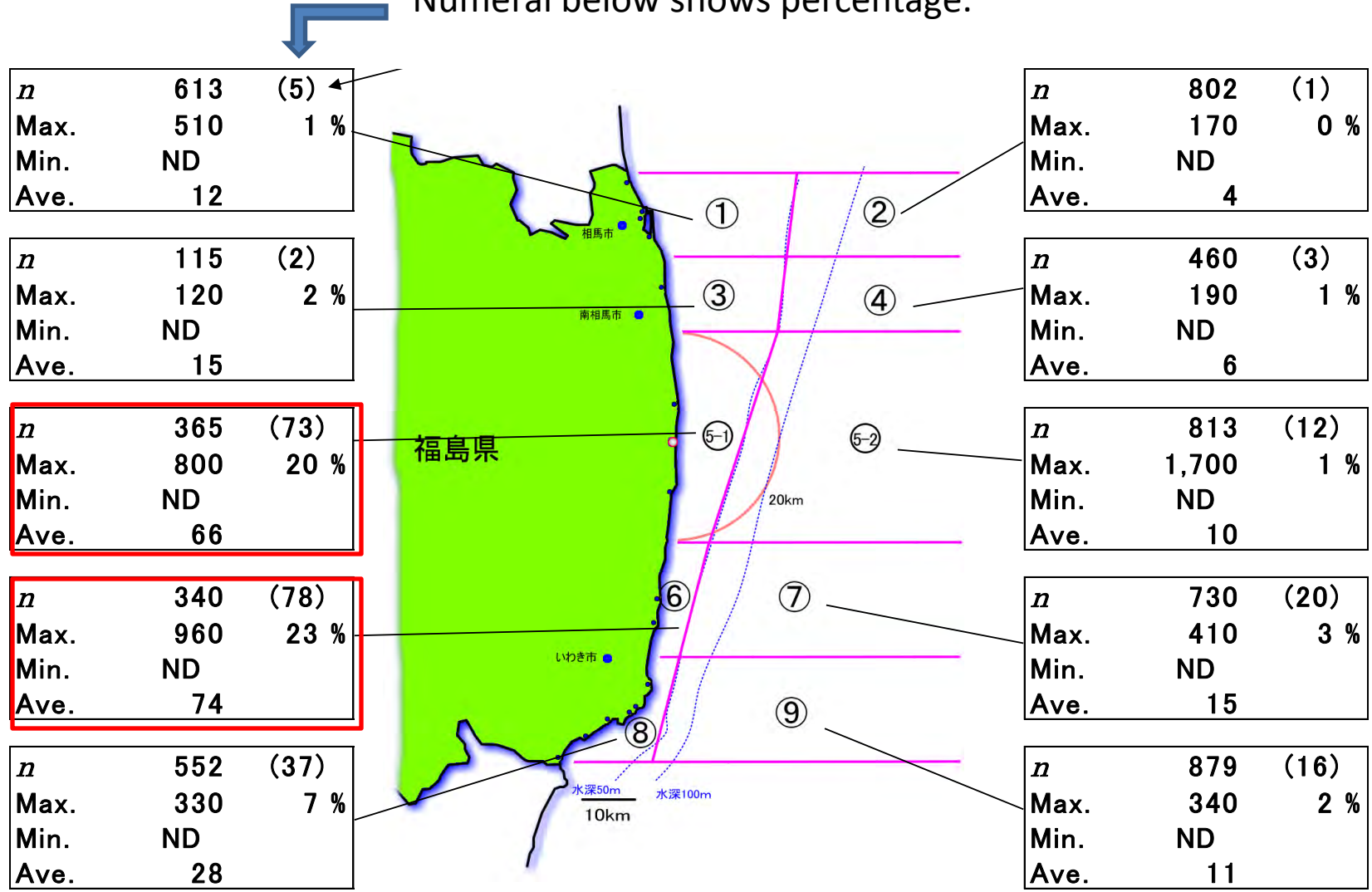
Number in parenthesis show number of samples above 100 Bq/kg
 Numeral below shows percentage.



Summary of ¹³⁴⁺¹³⁷Cs concentration of all the monitoring samples in 10 areas off Fukushima during January–December 2012.

ND (not detected) data were expediently dealt as zero during the calculation.

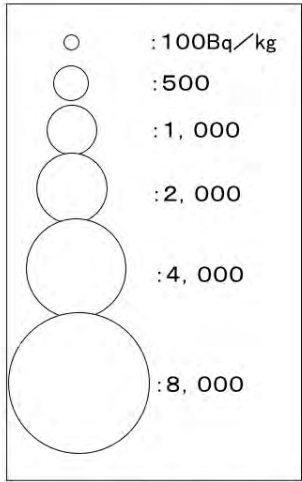
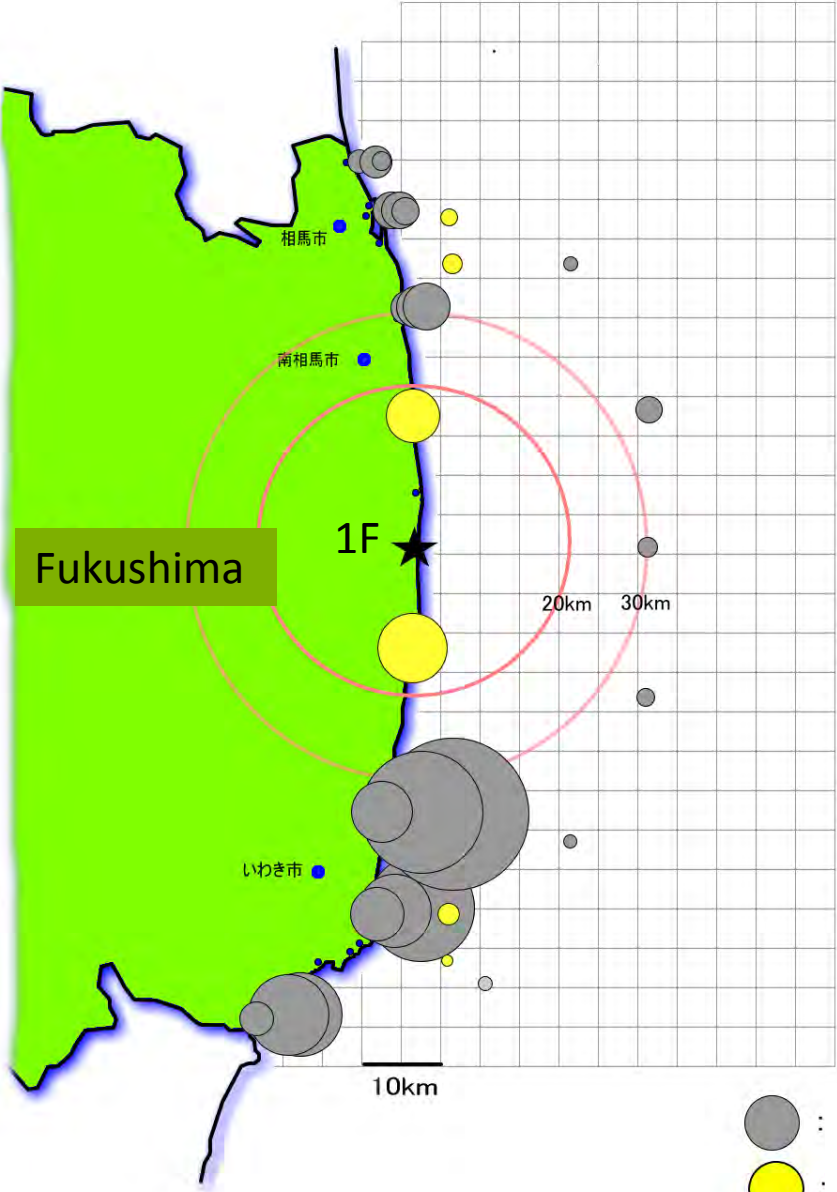
Number in parenthesis show number of samples above 100 Bq/kg
 Numeral below shows percentage.



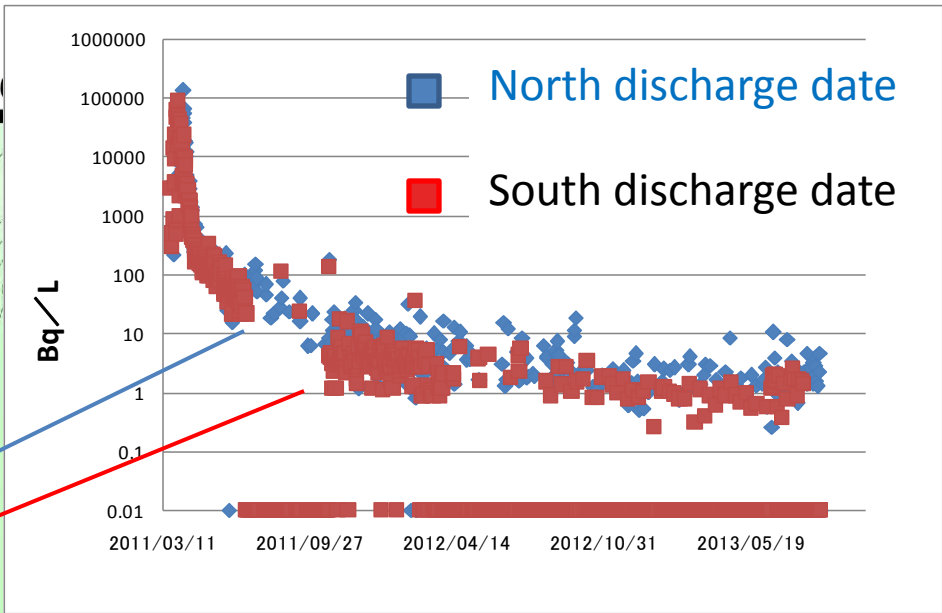
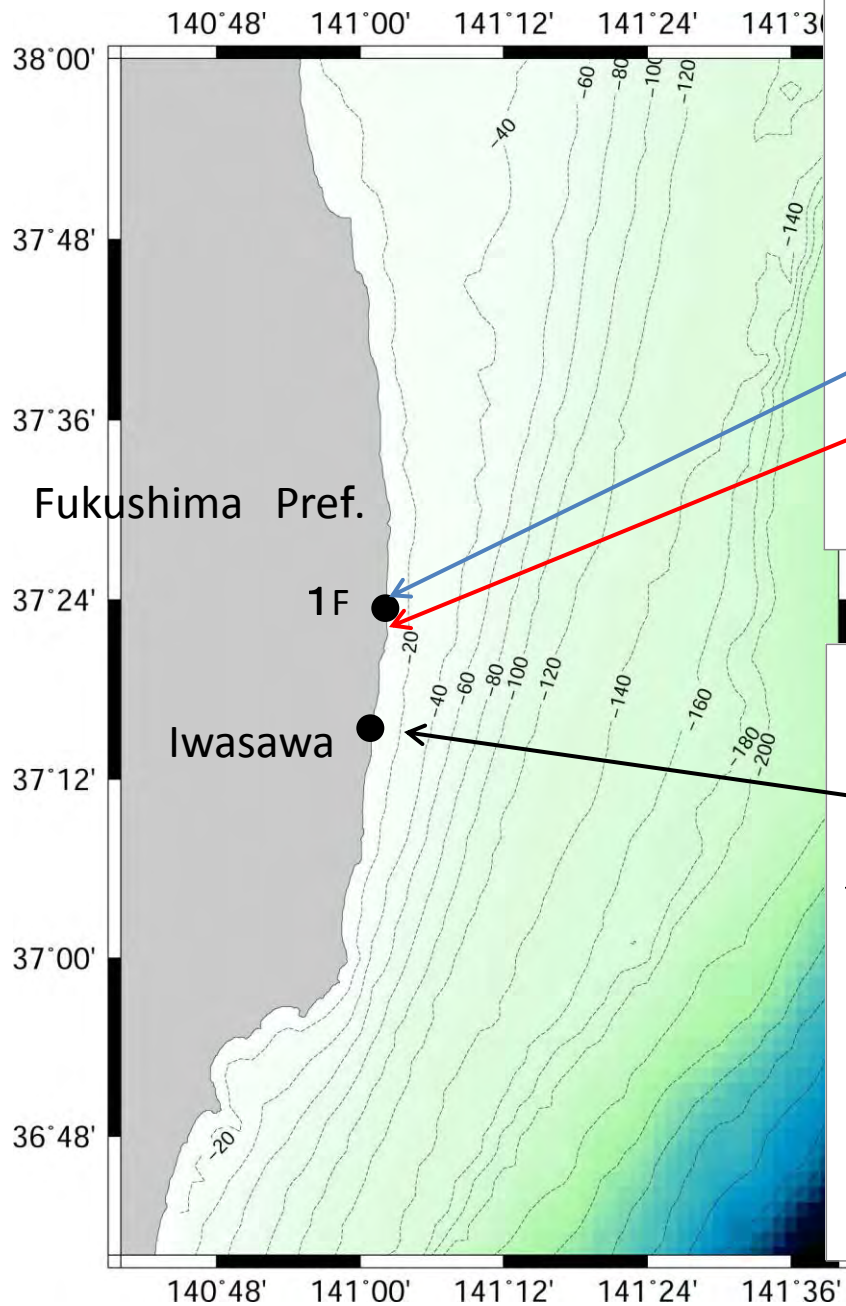
Summary of ¹³⁴⁺¹³⁷Cs concentration of all the monitoring samples in 10 areas off Fukushima during January–September 2012.

ND (not detected) data were expediently dealt as zero during the calculation.

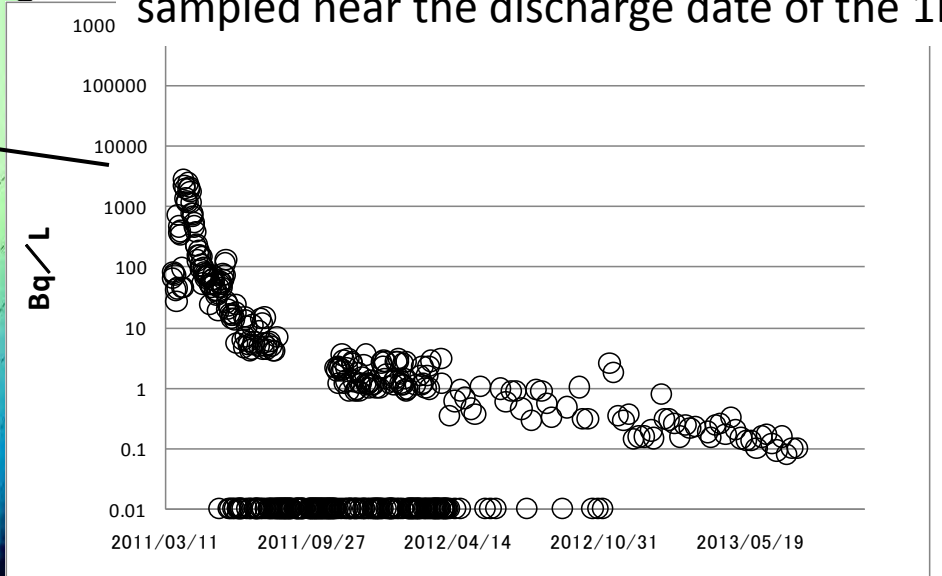
Contamination of marine soil (May, June-2011)



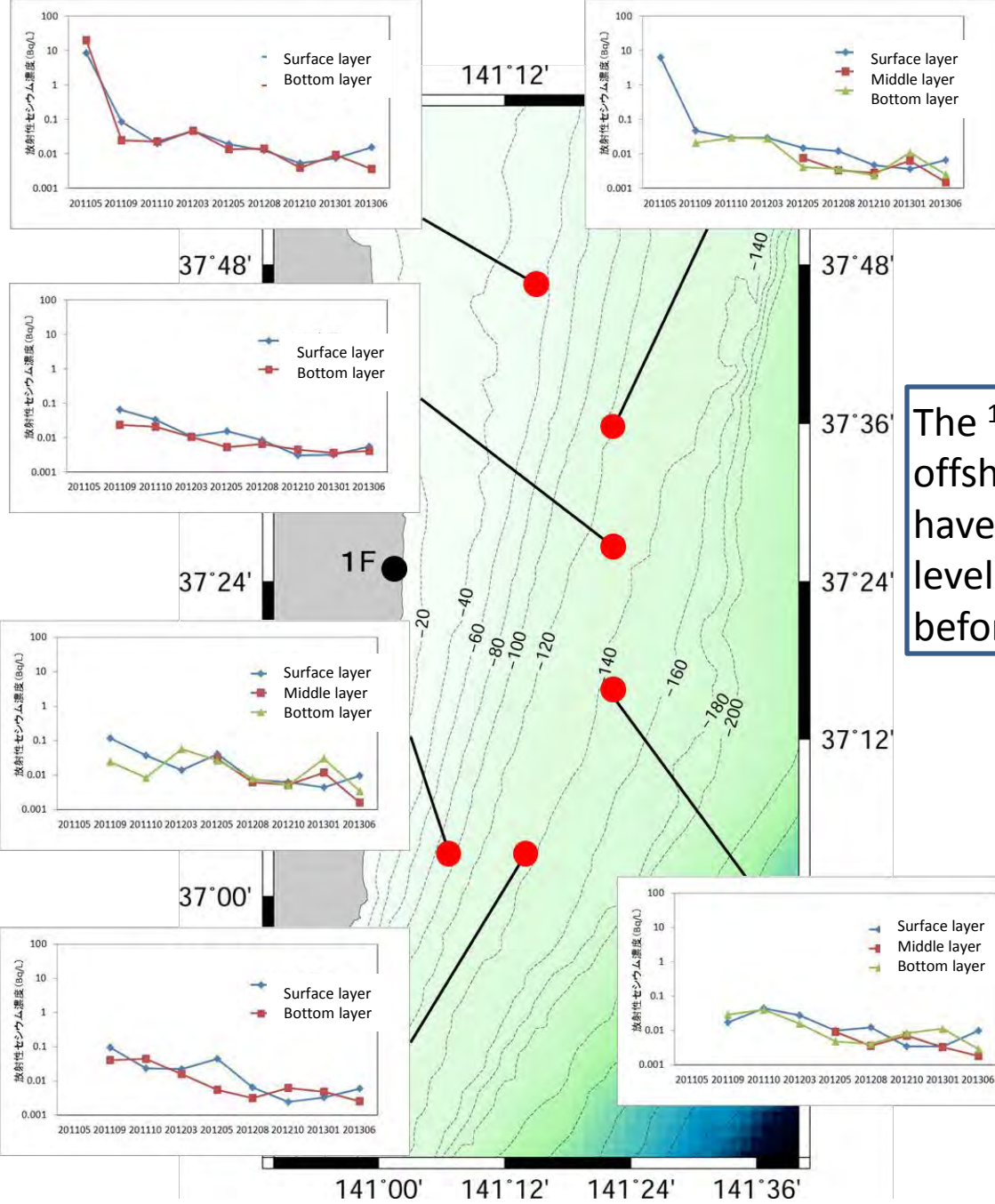
- : Released from MEXT ,Fukushima Pref.
- : Released from TEPCO



37°24' $^{134} + ^{137}\text{Cs}$ concentration in seawater sampled near the discharge date of the 1F

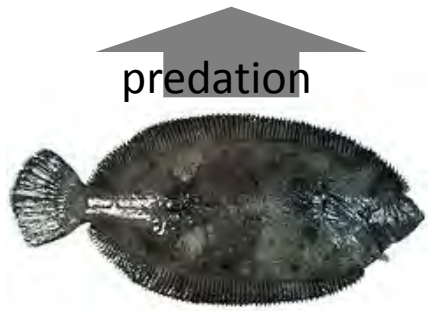


$^{134} + ^{137}\text{Cs}$ concentration in seawater sampled near the Iwasawa beach

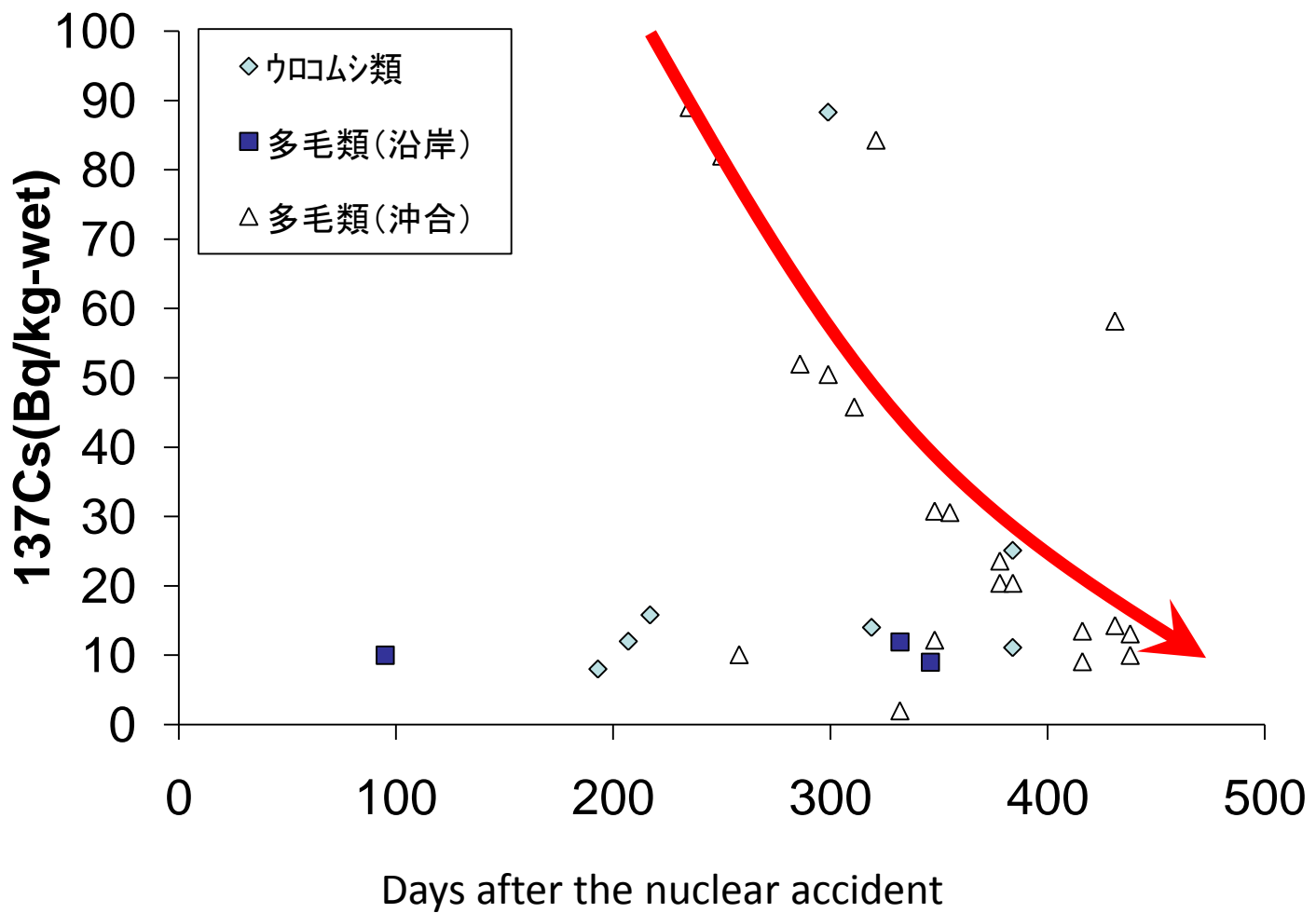


$^{134}\text{Cs} + ^{137}\text{Cs}$ concentration of offshore seawater (Bq/L) released from NRA and MEXT.

^{137}Cs concentration in prey organisms-1 (polychaetes)



Many demersal fish
(e.g., slime
flounder, willowy
flounder)



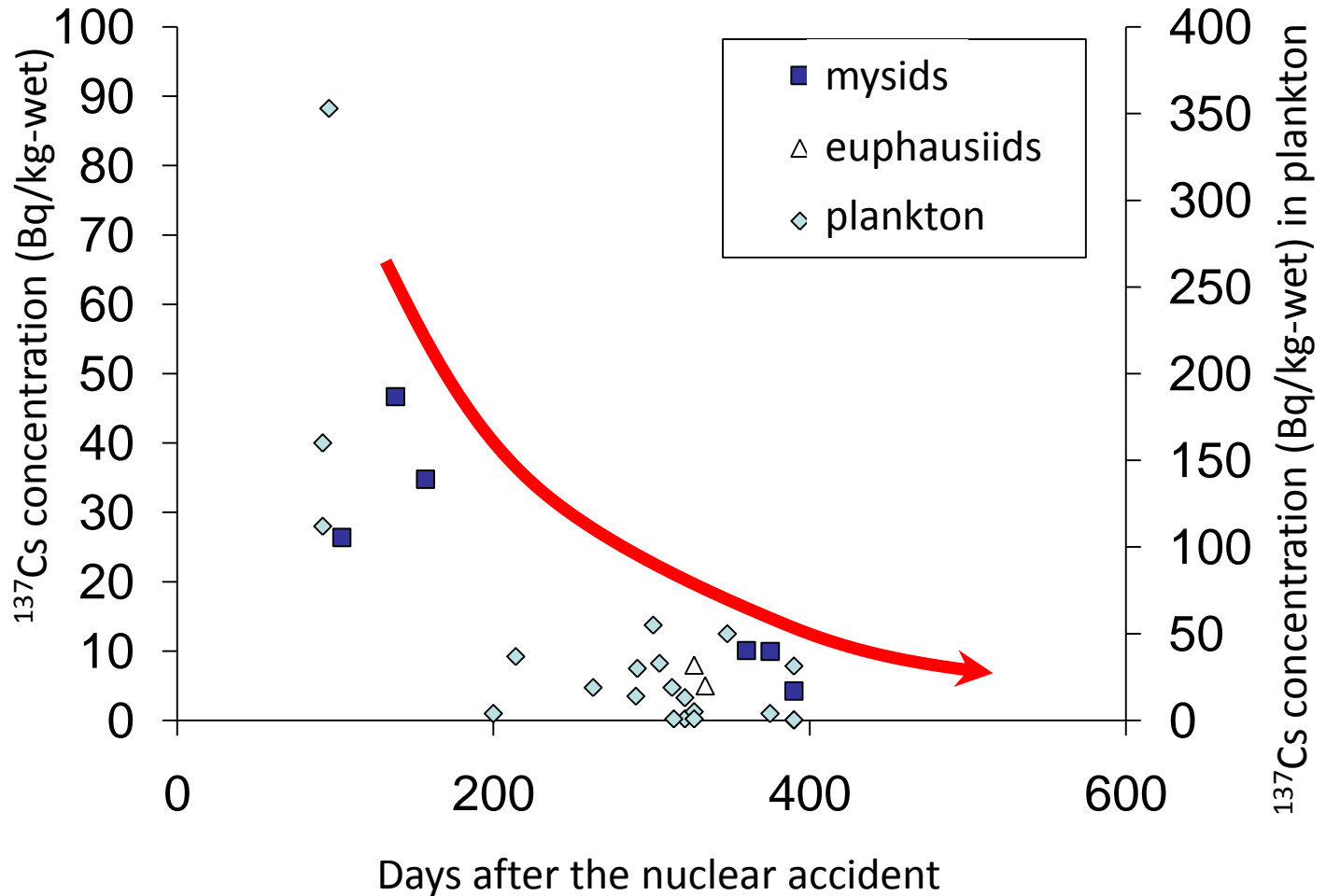
High ^{137}Cs concentrations have gradually decreased over time.

^{137}Cs concentration in prey organisms-2 (plankton, mysids, and euphausiids)



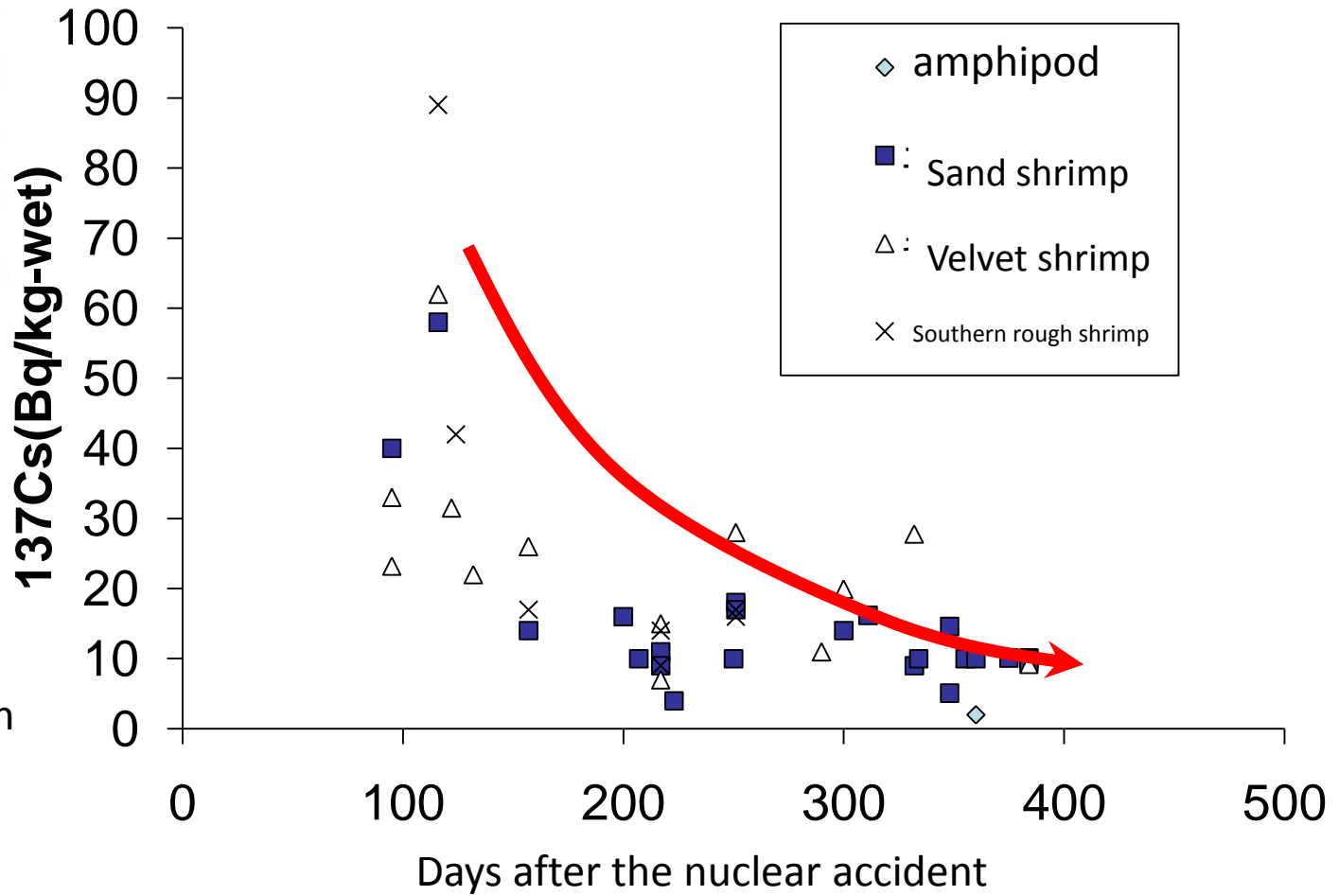
Mysids: e.g., juvenile Japanese flounder, black rockfish

Euphausiids: e.g., green eye, Pacific cod



^{137}Cs concentrations have decreased over time, and fluctuated within low level (around 10 Bq/kg in mysids).

^{137}Cs concentration in prey organisms-3 (gammarids and shrimps)



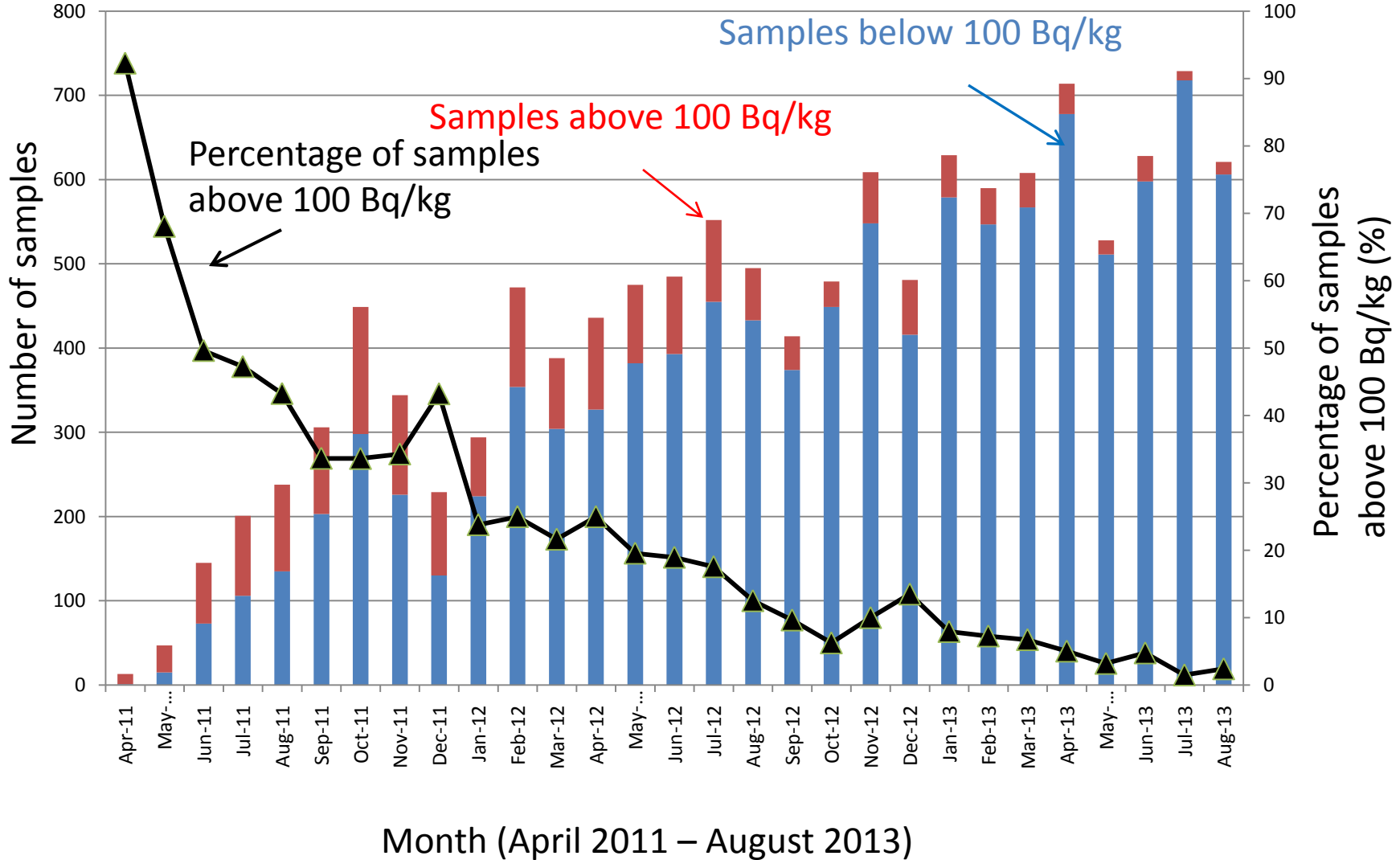
e.g., searobins, common skate

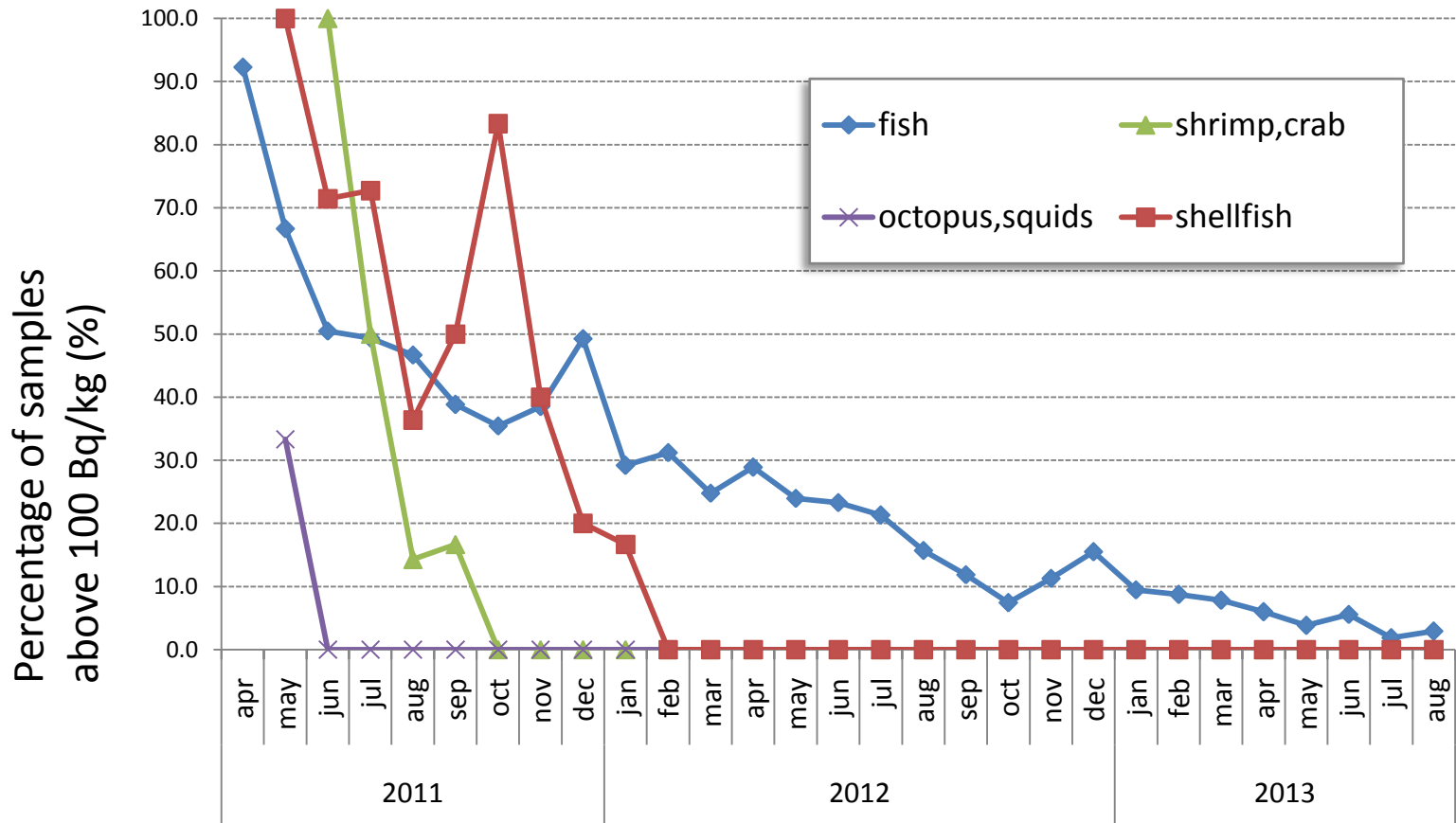
^{137}Cs concentrations have decreased over time, and fluctuated within low level (10–20 Bq/kg).

Quick decrease of radioactive Cs concentration in seawater
Gradual decrease of radioactive Cs concentration in prey organisms



Decrease of radioactive Cs concentration
In fish species





Samples above 100 Bq/kg have not been found in octopus, squids, shellfish, and shrimp after one year after the accident. Fish of some kinds have still exceeded 100 Bq/kg.

Representative species showing quick decrease of radioactive Cs concentration

Non fish species



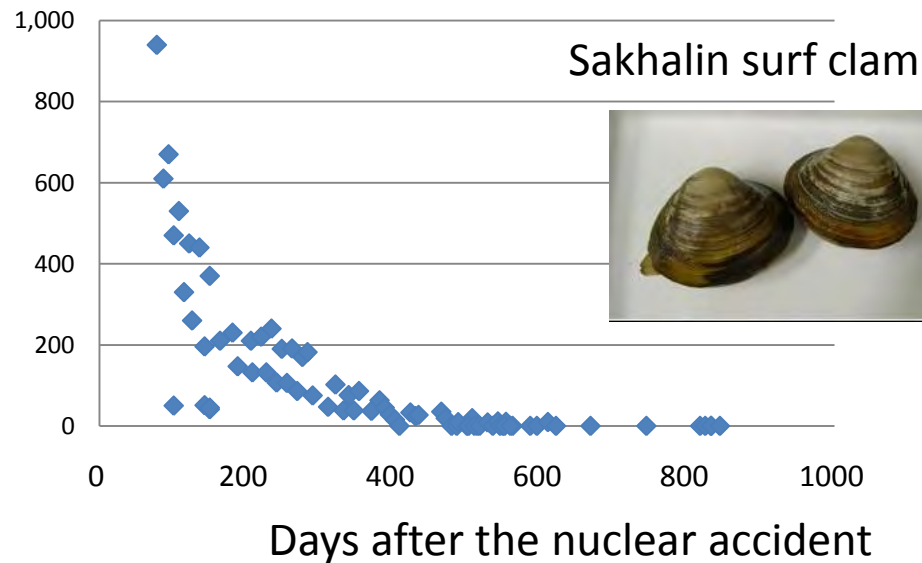
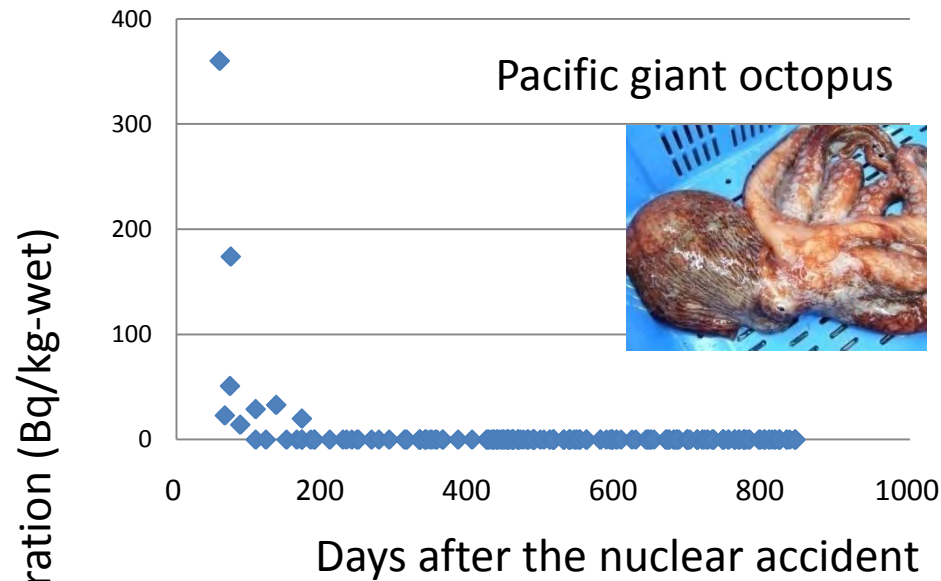
Cuttlefishes and squids

Shrimps and crabs



Welks and bivalves

Sea cucumbers



Two representative species showing quick decrease of radioactive Cs concentration

Representative fish species showing quick decrease of radioactive Cs concentration



Larval anchovy



Larval sand lance

Lower trophic level
+ alteration of generations



Skipjack tuna



Pacific saury

Migratory fish



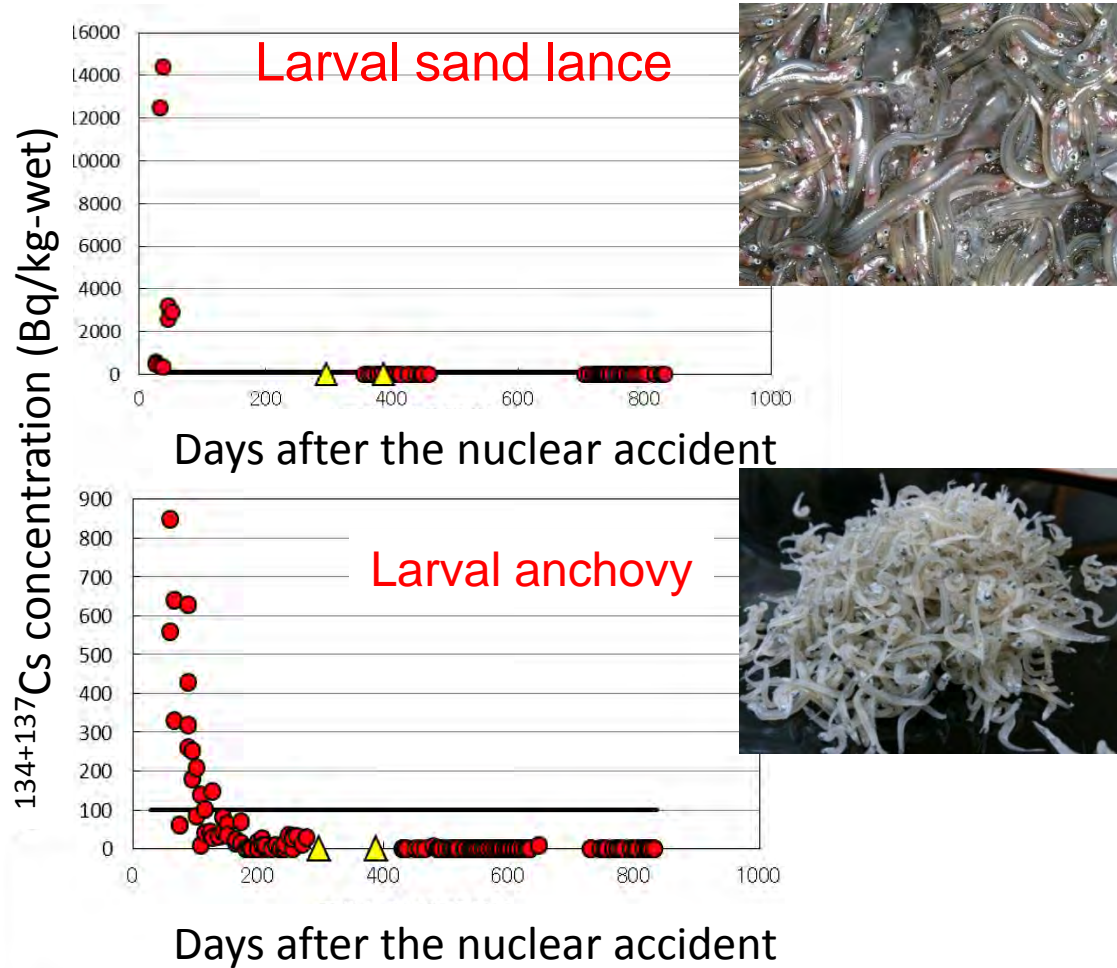
broadbanded thornyhead

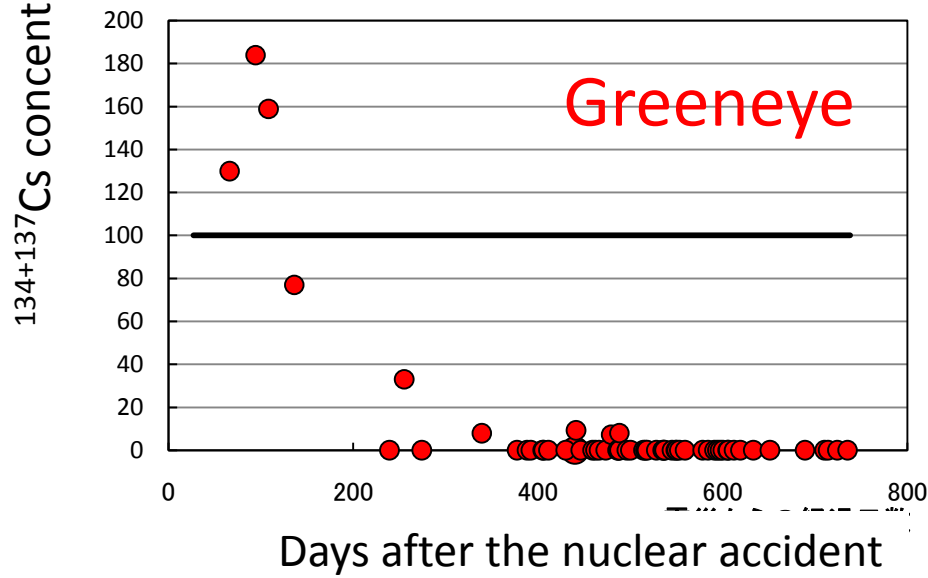
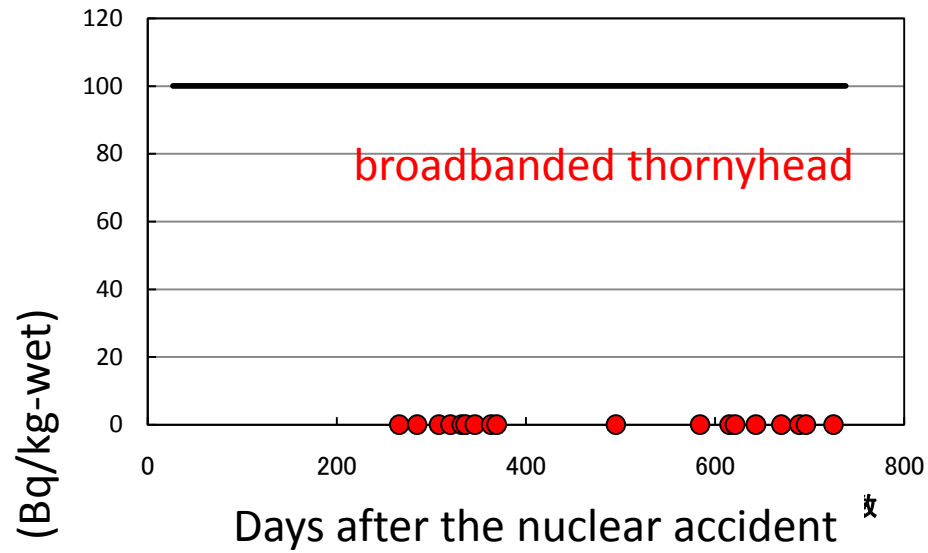


Greeneye

Deeper dwelling fish

Two representative fish species showing quick decrease of radioactive Cs concentration





Representative fish species showing high concentrations of radioactive Cs occasionally

Mainly demersal fish species with high site fidelity



Coastal rockfishes



Coastal flatfishes



Japanese flounder



Japanese temperate bass



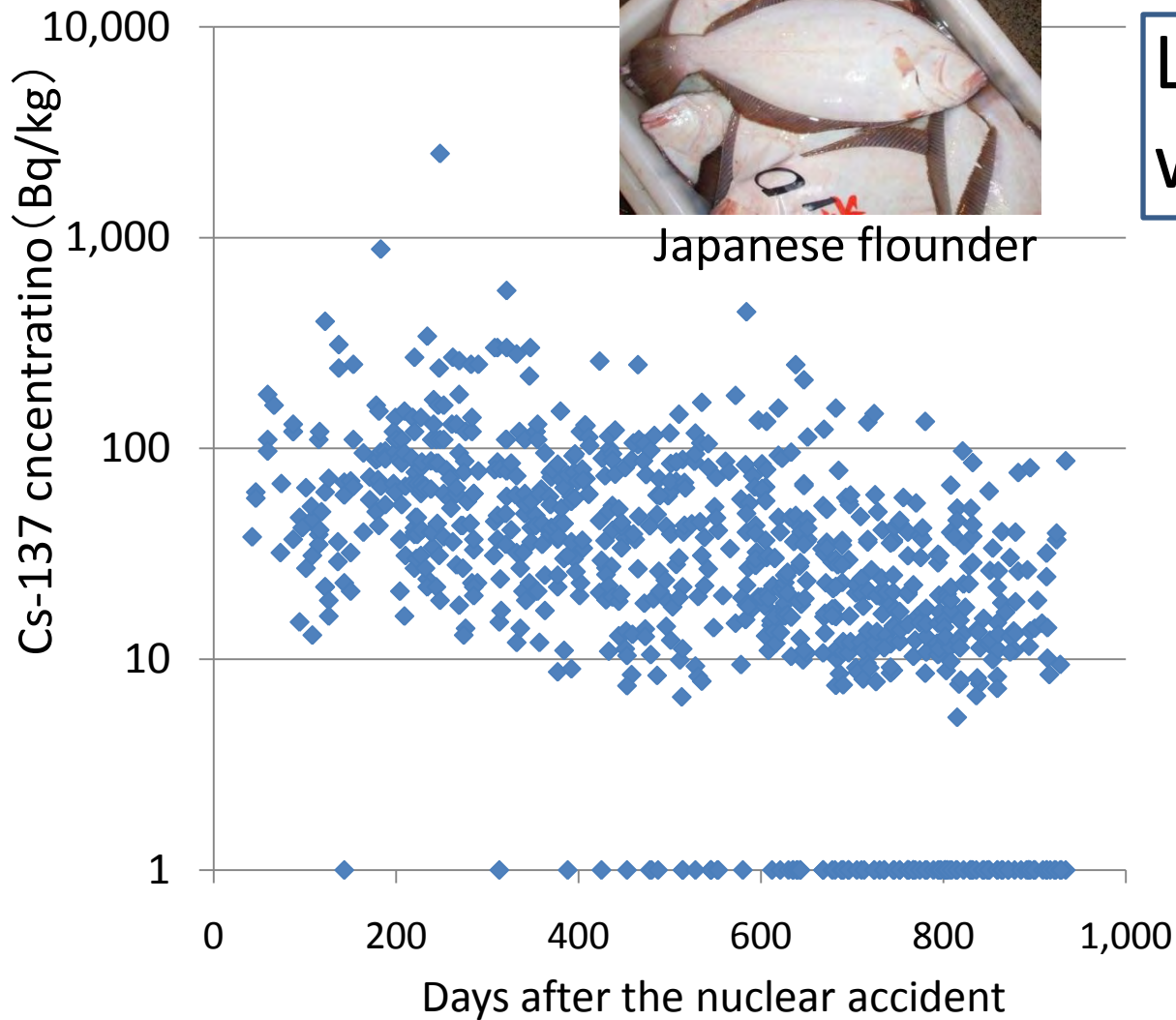
Fat greenling



Common skate



Japanese flounder



Large differences within individuals

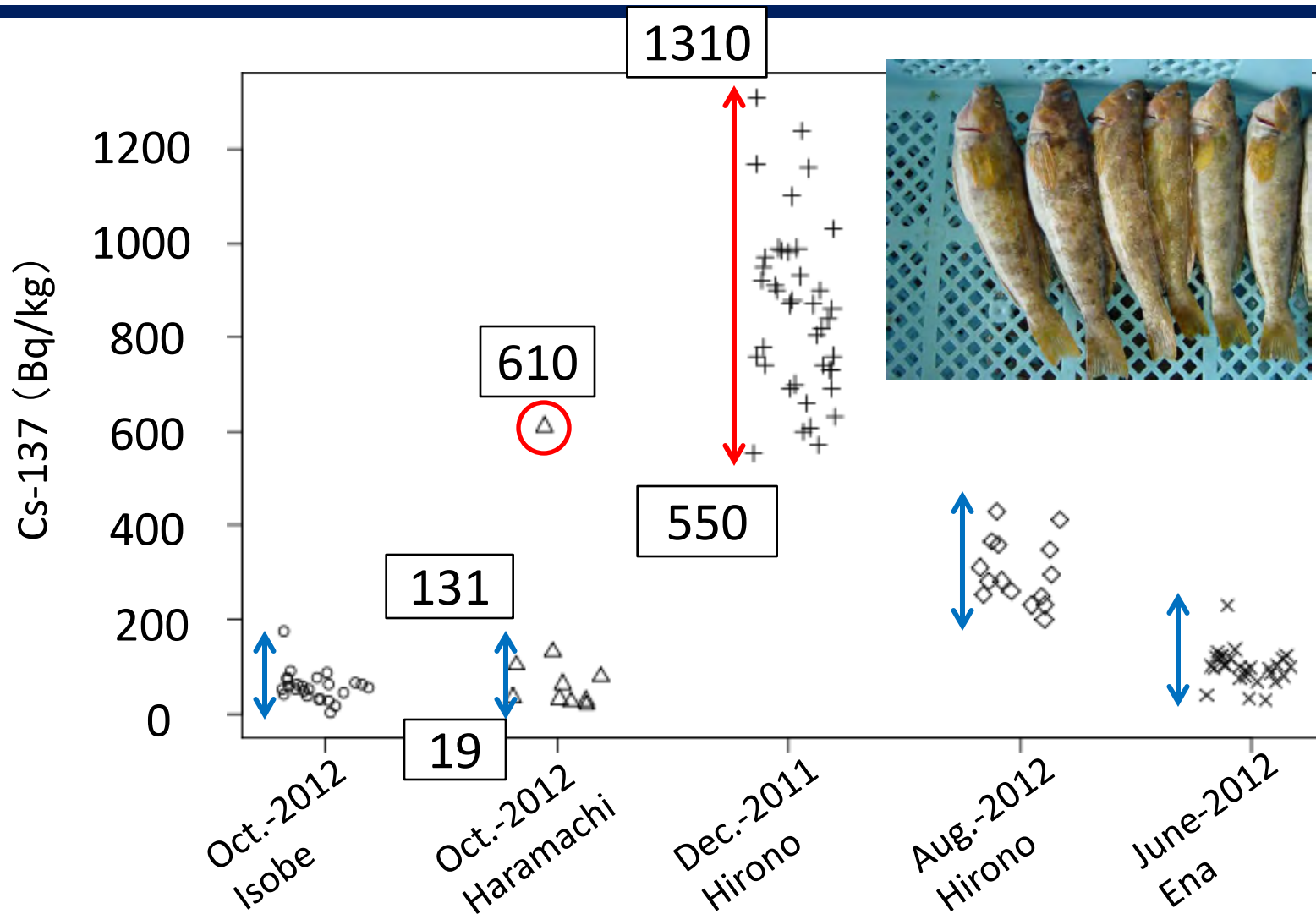


Differences in experienced habitats, age, and size



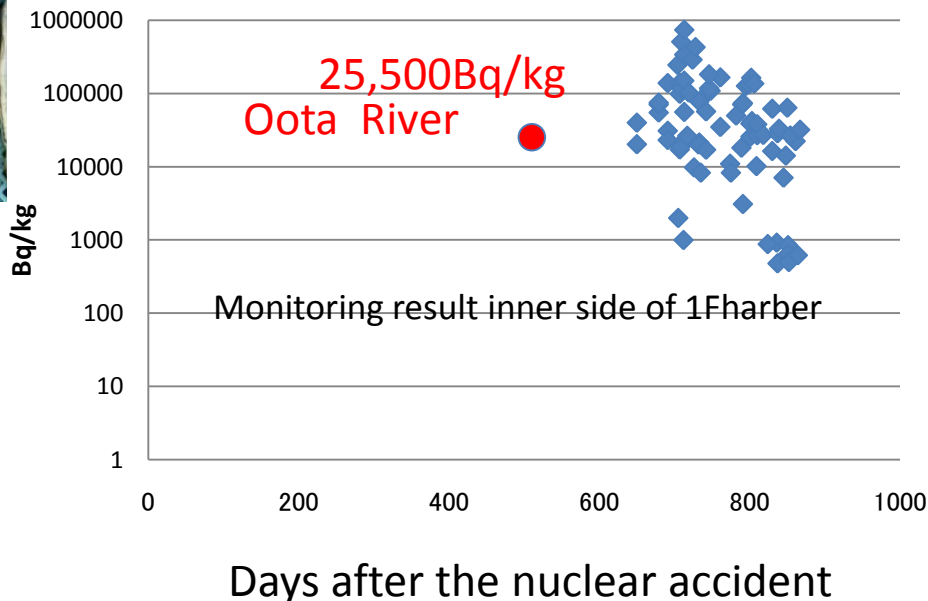
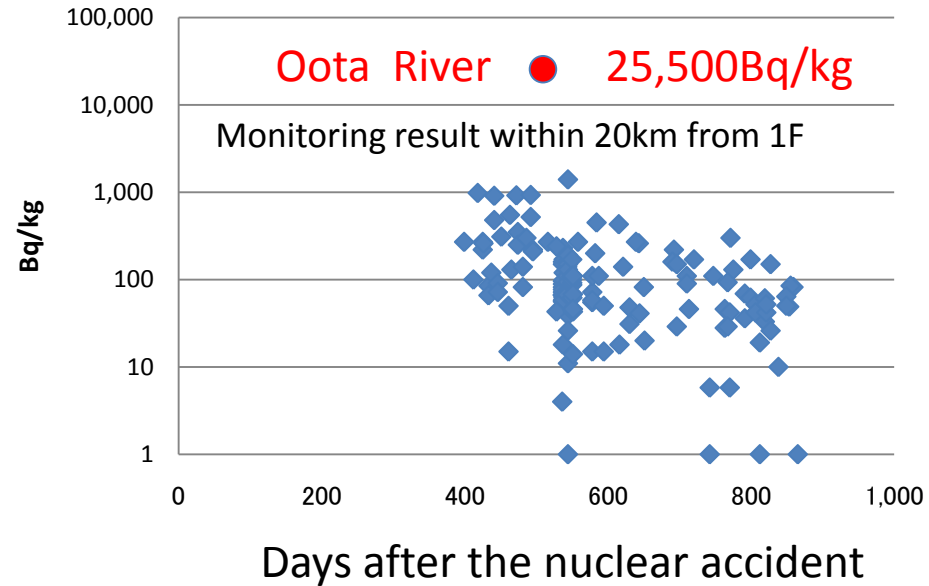
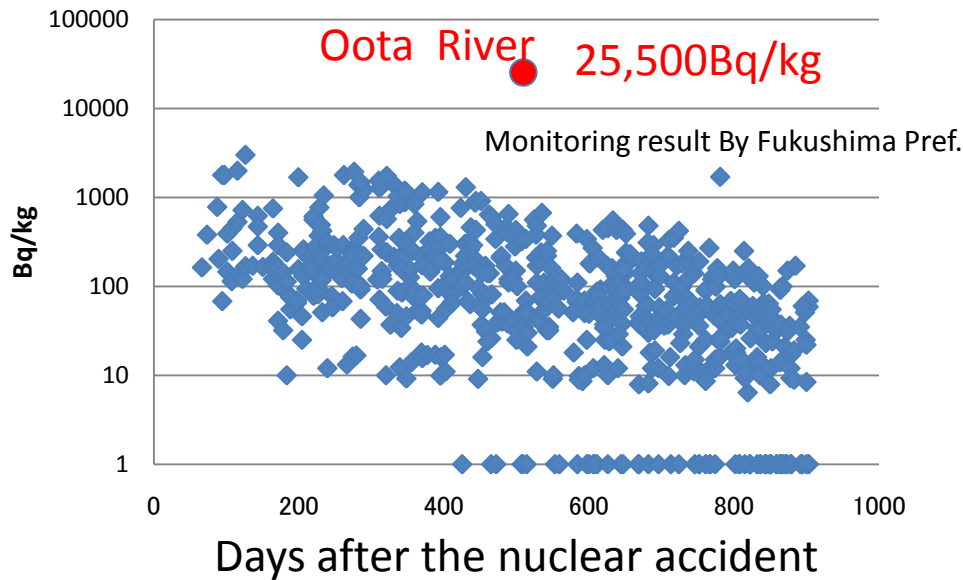
Species specific characteristics

Differences in Cs concentration for each individual collected in the same location (Fat greenling)



Outliers shown within the same location suggests migration of contaminated fish from different habitat.

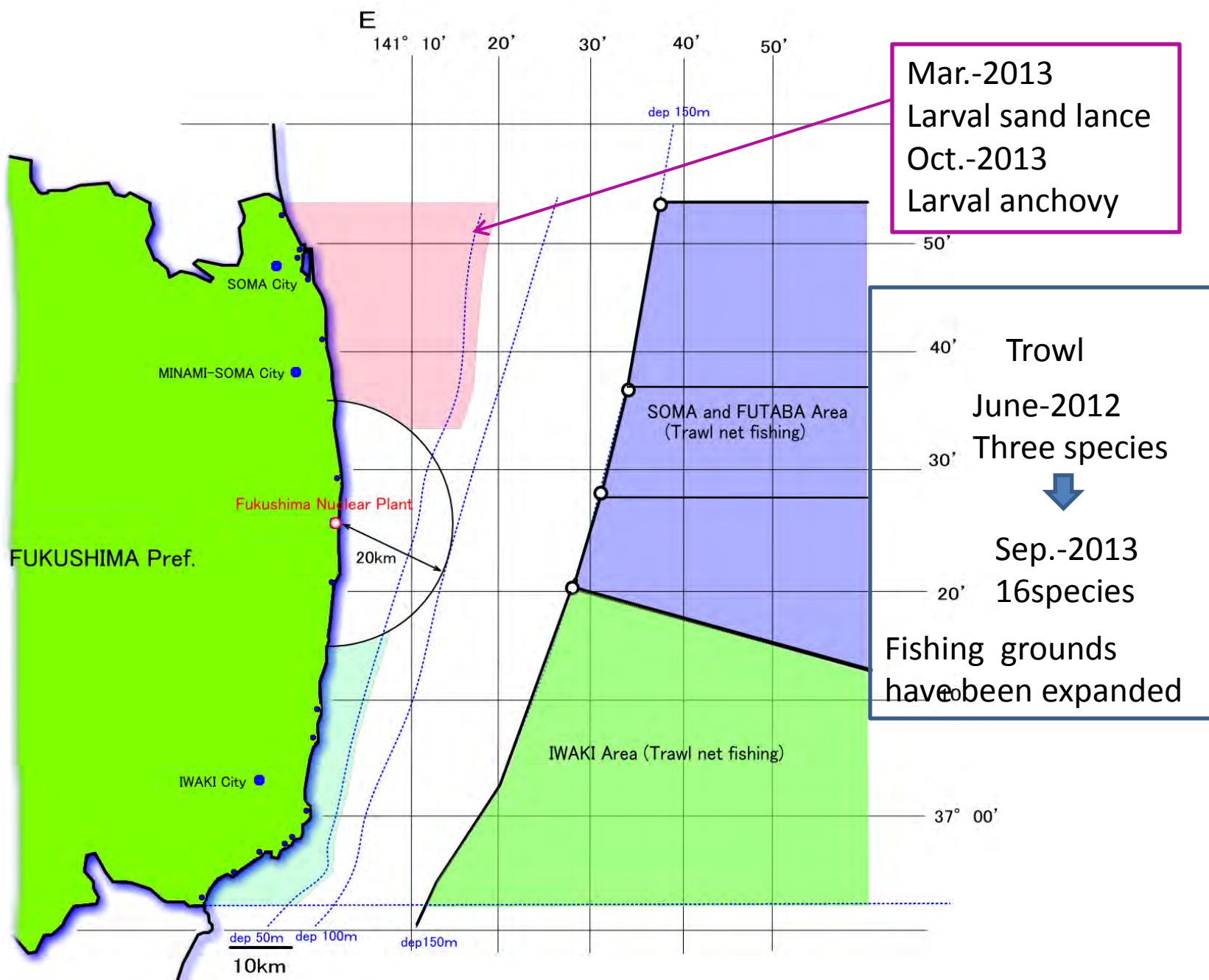
Examples of outliers suggesting inter-habitat migration



Extremely contaminated greenling collected from Ohta River on 2 August 2012

Migratory individuals from the port of 1F

Urgent task



Areas for trial fishing operations

Future subjects

Prevention of harmful rumors



Lifting a ban on shipment for about 40 species which had exceeded the Japanese standard limit



Restart of full-scale fishing operations