Tsunami disaster and nuclear power plant accident effects on fishery facilities and marine products in Fukushima Prefecture: Present conditions and prospects

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The waters off Fukushima, where the warm Kuroshio current meets the cold Oyashio current, are fertile fishing grounds for various fishing methods such as trawl, boat seine, purse seine, and stick-held dip net.
Before the tsunami accident

Sales in 2010 (11 billion yen)

- Trawl
- Boat seine
- Purse seine
- Gill net
- Stick-held dip net
- Others

Trawl and gillnet are the most important fisheries in coastal waters off Fukushima.

Wada et al. (2012) Aquaculture
Before the tsunami accident

Miyagi

Fukushima Prefecture

Fukushima Prefectural Fisheries Experimental Station (FFS)

Soma Branch of FFS

Fukushima Daiichi Nuclear Power Plant

RV Iwaki-maru (159t) RV Takusui (30t)
Before the tsunami accident

Fukushima Prefecture

Fukushima Daiichi Nuclear Power Plant

Released flounder landed on the market

Community-based stock enhancement of Japanese flounder (Tomiyama et al. (2008) Rev Fish Sci)
Drastic alterations after the tsunami and nuclear power plant disasters

**Objective**

- Effects of the tsunami disaster on fishery facilities in Fukushima
- Effects of the released radioactive substances on fishery products
- Recent and future attempts of FFS
- Present status and future prospects
➢ Tsunami damages on fishery facilities

- Parts of all 10 fishing ports and fish markets were destroyed.
- The damages caused by the tsunami disaster amounted to 6.7 billion yen, accounting for 68% of the total damages (99 billion yen)
In all, 873 fishing vessels, accounting for 74% of all registered vessels, were fully or partly damaged. Particularly, large fishing vessels necessary to conduct offshore trawl or purse seine fishing, that were unable to evacuate from the ports, were damaged.
➢ Tsunami damages on prefectural fisheries facilities

Soma Branch of FFS

RV Iwaki-maru (159t)

Fukushima Prefecture Fish Farming Station
Effects of the released radioactive materials on fishery products

- A huge amount of radioactive substances were released to the air and the ocean.
- The total amount of radioactive contaminants that entered the ocean was unknown.
- After the leaking of highly contaminated water from a cracked sidewall of the plant, analyses of seawater sampled near the plant yielded readings of 130,000 Bq/l of I-131, 32,000 Bq/l of cesium-137, and 31,000 Bq/l of cesium-134.
- The largest anthropogenic release ever of radioactive substances in the oceans.

Severe concerns arose for fishery products
Monitoring of fishery products (see details in a poster session presented by Nemoto et al.)

Since April 2011, FFS has fundamentally inspected about 120 specimens/week, sampled by fishing vessels or our research vessels.

These samples were gauged at the Fukushima Agricultural Technology Centre.

Results were officially announced by the Japanese government, and by the Fukushima prefectural government quickly.

As of September 2012, 5,988 specimens of 170 species have been inspected.
Comprehensive results of monitoring

1 April 2012

170 marine species
5,988 specimens

As of September 2012

Bq/kg

I-131

Cs-134+137

Tentative regulation limit

Legal limit

Days after the nuclear accident

1 April 2012

14,400
12,500

12,500
14,400

170 marine species
5,988 specimens

- The nuclear accident has posed severe negative effects on fishery products in Fukushima.
- Only 3 specimens exceeded the tentative regulation limit of I-131 with a short half-life.
- 258 specimens of 27 species exceeded the tentative regulation limit of Cs-134+137.
- 778 specimens of 41 species exceeded the legal limit of Cs enforced in April 2012.
- Cs-137, with a longer half-life of 30 years, is expected to pose the most severe concerns.
List of 40 species of which the Japanese government has banned shipments
Representative species that showed a clear declining tendency of radioactive cesium (134+137)

- Anchovy larvae
- Sakhalin surf clam
- Arame seaweed
- Ezo abalone

• Some species showed a clear declining tendency of radioactive cesium.
• These species were presumably contaminated mainly by the highly contaminated seawater that flowed around the coastal waters immediately after the nuclear accident.
Some species did not show the clear declining tendency of radioactive cesium, irrespective of the shorter half-life of cesium-134, which consisted the half of the total radioactive cesium immediately after the nuclear accidents.

A plausible possibility is that radioactive cesium can move up the food chain.
The biological half-life of radioactive cesium in muscles of black rockfish is estimated as 87 days, indicating that the concentration at the present time should be decreased to 1% of the initial value after exposure. However, the concentration of the rockfish sampled from field has not shown a clear declining tendency, which strongly demonstrates that radioactive cesium has been bioaccumulated through the food web.
Recent and future attempts of FFS

Cooperative organizations

FFS

Field surveys

Rearing experiments

- Clarification of intake/discharge mechanisms for radioactive substances to predict or simulate the declining time span, which will be helpful to restart the coastal fishery, and to safeguard the safety of consumers.
Present status and prospects

- Since June 2012, fishery vessels in Soma, 50 km north from the nuclear plant, restarted fishing on a trial basis, and caught two types of octopus and a whelk, selected because not even trace amount of radioactive cesium have been detected recently.
Present status and prospects

June 2012

September 2012

- Octopuses and whelks were sold at supermarkets in Fukushima, and quickly sold out.
- After September, Hair crab and Japanese common squid were added to the targets.
Present status and prospects

The Tokyo Electric Power Company announced that Greenlings caught within 20 km of the nuclear power plant on 1 August showed a record-high 25,800 Bq/kg, indicating that radioactive contamination around the area remains severe.

We will continue to struggle with these difficult situations in the hope that Fukushima’s Fishery will certainly revive someday as long as the fertile fishing grounds off Fukushima exist.

Satoshi Igarashi, Director-General of FFS
Photograph of Soma fish market in 2007

Thank you for your attention