

Horizontal distribution of Fukushima-derived radiocesium in zooplankton in the north-western Pacific Ocean

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The magnitude of the 9.0 Tohoku earthquake and the ensuing tsunami on March 11, 2011, inflicted heavy damage on the Fukushima Dai-ichi nuclear power plant (FDNPP). Fission products were emitted, falling over a broad range in the northern hemisphere, and water contaminated with radionuclides leaked into the ocean. In this study, we described the horizontal distribution of the Fukushima-derived radiocesium in zooplankton and in surface seawater in the western North Pacific Ocean (500-2100 km from the FDNPP) 10 months after the accident. ¹³⁴Cs and ¹³⁷Cs were detected in all zooplankton and seawater samples. Because of its short half-lives, ¹³⁴Cs detected in our samples could only be derived from the FDNPP accident. The radiocesium concentrations in zooplankton were high at around 25N while those in surface seawater were high at around the transition area between the Kuroshio and the Oyashio Currents (36-40N). We analyzed the structure of the zooplankton communities but could not find out evidence which biological factors (taxa composition and relative biomass of carnivores) influenced ¹³⁷Cs concentration in bulk zooplankton. Zooplankton communities contaminated with the Fukushima-derived radiocesium included many kinds of diel vertical migratory species. These migrants were exposed to higher concentrations of radiocesium while feeding at night in the ocean surface; however, exposure to contamination was lower as these species swam in the deeper mesopelagic layer during the day. In the subtropical region, 20-60% of krill and 3-36% of copepods on abundance basis were diel vertical migrants. On the other hand, 80-100% of krill and 77-88% of copepods were the migrants in the transition and the subarctic regions. Accumulated radiocesium in the migrant bodies are transported and may be taken into the mesopelagic food web.

Keywords: North Pacific ocean, zooplankton, FDNPP accident, ¹³⁴Cs, ¹³⁷Cs