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TITLE: Vertical distribution of 129I released from the Fukushima Daiichi Nuclear Power Plant in the Kuroshio and Oyashio current areas

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ABSTRACT:

The Fukushima Daiichi Nuclear Power Plant (FDNPP) accident occurred in March 2011, resulting in the release of significant amounts of radionuclides. Considering the impact of these radionuclides on fisheries, it is important to understand the fate of radionuclides released from FDNPP in both the surface layer and deep layers. Many studies have focused on the level of radionuclides in surface seawater. In this study, we investigated the vertical distributions of radionuclides in seawater between the Kuroshio and Oyashio current areas from the surface layer to the deep layer using 129I. We found that the 129I released from FDNPP penetrated to depths of 370?470, 0?150, and 0?100 m in the Kuroshio current area, transition area, and Oyashio current area, respectively. The FDNPP-derived 129I was observed in the surface mixing layer of the Oyashio current and transition areas and in the intermediate layer of the Kuroshio current area. In the surface mixing layer of the Oyashio current and transition areas, the FDNPP-derived 129I/134Cs ratios were higher than the ratio in the FDNPP reactor and that measured in a previous study. In the intermediate layer of the Kuroshio current area, an 129I-rich layer was formed at depths of 370?470 m. The high FDNPP-derived 129I/134Cs ratio suggests three potential mechanisms for the migration of radionuclides in the environment: (1) the released radioiodine/radiocesium ratio was higher than those in FDNPP; (2) 129I was supplied from the atmosphere by re-emitted 129I from contaminated areas around Fukushima; and (3) leaked water that removed radiocesium reached the sampling stations. The seawater containing the 129I-rich layer would be transported from the surface seawater in the transition area, moving southward and downward along the isopycnal via the strong descending flow created by the meander of the Kuroshio Extension current. The results of this study are useful for understanding the movement of radionuclides released from FDNPP and for investigating local mesoscale seawater mixing in the transition area in oceanographic studies.

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