Transfer of Radiostrontium from Seawater to Marine Organisms

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Abstract

In the safety review of the commercial spent nuclear fuel reprocessing plant in Rokkasho, a certain amount of radiostrontium is assumed to be discharged into the Pacific Ocean. In order to assess realistic impact of radiostrontium discharged to the public, it is important to understand the processes of transfer and accumulation of radiostrontium from seawater to marine organisms. In this research, the transfer rates of radiostrontium in seawater to olive flounder (*Paralichthys olivaceus*) are studied by using stable ^{86}Sr tracer instead of radiostrontium. Since transfer through the food chain to the olive flounder is an important route of radiostrontium, the route is also included in the scope of this study.

In FY 2015, we tried to select an organism used as bait for catching olive flounder to investigate transfer of radiostrontium through the food chain. Whiteleg shrimp (*Litopenaeus vannamei*), ragworm (*Perinereis aibuhitensis*) and Japanese rice fish (*Oryzias latipes*) were kept in ^{86}Sr enriched seawater, followed by analysis of samples collected at pre-determined intervals for ^{86}Sr/^{87}Sr ratio with a double sector mass spectrometer. The ^{86}Sr/^{87}Sr ratios of whiteleg shrimp and ragworm reached equilibrium with seawater in two weeks and <4 d after starting the exposure, respectively. The Japanese rice fish were kept in ^{86}Sr enriched fresh water or brackish water for approximately 3 months after starting the exposure. The ^{86}Sr/^{87}Sr ratio of Japanese rice fish did not reach equilibrium at the end of exposure in both fresh water and brackish water. Concentration of Sr is another important factor for the study of food chain simulation. Strontium concentration in the body of whiteleg shrimp was higher than that in ragworm and Japanese rice fish. As living bait, the Japanese rice fish was the best for the olive flounder, while the other two organisms were hard to feed. Further study is necessary to decide the bait organism for the olive flounder.

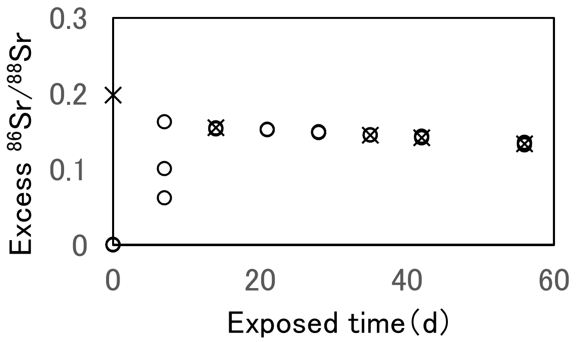

Fig. 1 $^{86}Sr/^{88}Sr$ ratio in whiteleg shrimp and in seawater exposed to seawater enriched with ^{86}Sr. ○, whiteleg shrimp; ×, seawater.Background $^{86}Sr/^{88}Sr$ ratio was subtracted.

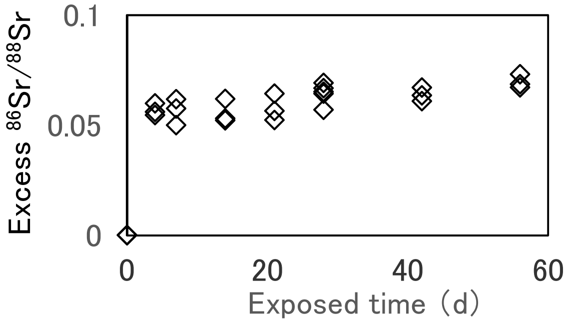

Fig. 2 $^{86}Sr/^{88}Sr$ ratio in ragworm exposed to seawater enriched with ^{86}Sr. Initial excess $^{86}Sr/^{88}Sr$ ratio in seawater was 0.087.Background $^{86}Sr/^{88}Sr$ ratio was subtracted.

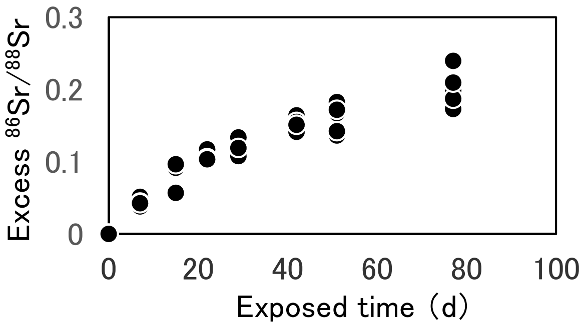

Fig. 3 $^{86}Sr/^{88}Sr$ ratio in Japanese rice fish exposed to brackish water enriched with ^{86}Sr. Initial and final excess $^{86}Sr/^{88}Sr$ ratios of brackish water were 0.3871 and 0.3661, respectively. Background $^{86}Sr/^{88}Sr$ ratio was subtracted.

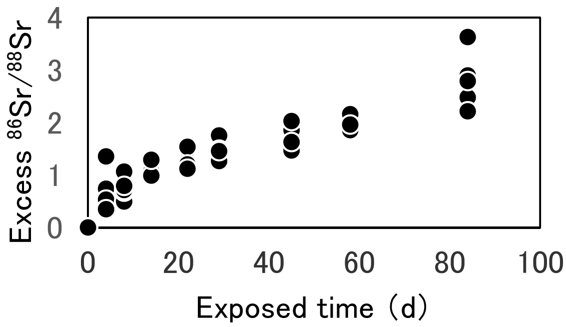

Fig. 4 $^{86}Sr/^{88}Sr$ ratio in Japanese rice fish exposed to fresh water enriched with ^{86}Sr. Initial and final excess $^{86}Sr/^{88}Sr$ ratios of fresh water were 12.11 and 0.27, respectively. Background $^{86}Sr/^{88}Sr$ ratio was subtracted.