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 addition, radioiodine was discharged to the ocean during the final test of the plant using actual spent fuel in 2006-2008. In order to assess the realistic impact of those radionuclides to the public, it is important to understand the processes of their accumulation from seawater to marine organisms. In this research, the transfer rate of radiostrontium in seawater to olive flounder (*Paralichthys olivaceus* Temminct et Schlegal) has been studied by using stable ^{86}Sr tracer instead of radiostrontium from FY2016, while from FY 2018, it is planned to measure the transfer rate of radioiodine.

In FY 2016, we started exposure of one olive flounder group, 284 d after hatching, to ^{86}Sr-enriched seawater with $^{86}Sr/^{88}Sr$ ratios of 0.1495; we kept the fish at 15°C, giving then commercial olive flounder feed (EP-4). The accumulation of ^{86}Sr in their muscle and bone was measured by using samples collected sequentially up to 112 d after the start of the exposure. We plan to continue the exposure for up to ~600 d. A multi-compartment model for metabolism of Sr in olive flounder was tentatively constructed by using measured results. In the model, Sr in seawater directly entered into muscle and bone compartments with a transfer path from bone to muscle. Although the parameters in the model were calculated by a least square fitting method, the excretion rate constant from the bone compartment could not be obtained because of its slow excretion rate. Therefore, the present model did not take into account Sr excretion from bone; however, the model well simulated the measured data during the exposure period.

We also started to expose a second olive flounder group, which will be used from FY 2018 for measuring excretion rate of ^{86}Sr from the fish body, to ^{86}Sr-enriched seawater.

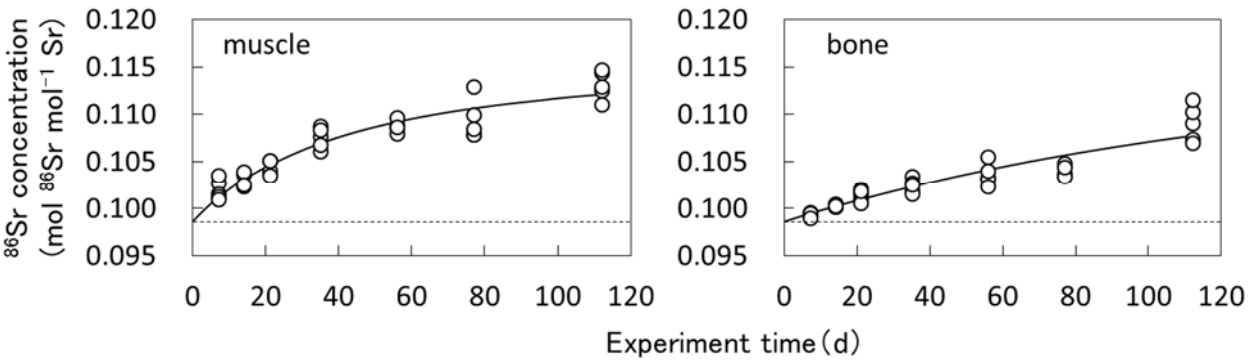

Fig. 1 Time dependency of ^{86}Sr concentration in the muscle and bone of olive flounder (*Paralichthys olivaceus* Temminct et Schlegal) during ^{86}Sr seawater exposure. Open circles show measured values and the solid line shows values estimated by the metabolism model. The dotted line is the background ^{86}Sr concentration in seawater.

Table 1 Parameters of ^{86}Sr metabolism model in olive flounder.

Parameter	Unit	Value	Confidence interval of 95%
α		0.24	0.17 - 0.30
k_1	d^{-1}	0.036	0.019 - 0.057
k_2	d^{-1}	0.0018	0.0008 - 0.0029
k_3	d^{-1}	0	

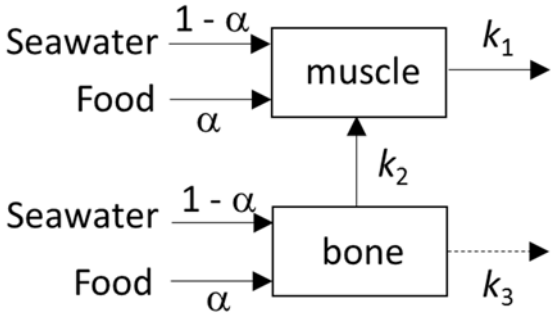

Fig. 2 Scheme of ^{86}Sr metabolism model in olive flounder.