

## Abstract

**Thesis title: Biomagnification process of total mercury in the aquatic ecosystem of an enclosed Isahaya Bay, Kyushu, western Japan**

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The studied of biomagnification process of total mercury (THg) in the coastal benthic ecosystem in Isahaya Bay, Kyushu, western Japan, where a part of mercury, was discharged by the volcanic activities of Mt. Unzen, which is being taken up by the primary producers (phytoplankton, cyanobacteria, benthic diatoms). Through environmental surveys and samplings of macro-benthic animals and fishes, the sediment contained  $133 \pm 23$  ng/g d.w. (mean  $\pm$  S.D.) of THg, which was about 4.9 times higher than that of particulate organic matter (POM) suspended in the overlying water on the sediment. This indicated that the sediment acted as if it was a concentrator of mercury, since the mercury was supplied continuously on the sediment by the deposition of POM. The biomagnification of THg tended to be accelerated significantly among the primary consumers of the macro-benthic communities that relied on the sediment for diets and/or habitats, which is referred to as “High THg content group”, and the secondary consumers that favored to prey on the primary consumers of “High total mercury content group” in the detritus food chain on the sea floor.

Among the fishes and mega-benthos such as cuttlefish, mantis shrimp, octopus, it was not able to recognize any significant relationship between the trophic position and THg content of the body tissues. The two species of the tertiary consumers of fish, *Lateolabrax japonicus* (Japanese seabass) and *Paralichthys olivaceus* (bastard halibut), contained  $266 \pm 99$  ng/g d.w. (mean  $\pm$  S.D.,  $n = 5$ ) and  $249$  ng/g d.w. ( $n = 1$ ) of THg, while the THg contents of the six species of fishes of the secondary consumers or the intermediate consumers between the secondary and tertiary ones exceeded those of the tertiary consumers of fish. In particular, extremely high contents of THg were detected from *Hemitrygon akajei* (red stingray) (extra-large size class (72.0 cm, 5,150 g);  $3,700$  ng/g d.w., large size class ( $63.3 \pm 4.9$  cm,  $1,847 \pm 145$  g,  $n = 4$ );  $671 \pm 340$  ng/g d.w.), and *Acanthopagrus schlegelii* (blackhead seabream) ( $942$  ng/g d.w.). The six species of fishes have a common feeding habit that favor benthic animals for diets, including

bivalves, polychaetes, crabs, shrimps etc., and are referred to as “bentho-pelagic species”. Some of these benthic animals contain high levels of mercury, which are referred to as “High THg content group”, in both of the primary consumers and secondary ones. The extremely high contents of THg detected from the benthopelagic fishes seemed to be transferred from the sediment deposited on the sea floor via the detritus food chain of the benthic community and preferential predation of the benthic animals by the fishes.

**Keyword:** biomagnification, mercury, detritus food chain, macro-benthic animals, fish, mega-benthos, Isahaya Bay