Declining mercury concentrations in Atlantic bluefin tuna

CHENG-SHIUAN LEE[1], NICHOLAS S. FISHER[1], DANIEL J. MADIGAN[2], AND ROBERT M. CERRATO[1]

[1]School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY 11794-5000 USA; nicholas.fisher@stonybrook.edu

[2] Harvard University Center for the Environment, Harvard University, Cambridge, MA 02138 USA

Tunas are apex predators in marine food webs that accumulate mercury (Hg) to higher concentrations than most other fish. High human consumption and moderate to high species-dependent Hg concentrations cause tunas to provide more Hg (~40%) to the U.S. population than any other source. Reduced Hg emissions in North America in recent years have decreased Hg concentrations in North Atlantic waters and investigating whether changes propagate up to top predators is a key to evaluating the benefits of emission reduction efforts. To investigate recent temporal Hg trends in the largest and longest-lived tuna species, we measured total Hg concentrations in 1,292 Atlantic bluefin tuna (ABFT, *Thunnus thynnus*) captured in the Northwest Atlantic from 2004 to 2012. Mean Hg concentrations in ABFT muscle tissue were 0.76 ± 0.33 ppm; concentrations increased nonlinearly with length, weight, and estimated age, ranging from 0.25 ppm in fish <100 cm in length to 3.15 ppm in fish >250 cm (14-15 years old). No significant differences in Hg concentrations were noted between male and female ABFT. The tissue Hg concentrations exceeded the US EPA guideline (0.3 ppm) for human consumption in 99% of all the fish sampled, and exceeded the US FDA limit (1.0 ppm) in 16% of the fish (primarily the largest fish). For six size classes of ABFT corresponding to 9-14 year old fish, the Hg concentrations declined significantly over time of capture, at a rate of 0.018 ± 0.003 ppm per year or around 2% per year. The decline rate of 19% over an 8-year period from the 1990s to the early 2000s paralleled comparable declines in anthropogenic Hg emission rates in N. America, N. Atlantic atmospheric Hg^0 concentrations, and N. Atlantic seawater concentrations during this period. Because of their pronounced migratory behavior, Hg concentrations in ABFT are presumed to reflect ocean basin-wide exposures (through forage fish) rather than local exposures at one particular location. It thus appears that reductions in atmospheric Hg loading have rapidly propagated up marine food webs to a commercially important species, suggesting that emission reduction efforts have resulted in lower Hg concentrations in large, long-lived fish.