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Stable Isotope Evidence of Mercury Transfer from Prey to Pacific Bluefin Tuna

CHUN-MAO TSENG

Institute of Oceanography, National Taiwan University

Mercury accumulation in marine predators is shaped by the interaction of environmental methylmercury supply, food-web structure, and species life history. We assessed total mercury (THg) in Pacific Bluefin Tuna (Thunnus orientalis, PBFT) across the North Pacific by integrating morphometrics, stable isotopes ($\delta^{13}C$, $\delta^{15}N$), prey characteristics, and seawater MeHg concentrations. Low-trophic, fast-growing forage species exhibited low THg, whereas interspecific variability reflected habitat use and intrinsic biological traits. In PBFT, THg increased with body size and paralleled isotopic evidence of ontogenetic dietary shifts, consistent with trophic magnification. Isotopic patterns further indicated basin-scale foraging segregation, linking western individuals to the Kuroshio and eastern individuals to the California Current. Elevated MeHg concentrations in the western basin corresponded to higher Hg accumulation rates. Overall, these findings show that spatial differences in MeHg availability and regional foraging ecology jointly govern mercury burdens in this highly migratory apex predator.