Trophic Transfer of Mercury in Intertidal Food Webs

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Mount Desert Island (MDI) is an important location to study Hg bioaccumulation in aquatic food webs because Hg deposition in Northeastern coastal areas is known to be elevated, Hg levels in aquatic biota on MDI are exceptionally high, and intertidal areas are important sites of Hg methylation[1,2]. The objective of this research was to examine the bioaccumulation and trophic transfer of Hg in resident and transient benthic, epibenthic, and nektonic species inhabiting the intertidal and subtidal portions of estuaries. The food webs of several sites on MDI including Northeast Creek, Salisbury Cove, Seal Cove, and Somes Sound were sampled in the summers of 2003-4 as part of a larger survey of sites in the Gulf of Maine including Great Bay NH.

We collected biotic samples of resident intertidal and transient subtidal nekton species for Hg analysis at each site. Zooplankton and particulate samples were taken in deeper water near the intertidal sites. Samples from each site were collected using minnow traps, Ponar dredge, pitfall traps, and fyke nets and were handled using trace metal clean technique. We measured ^{15}N and ^{13}C signatures for each taxa in order to determine whether Hg bioaccumulation was related to trophic level or carbon source. Earlier studies have shown that ^{15}N is preferentially enriched with increasing trophic level and ^{13}C is more depleted in organisms with pelagic vs. detrital food sources. Samples from 2003 were analyzed for Hg, ^{15}N, and ^{13}C and samples from 2004 are being analyzed for Hg speciation (inorganic and MeHg).

Hg concentrations in biota from MDI were positively related to ^{15}N signature indicating biomagnification. Also, there were higher Hg concentrations in fish (*Fundulus heteroclitus, Menidia menidia*) and benthic epifauna (*Littorina littorea, Mytilus edulis*, amphipods) than in benthic infauna (polychaetes, *Mya arenaria*). The latter indicated that organisms feeding at lower trophic levels and in the sediments had lower Hg bioaccumulation. Although, as expected, the algal grazers (*Mytilus edulis* and *Menidia menidia*) were more depleted in ^{13}C than benthic infauna such as *Mya arenaria* and polychaetes that feed on detrital carbon, there was no relationship between Hg and ^{13}C enrichment. Hg bioaccumulation at MDI contrasted greatly with Great Bay NH, a more contaminated industrialized site. Although aqueous concentrations were similar at the two sites, Hg concentrations in biota were 2-20X higher in Great Bay and did not increase with increasing ^{15}N signature indicating that the exposure to metals via sediments was a much more important vector for Hg bioaccumulation. Thus, in intertidal sites with relatively uncontaminated sediments (like MDI), benthic infauna have very low exposures and Hg is biomagnified from lower to higher trophic levels.

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