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Riverine particulate organic matter (POM) discharges into estuaries. Some of riverine POM is utilized by estuarine organisms such as bivalves and amphipods, and the other is decomposed by heterotrophic microorganisms with oxygen consumption in estuaries. As the fate of riverine POM depends on its origin, understanding of the sources of riverine POM is important for environmental conservation in estuaries. In this study, therefore, we focused on the elucidation of origins of POM in river waters. Our observations were conducted along the Yura River, which discharges into the Sea of Japan and is typical of rivers in southwest Japan. The Yura River has a total length of 146 km and a total drainage area of 1882 km^2. Forest covers much of the watershed areas from upstream to midstream, while from midstream to downstream land usage is agricultural and urban. Riverine POM samples were collected from 11 sites along the main stream of the Yura River in May and November 2006, and were analyzed for carbon and nitrogen stable isotopic compositions. Isotopic compositions and C/N ratios of POM suggested that riverine POM originated mainly from attached algae, phytoplankton and anthropogenic materials. Assuming that each POM source mixed conservatively, the fraction of each POM source can be estimated using a three source mixing model. POM was mainly dominated by attached algae in the upstream area, and phytoplankton and anthropogenic materials increased in the midstream area (including dam) and in the downstream area, respectively, during both months (see figure). The calculated carbon and nitrogen concentrations of anthropogenic POM in river waters were positively correlated ($r^2 > 0.7$) with the population density. This indicates that the increase of those concentrations were due to the increase of population density. In May, phytoplanktonic matter showed high concentrations at sites in the midstream and downstream areas. This may be caused by phytoplankton input from rice paddy fields. Our study indicates that human activities in the river watershed account for about 50% of the total POM input into the estuarine ecosystem.

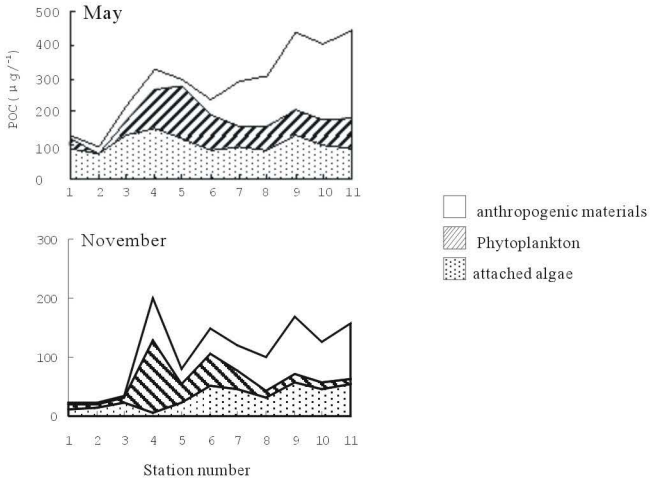

Figure Seasonal variation in the fraction of each POM source estimated from isotopic compositions. Stn. 1 is the most upstream and Stn. 11 is the most downstream. Stn. 4 is the dam

Riverine and wetland influences on methylmercury contamination of the aquatic food web in nearshore environments of Chequamegon Bay (Lake Superior, Wisconsin, USA)

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Mercury is a potent neurotoxin that is known to have developmental effects on humans and wildlife. The most toxic chemical form, methylmercury, is synthesized by naturally-occurring bacteria in aquatic ecosystems. Such bacteria thrive in oxic/anoxic interfaces that have abundant organic carbon supply and sulfateconditions typically found in wetland environments. Thus, tributaries and coastal regions with a significant wetland component in their watershed are particularly prone to elevated methylmercury concentrations in water, sediment, and the entire aquatic food web.

Lake Superior is the largest fresh water lake in the world by area, and is the deepest and coldest of the Laurentian Great Lakes of North America. The lake and its surrounding region are not heavily industrialized or populated, and are largely devoid of major atmospheric or aqueous point sources of mercury. Despite these characteristics, Lake Superior has regions with fish consumption advisories for certain long-lived fish species along its more populated and warmer southern margin. Our study objective was to determine the

relative role of contrasting coastal environments on supplying methylmercury to the lower aquatic food web. We examined the cycling and sources of mercury to a southern semi-enclosed embayment of Lake Superior (Chequamegon Bay), where the water is relatively shallow and warm compared to the majority of the lake.
We sampled the Bay at several contrasting locations to evaluate the relative contributions of wetland- versus non-wetland dominated coastal zones to water, sediments, and the lower portion of the aquatic food web. The principal sites included 1) two small wetland-dominated tributaries, 2) a wetland coastal margin (no tributary), and 3) two reference locations. Water, sediment, zooplankton, benthic macroinvertebrates, and small prey fish were collected over a 3-year period from five locations, and analyzed for total mercury, methylmercury, and stable isotopes of carbon and nitrogen.
Our results indicate that the lower food web of the wetland-influenced tributaries were highest in total and methylmercury content, followed by the marginal wetland, and the reference sites. Methylmercury concentrations observed in filtered water (site mean 0.05-0.2 ng/L), sediment (0.03-0.43 ng/g dry weight), zooplankton (22-66 ng/g), benthic invertebrates (15-55 ng/g), and age-1 yellow perch (61-153 ng/g) indicate bioaccumulation through the lower food web. Analyses of stable carbon isotopes in benthic invertebrates indicated that the highest methylmercury concentrations correlated with terrestrial (watershed) carbon sources rather than from in-lake cycling. Observed levels of methylmercury contamination in the Bay are greater than the bulk of Lake Superior, but lower relative to small lakes typical of central North Americaup to six times lower in the small prey fish.
Our findings suggest that tributaries draining extensive wetland-dominated watersheds may lead to significant exposure of biota to methylmercury in localized estuarine mixing environments, which are typically regions of high productivity, trophic transfer, and fish harvest. Even Lake Superior, with its low temperature and mercury content, appears to favor elevated fish mercury in its largest and oldest fish due to these localized wetland-tributary influences.

San Francisco Bay mercury loads: scientific information development and management resp onse

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The State of California lists San Francisco Bay as mercury-impaired and a fish consumption advisory was issued in 1994. In the 1990s, management solutions were hampered by poorly defined loads. In response, the Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) methodically completed research to determine the magnitude of loads from key pathways. Now, after eight years, RMP program scientists and collaborators have provided quantitative load estimates of atmospheric mercury deposition to the Bay (27 kg/y) (Tsai and Hoenicke 2001), of the large rivers (261 kg) (David et al. 2008), of the mining impacted Guadalupe River (140 kg) (McKee et al. 2005), and of an industrial urban tributary for a dry year (results not yet available). In parallel, the Regional Water Quality Control Board (RWQCB) developed a series of draft Total Maximum Daily Load Reports (2000, 2003, and 2004) that collated knowledge about mercury in the Bay and incorporated RMP research information year-by-year. The RWQCB prepared a Basin Plan Amendment that prescribed waste load allocations designed to remove impairment within 20 years (25% reduction from the large rivers; 50% reduction from urban runoff; 98% reduction from Guadalupe River; 33% reduction from municipal and industrial wastewater) (Looker 2006). Then a first-of-its-kind mercury budget for urban stormwater was developed that indicated historic and ongoing atmospheric deposition was the largest source to urban stormwater (45%), that erosion of natural soil mercury accounted for 27%, and that mercury spilled or volatilized as it is moved into the waste-stream (transport to and processing in land fills and recycling facilities) accounted for 22% (McKee et al. 2006). Given little opportunity for improving waste management or recycling, it was concluded that mercury capture across large areas of the urban landscape would be most effective (street sweeping, drainage maintenance, and industrial area retrofit treatment). However, to achieve the prescribed waste load allocations in