



Using Larval Dragonflies to Monitor Mercury

Why and How We Monitor

- Methylmercury (MeHg) is a highly toxic form of mercury that readily accumulates in organisms and increases in concentration as it moves up aquatic food webs from microscopic plants and small invertebrates to fish and wildlife.
- Studies have found high concentrations of MeHg in songbirds and bats that feed on insects with aquatic larval stages. Thus, the risks of MeHg exposure are not limited to fish-eating wildlife, as previously assumed, but also extend to terrestrial birds and mammals that feed on invertebrates. These recent findings illustrate the importance of including aquatic invertebrates in monitoring mercury.
- Since 2008, we have sampled and analyzed larval dragonflies, fish, and other aquatic organisms to assess mercury contamination and risks in Great Lakes Network parks.



The dusky clubtail (*Gomphus spicatus*) is a widespread species of burrowing dragonfly found in 13 of the 17 lakes sampled in four national parks and lakeshores. Photo by Roger Haro.

What We're Finding

We evaluated the effectiveness of larval burrowing dragonflies (Gomphidae family) as indicators (biosentinels) of MeHg in aquatic food webs. "Gomphids" were the most abundant dragonfly family collected from 17 lakes in four national parks and lakeshores of the Great Lakes Network—Isle Royale National Park (ISRO), Pictured Rocks National Lakeshore (PIRO), and Sleeping Bear Dunes National Lakeshore (SLBE) in Michigan, and Voyageurs National Park (VOYA) in Minnesota.

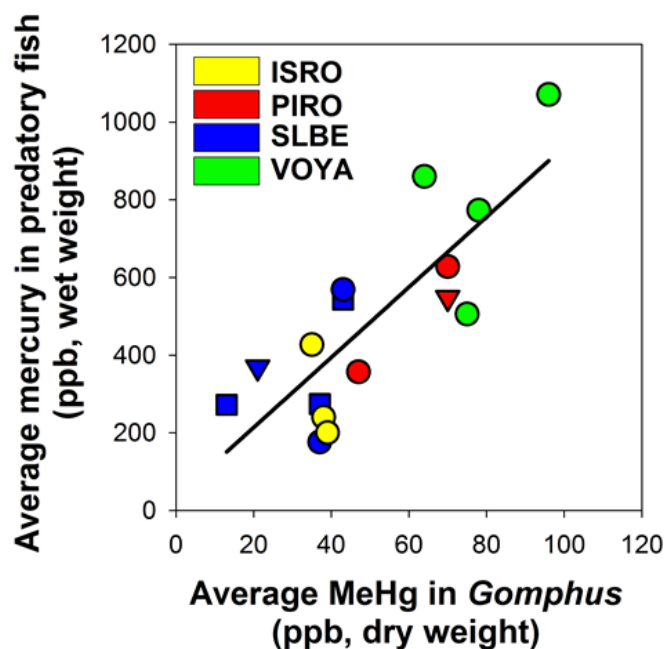
Analysis of a biosentinel organism should convey information about concentrations of MeHg in other components of the aquatic food web, and burrowing gomphids met this criterion.

Average concentrations of MeHg in dragonfly larvae were positively correlated with those in unfiltered lake water.

Average concentrations of both total mercury and MeHg in dragonfly larvae of the genus *Gomphus* were positively correlated with average concentrations in prey fish (small yellow perch) and predatory game fish collected from the same waterbody (see graph).

Management Implications

These findings illustrate the utility of burrowing dragonflies as biosentinels for mercury. Public interest in dragonflies is substantial, and larval dragonflies are well suited for study in citizen-science programs. Larvae can be sampled with inexpensive, portable gear, and volunteers can be readily trained to collect larvae. The use of this widespread group of organisms as biosentinels can extend the bioassessment of MeHg to fishless waters, or to situations where the sampling of fish is not practical.



Average concentrations of MeHg in larval dragonflies of the genus *Gomphus* are correlated with those in fillets of coexisting northern pike (circles), smallmouth bass (triangles), and largemouth bass (squares) inhabiting lakes in four park units. Mercury concentrations are in parts per billion (ppb).