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Recent advances in the toxicology of methylmercury in wildlife

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Numerous local and regional environments are contaminated with mercury from a variety of industrial sources, such as chloro-alkali plant emissions and mining wastes. In addition, many remote and semi-remote ecosystems have become contaminated with anthropogenic mercury deposited after atmospheric transport from emission sources, including the combustion of fossil fuels (coal), and large-scale waste incineration. Current levels of mercury in the environment are about threefold greater than pre-industrial values (Lamborg et al. 2002; Lindberg et al. 2007). In mercury-sensitive landscapes, methylation of inorganic mercury and subsequent bioaccumulation and biomagnification of methylmercury commonly results in elevated mercury concentrations in aquatic biota, presenting a potential health risk to some species of fish and wildlife (Scheuhammer et al. 2007).

Assessing the health risks associated with elevated exposure to methylmercury in fish and wildlife has been an ongoing concern for more than 30 years. During this time, much has been learned about the important routes of exposure to methylmercury, its concentration in various tissues, and its toxic effects. In recent years, increasingly subtle yet biologically important effects have been documented, including behavioral, neurochemical, hormonal, and reproductive changes in fish and wildlife exposed to environmentally relevant levels of methylmercury. Moreover, potential population-level impacts are now being assessed for some species.

In August 2006, a special session on Contributions of Wildlife Toxicology to Environmental Mercury Science and Policy was held as part of the Eighth International Conference on Mercury as a Global Pollutant, which was co-hosted by the University of Wisconsin–Madison, the US Geological Survey, and the University of Wisconsin–La Crosse in Madison, WI. Some of the papers presented at that combined platform and poster session are published in this issue of *Ecotoxicology*, including a broad spatial and temporal analysis of the effects of mercury exposure on common loons (*Gavia immer*) in the northeastern US (Evers et al. this issue); an assessment of the effects of mercury exposure on common loon productivity in Wisconsin, USA, and in New Brunswick and Nova Scotia, Canada (Burgess and Meyer this issue); an evaluation of the effects of mercury exposure on survival of young free-ranging American avocets (*Recurvirostra americana*) and black-necked stilts (*Himantopus mexicanus*) in San Francisco Bay, California (Ackerman et al. this issue); an assessment of waterbird reproduction in the mercury-contaminated Carson River Basin, Nevada (Hill et al. this issue), and a comparison of mercury and selenium accumulation and neurochemical changes in common loons and bald eagles (*Haliaeetus leucocephalus*) (Scheuhammer et al. this issue). Most studies on the effects of methylmercury have focused on piscivorous wildlife, but there is growing evidence that insectivorous birds may also be at risk in some environments. Brasso and Cristol (this issue) present information on bioaccumulation and reproductive effects of methylmercury in tree swallows (*Tachycineta bicolor*) along a contaminated stretch of the Shenandoah River, Virginia.

These studies are important, from both scientific and policy perspectives. They substantially advance our

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understanding of the toxic effects of methylmercury in wildlife and will hopefully influence risk assessment and environmental policy regarding contamination of mercury-sensitive ecosystems. Data are presented that shed new light on key areas of mercury research, such as the population-level effects of methylmercury exposure in piscivorous wildlife, the importance of mercury exposure in certain non-piscivorous species, and the interactions of mercury and selenium in biological systems. Future studies with fish and wildlife will be required to address differences in species sensitivity to methylmercury; to better assess the ecotoxicological effects on populations and communities; and to explore interactive effects on key biological processes from exposure to mercury and co-occurring contaminants such as organochlorines.

In North America, industrial use of mercury has declined markedly since the 1990s and earlier. However, global consumption of coal for energy production is predicted to increase 74% between 2004 and 2030 (Energy Information Administration 2007). Thus, the need for ecotoxicological research on methylmercury in fish and wildlife will almost certainly continue in the years ahead.

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