

US EPA ARCHIVE DOCUMENT



## Toxicological Effects of Methylmercury on Fishes in Inland Lakes of Isle Royale National Park

### Environmental Issue

Isle Royale National Park (ISRO) is contaminated with mercury (Hg) from atmospheric deposition of Hg from human sources is contaminating the remote wilderness landscape of ISRO. The State of Michigan has issued a fish consumption advisory for six inland lakes.

Reproduction of fishes in the inland lakes of ISRO may be impaired due to Hg. Laboratory studies have documented decreased spawning success, delayed spawning, reduced fecundity, suppressed hormone levels, and altered reproductive behavior in fish with mercury concentrations as low as  $1.0 \mu\text{g}\cdot\text{g}^{-1}$  wet weight.  $1 \mu\text{g}\cdot\text{g}^{-1}$  wet weight is not an uncommon concentration of Hg in piscivorous (fish-eating) fishes in inland lakes of ISRO.

Every effort should be made to protect Isle Royale's fish fauna" (Kallemeyn 2000). The inland lakes of ISRO contain ecologically and culturally important fish communities. Elevated concentrations of Hg in fish from the inland lakes is of concern because ISRO has been designated as an International Biosphere Reserve, serving as a reference system that has been minimally affected by pollution.

### Scientific Approach

- Hypothesis: Reproduction of piscivorous fishes is impaired in inland lakes with elevated concentrations of Hg at ISRO

- Research Plan:

Determine the mechanisms responsible for impaired reproduction in fish due to Hg

- novel techniques will be used to determine the action of Hg on the reproductive system of laboratory-exposed fish
- zebrafish (*Danio rerio*) will be used as the model fish species
- methylmercury will be used as the chemical form of Hg

Develop biomarkers based on mechanisms

- it is difficult to quantify the reproductive success of wild fish
- biomarkers are useful because they provide quantifiable measures of physiological changes due to contaminants

Assess the reproduction of piscivorous fishes in inland lakes of ISRO with biomarkers

- reproduction of adult northern pike (*Esox lucius*) and yellow perch (*Perca flavescens*) will be assessed in lakes that span a gradient of Hg contamination within the Park



Isle Royale National Park is a remote island archipelago located in Lake Superior, Michigan, USA

### Impact

- ISRO ecosystem
  - information gained from this study will assist the U.S. National Park Service in assessing the relative effects of Hg on year-class strengths of piscivorous fishes in inland lakes
- Other ecosystems
  - Hg contamination is a global environmental problem
  - this problem is magnified in ecosystems that are "mercury sensitive", such as boreal ecosystems like ISRO
  - fish consumption advisories are common for lakes in boreal regions of Canada, Scandinavia, and the United States
  - information from this study will also help assess the effects of Hg on fish in these ecosystems