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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)

-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 $\mu g \bullet g^{-1}$ wet weight

-1.0 $\mu g \bullet g^{-1}$ 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 great concern because ISRO has been designated as an International Biosphere Reserve, serving as a reference ecosystem 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

Citation: Kallemeyn, L.W. 2000. A comparison of fish communities from 32 inland lakes in Isle Royale National Park, 1929 and 1995-1997. U.S. Geological Survey, Biological Resources Division Biological Science Report USGS/BRD/BSR2000-0004.

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