Links Between Mercury and Liver Damage in Wild Fish Populations

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Background

Sources of Mercury:
- atmospheric deposition
- metal mining
- power plants
- natural sources

Mercury is *methylated* in aquatic systems

\[ \text{Hg} \rightarrow \text{MeHg} \]
Biomagnification occurs as methylmercury is passed through food web

Environment Canada
Effects of Mercury

- Neurotoxic to humans

- Laboratory studies have demonstrated effects on fish survival, fertility, development, and behavior.

- No studies have demonstrated impacts of atmospherically-deposited Hg on wild fish at ecologically-relevant levels.
Isle Royale National Park

- Located in Lake Superior
- Unusually high levels of methylmercury due to atmospheric deposition
Question: Does Hg pose a threat to fish health on IRNP?

- 124 northern pike were collected from 8 lakes
- Fillets and livers were tested for mercury with cold-vapor A.A. spectroscopy
- Subsamples of liver from each fish were embedded in paraffin for histology
What was found…

…a correlation between liver color and fish mercury content

Question: Why was the liver color different?
**Lipofuscion**

- Pigmentation change that occurs as a result of accumulation of cellular-breakdown products
- Can indicate increased cellular damage as a result of toxicant exposure

Question: Does LF correlate with [Hg] in fish?

*Dark livers from IRNP contained large numbers of LF bodies*
Lipofuscin Quantification

- Small samples of liver were embedded in paraffin and sectioned on a microtome.
- Each sample was photographed at 200X.
- A grid (squares 25 X 25µm) was overlaid on each image.
- 50 squares were randomly selected and evaluated for the presence of LF.
- The proportion of squares containing LF were used to quantify the amount of liver damage.
Lipofuscin content was correlated with liver color

Liver color was correlated with Hg content
Conclusions

1) LF levels are higher in the dark liver samples
2) Darker samples have higher mercury content
3) Lipofuscin quantification might provide an accurate method to determine mercury concentration and as well as damage

Future Directions

- Caddo Lake
- Lab studies
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Questions?

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