Presence of Mercury in Lakes and Rivers in Central New York

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Abstract
In 2004, a study by the USGS was released indicating that the mercury concentrations in NY were below drinking water limits. However, in a 2009 Department of Environmental Conservation (DEC) fish advisories report, several streams and rivers in central NY were classified as having high mercury concentrations in fish. Measured mercury concentrations were above the limit dictated by the DEC. The DEC routinely tested rivers and streams, but lakes were never investigated. The purpose of this study was to test three lakes (Wilbur, Goodyear, and Otsego Lake) and two rivers (Unadilla and Susquehanna River) for mercury in Central New York. The water bodies were tested for methyl and total mercury. Part of the study included testing the drinking water source for Oneonta, NY. All five bodies of water were found to have traces of total mercury and four out of five had traces of methyl mercury. Otsego Lake was the only site that had methyl mercury concentrations below detection limits. Although our results remained under state limits, it is still a concern for human health in regards to fish consumption. Our next step is to find the source of the mercury and test mercury levels in fish from the lakes tested in this study.

Purpose
According to DEC annual reports, mercury levels in several streams, reservoirs, and rivers in New York are currently above the acceptable limit (0.7 µg/L) which has been mandated by New York State. Many streams and rivers in New York have been tested; however, lakes have not been tested thus far (DEC, personal communication 2011). When levels of mercury rise above New York State’s maximum limit, the amount of fish intake by consumers must be controlled and regulated (DEC DoH Fish Advisories, 2009). However, since lakes have not been regularly tested by the DEC, limits for mercury levels have not been set for New York Lakes. Without knowing if lakes in Central New York contain high levels of mercury, so not, residents of New York could be eating fish that is detrimental to their health. This study evaluates concentrations of dissolved mercury and methyl mercury in three New York lakes and two rivers with known mercury concentrations.

Sample Collection Method
• The basic procedure for sampling includes the “Clean Hands(CH)/Dirty Hands(DH)” method.
• We designated “clean hands”(CH) and “dirty hands”(DH) members of the team, and preserved roles through the entire sample collection day.
• DH gets double-bagged sample bottle out of dedicated Hg cooler and CH removes sample.
• CH then washes out to sampling location (~10 ft. offshore), approaching the sample point from shore and upwind of possible contamination sources if possible.
• Facing and reaching towards shore, CH plunges the still capped, empty sampling container underwater (keep cap underwater during filling).
• CH wades back to the bank and staging area and places sample bottle in inner bag and re-caps.
• DH seals outer bag.

This process is done twice at each location, once for methyl mercury, and once for total mercury.
• All samples were immediately placed in cooler, and were shipped overnight to Frontier Global Sciences Lab for analysis.

Results

<table>
<thead>
<tr>
<th>Water Body</th>
<th>Sample Location</th>
<th>Concentration (µg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilbur Lake</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>Otsego Lake</td>
<td>1.35</td>
<td></td>
</tr>
<tr>
<td>Otsego Lake</td>
<td>0.68</td>
<td></td>
</tr>
<tr>
<td>Unadilla River</td>
<td>5.31</td>
<td></td>
</tr>
<tr>
<td>Susquehanna River</td>
<td>7.42</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Mercury results for the five water bodies categorized as methyl and total mercury.

Figure 4: Results of mercury and methyl mercury analysis. ND stands for non-detectable traces of mercury. 1 nanogram = 10^-9 grams. The 14 used for these results is Frontier Global Sciences. The samples were prepared and analysed for total mercury in accordance with EPA method 1631 E. The samples were prepared and analysed for methyl mercury in accordance with modified EPA method 1630/FGS 70.

Conclusion
All water bodies tested had detectable total mercury concentrations. For methyl mercury, all water bodies had detectable concentration except for Otsego Lake. Although all locations have concentrations of total mercury, it is important to note that all are still below the standard limit for drinking water.

Future Work
Although our mercury samples remained under the drinking water threshold, it does not mean that future work should not be pursued. Because mercury can bioaccumulate in fish, it can become a problem with fish consumption and can have detrimental affects on our local fisheries, as well as public health. This spring, we have received a grant from the Student Grant Program to begin the next step of our research. We have now decided to take this extra step in three different directions: 1) to collect and analyze fish samples from these bodies of water, 2) collect rain water samples to see if this presence of mercury is from current rainfall or past events, and 3) to analyze the shale surrounding these bodies of water to determine if mercury is leaching out of shale or if it is coming from somewhere else. With these three approaches of testing, we have surrounded this issue from every angle in hopes to finally discover where this mercury is coming from, and if our local fish are a safe source of food and nutrition.

References

Figure 1: Adapted chart displaying Fish Advisory warnings according to the New York Department of Health. This fish advisory is for the 2009 Leatherstocking and Central Region of New York State. Highlighted rows are locations that we sampled that were listed as a concern on the Fish Advisory.

Figure 2: Pictured above is a map of the Central New York region. Our 5 testing locations are mapped along with total and methyl mercury concentrations. Delineation regions are displayed as well. Dots are to scale; larger dots equate to larger total and methyl-mercury concentrations. Inset is a map of NY counties. Highlighted in Red is Oneonta County, where our testing took place.

Figure 3: Colleen Parker and Myles Moore sampling on Otsego Lake. Displays the Clean Hands/Dirty Hands collection method. May 16, 2012.

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