NJDEP’s Annual Fish Tissue Monitoring Program 2014-2017

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NJ Water Monitoring Council
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A routine tissue monitoring program was identified as a key gap in NJ’s Long-term Monitoring and Assessment Strategy.

- **Goal is to provide annual, cost-efficient monitoring**
  - Monitoring designs (Targeted and Probabilistic)
    - Provide current and more comprehensive data on concentrations of toxic contaminants in fish to assess human health risks and update/recommend fish consumption advisories.
    - Provide data to assess the impairment of the fish consumption designated use of the waterbodies sampled.
    - Provide data to assess the overall status and trends in levels of contaminants that contribute to use impairment and fish consumption advisories.
Targeted Monitoring

- Rotating basin design
- Initiated first targeted monitoring in Raritan Basin in 2014
- Mix of lakes and rivers, some freshwater tidal rivers
- Sites are selected in cooperation with the Division of Science, Research, and Environmental Health
- Waterbodies are targeted for sampling based on having previous years’ data available for trends analysis, targeting areas of concern and updating advisories
Targeted Monitoring

Field Collection Methods

- Boat electrofishing primary (mostly day, some night)
  - Secondary hoop and gill nets

Collect 3 individuals from the following of similar size:

Largemouth bass or chain pickerel (trophic level 4)

Sunfish sp. (trophic level 3)

Common carp, catfish or eels (trophic level 3)
Targeted Monitoring

Fish Processing

Analytes
Primarily- Mercury and PCBs

Additional contaminants (e.g., OCPs, PBDEs) may be measured on a site-specific basis

- Measure and weigh each fish
- Descale fish, remove 2 muscle plugs out of each fish for total Hg (8mm biopsy punch)
- Wrap whole fish in aluminum foil for PCBs
- Stored in freezer until shipped to laboratory

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Method</th>
<th>Holding Time</th>
<th>Preservative</th>
<th>Plug/Fillet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Mercury</td>
<td>USEPA 1631</td>
<td>1 year</td>
<td>Ice to 4°C in field. Freeze within 24 hours.</td>
<td>Plug</td>
</tr>
<tr>
<td>PCBs</td>
<td>USEPA 1668</td>
<td>1 year</td>
<td>Ice to 4°C in field. Freeze within 24 hours.</td>
<td>Fillet</td>
</tr>
</tbody>
</table>
# Targeted Monitoring Results 2014-2015

## 2014 Raritan Basin

<table>
<thead>
<tr>
<th>Fish Type</th>
<th>Range (Hg, ppm)</th>
<th>Average (Hg, ppm)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largemouth bass</td>
<td>0.11 - 1.29</td>
<td>0.40</td>
<td>(n=30)</td>
</tr>
<tr>
<td>Chain pickerel</td>
<td>0.09 - 0.14</td>
<td>0.12</td>
<td>(n=6)</td>
</tr>
<tr>
<td>Sunfish</td>
<td>0.03 - 0.32</td>
<td>0.11</td>
<td>(n=36)</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>0.076 - 0.53</td>
<td>0.26</td>
<td>(n=15)</td>
</tr>
</tbody>
</table>

## 2015 Atlantic Basin

<table>
<thead>
<tr>
<th>Fish Type</th>
<th>Range (Hg, ppm)</th>
<th>Average (Hg, ppm)</th>
<th>Sample Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Largemouth bass</td>
<td>0.05 - 1.14</td>
<td>0.37</td>
<td>(n=36)</td>
</tr>
<tr>
<td>Chain pickerel</td>
<td>0.29 - 5.61</td>
<td>1.24</td>
<td>(n=24)</td>
</tr>
<tr>
<td>Sunfish</td>
<td>0.01 - 0.63</td>
<td>0.16</td>
<td>(n=39)</td>
</tr>
<tr>
<td>Channel catfish</td>
<td>0.14 - 0.84</td>
<td>0.48</td>
<td>(n=9)</td>
</tr>
</tbody>
</table>

### New Jersey Fish Consumption Advisory Criteria

<table>
<thead>
<tr>
<th>Consumption Rate</th>
<th>High Risk Population</th>
<th>General Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do Not Eat</td>
<td>&gt;0.54 ppm</td>
<td>&gt; 2.81 ppm</td>
</tr>
<tr>
<td>1 meal / month</td>
<td>0.54 - 0.19 ppm</td>
<td>2.81 – 0.94 ppm</td>
</tr>
<tr>
<td>1 meal/ week</td>
<td>0.18 – 0.08 ppm</td>
<td>0.93 – 0.35 ppm</td>
</tr>
<tr>
<td>No restrictions</td>
<td>≤ 0.07 ppm</td>
<td>≤ 0.34 ppm</td>
</tr>
</tbody>
</table>
Fish Muscle Plugs

Advantages over conventional fillet samples
• Non-lethal (see photo of healed plug wounds)
  • Collect larger sample sizes without harm to population
  • Threatened species can be monitored
• Cost effective when shipping samples
• Comparable results to fillets
• High survival rate of plugged fish (97% in study below)

Disadvantages of plug samples
• Limited quantity of tissue
• Limited analytes (i.e. Hg, Selenium)
• No archive sample if released
2014 comparison of Hg in muscle plug to Hg in fillet

- 3 chain pickerel from Millstone River
- 3 largemouth bass from Farrington Lake
- 3 Redbreast from Raritan River
A total of 50 probabilistic lakes (greater than 5 surface acres) generated using a Generalized Random Tessellation Stratified (GRTS; Stevens and Olsen, 2004) survey design. Initiated in 2016, only publicly accessible freshwater lakes are included. Private (not generally open to public fishing access), tidally influenced, quarry pits (mining), and retention ponds are not considered for sampling. Scheduled to be completed in 5 years (2020) by sampling 10 lakes annually. Will provide a statistical statewide status estimate of total mercury concentrations in fish from public New Jersey lakes greater than 5 acres in size.
Probabilistic Monitoring

Methods

• Boat Electrofishing primary (mostly day, some night)
  • Secondary hoop and gill nets

• 5 largemouth bass OR 5 pickerel of similar size from each lake
  • Weigh, measure, descale dorsal area, 8 mm plug
  • 1 muscle plug taken from each of 5 fish, then composited in glass vial

Analytes

• Only total Hg
## Network Comparison

Comparison of fish tissue monitoring networks.

<table>
<thead>
<tr>
<th>Monitoring Network</th>
<th>Site selection</th>
<th>Waterbodies</th>
<th>Species targeted</th>
<th>Sample Quantity</th>
<th>Analytes</th>
<th>Sample matrix</th>
<th>Fish sacrificed</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Targeted Regional</strong></td>
<td>Targeted</td>
<td>Rivers and Lakes</td>
<td>1) Largemouth bass or chain pickerel; 2) Sunfish species; 3) common carp or American eel or catfish/bullhead species</td>
<td>3 individuals from each of the 3 groups</td>
<td>total mercury (1, 2 and 3), PCBs (3 only)</td>
<td>Whole fish (PCBs) and plug (Hg)</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Probabilistic</strong></td>
<td>Random</td>
<td>Lakes</td>
<td>Largemouth bass or chain pickerel</td>
<td>5 individuals</td>
<td>total mercury (5 fish composite)</td>
<td>Plug (Hg)</td>
<td>No</td>
</tr>
</tbody>
</table>

Photo Credit: Ray Cywinski
NJDEP participated in wadeable and non-wadeable collection
• 2008-2009 (Whole fish, > 5th order rivers)
  Hg results reported
  selenium, pesticides, PCBs pending
• 2013-2014 (Muscle plugs)
• Scheduled for summer 2018-2019

Collection
• two individuals of the same target species (predators) from each site
• Weigh, measure, 1 plug per fish, ship
Acknowledgements
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Questions?
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