Bioindicators of Water Quality Quick–Reference Guide

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Bioindicators are biological systems that can show (indicate) a measurable effect. Aquatic insects can be used as bioindicators of water quality.

The Indiana 4-H bioindicator flash cards show larval stages of aquatic insects that may be found in Indiana waterways along with a tolerance score for each insect. The tolerance score, ranging from 0–10, represents the insect’s sensitivity to pollution and can be used to estimate the quality of the water in which the insect was found. Insects with a score of 0 are intolerant to pollution, meaning they cannot tolerate any water pollution, while insect families with a score of 10 are very tolerant of polluted water.

Materials Needed
- dip net
- white plastic pail, bowl, or dishpan (Note: The white color makes it easier to see the insects.)
- 2–3 white styrofoam egg cartons or plastic ice cube trays
- data sheet (available online at: www.four-h.purdue.edu/natural_resources/Resources/BioindicatorWQ/BioindicatorsWQ.html)

Instructions
- Locate a body of water (e.g., stream, pond, lake) to sample. The water should only be at most knee deep and allow easy access for obtaining the sample. Make sure you have permission to sample the water.
- Dip the pail in the water to be sampled.
- Collect insect samples from all habitats within a 200-foot section of that body of water, and place them in the pail. Jab your dip net against the vegetation and into mud or sand at the bottom to collect insects. Scrape the underside of rocks and logs into the net.
- Collect insects for 45 minutes.
- Using the ice cube tray, sort the insects that look the same into the different compartments of the tray using your hand or forceps. Be sure to put some water in the ice cube tray first to keep the insects from drying out.
- Use the bioindicator flash cards or quick reference guide to identify the insects. Record the number of insects from each insect family you identify on the data sheet.
- Place the insects back in the water when you are finished.
- Complete the calculations described in the next section to determine the quality rating.

Assessing the Water Quality of a Site
For each insect family group:
- Record the number of insects found.
- Multiply the Tolerance Value by the Number Found, and enter the result as the Family Tolerance Score.
- Add up the columns of Number Found and Family Tolerance Score, and enter each result in the Order Totals boxes at the end of these columns.

For each insect order:
- Transfer all Order Totals to the summary area of the data sheet.
- Add up the columns of Number Found and Order Tolerance Score, and enter each result in the Grand Total boxes at the end of these columns.
- Determine the Biotic Index by dividing the Grand Total Tolerance Score by the Grand Total Number Found.
- Use the biotic index in the table provided to estimate the water quality rating and degree of organic pollution.

Biotic Index | Water Quality Rating | Degree of Organic Pollution
---|---|---
0.00-3.75 | excellent | organic pollution unlikely
3.76-4.25 | very good | slight organic pollution possible
4.26-5.00 | good | some organic pollution probable
5.01-5.75 | fair | fairly substantial pollution likely
5.76-6.50 | fairly poor | substantial pollution likely
6.51-7.25 | poor | very substantial pollution likely
7.26-10.0 | very poor | severe organic pollution likely

Resources
- U.S. Environmental Protection Agency (EPA)
- About Biological Integrity and Indicators: www.epa.gov/bioindicators/html/about.html
- Invertebrates as Indicators (look for Bugs as Indicators of Water Quality): www.epa.gov/bioindicators/html/invertebrate.html
- Bugguide.net (hosted by Iowa State University Entomology): www.bugguide.net
- Hoosier Riverwatch (provides training on this and many other water-related topics): http://www.in.gov/dnr/nrec/3046.htm
- Hoosier Riverwatch events calendar: http://www.in.gov/dnr/nrec/
**Coleoptera**

**Beetles**

- **Dryopidae**
  - Long-toed Water Beetle
- **Dytiscidae**
  - Predaceous Diving Beetle
- **Haliplidae**
  - Crawling Water Beetle
- **Elmidae**
  - Riffle Beetle
- **Hydrophilidae**
  - Water Scavenger Beetle

**Diptera**

**Flies**

- **Gyrinidae**
  - Whirligig Beetle, Apple Beetle
- **Haliplidae**
  - Crawling Water Beetle
- **Hydrophilidae**
  - Water Scavenger Beetle
- **Psephenidae**
  - Water Penny
- **Chironomidae**
  - Non-biting Midge
- **Culicidae**
  - Mosquito
- **Athericidae**
  - Aquatic Snipe Fly
- **Dixidae**
  - Dixid Midge
- **Empididae**
  - Aquatic Dance Fly
- **Ceratopogonidae**
  - Biting Midge, Punkie, No-See-Um
- **Ephydridae**
  - Shore Fly, Brine Fly
- **Muscidae**
  - House Fly, Stable Fly, Green Bottle Fly

**Additional Notes**

- DRAFT
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<tr>
<th>Family</th>
<th>Genus</th>
<th>Common Name</th>
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<tbody>
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<td>Corixidae</td>
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<td>Water Boatman</td>
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<td>Toad Bug</td>
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**Ephemeroptera**

**Mayflies**

**Hemiptera, Aquatic Bugs**

- **Gelastocoridae**
  - Toad Bug
- **Corixidae**
  - Water Boatman
- **Belostomatidae**
  - Giant Water Bug, Toe-Biter
- **Gelastocoridae**
  - Toad Bug
- **Hemiptera**
  - Aquatic Bugs
  - **Gelastocoridae**
  - Toad Bug
**Lepidoptera**

Aquatic Moths

- *Pyralidae*
  - Aquatic Caterpillar

- *Nepidae*
  - Water Scorpion

- *Undetermined*
  - Backswimmer

**Megaloptera**

Fishflies, and Alderflies

- *Corydalidae*
  - Dobsonfly, Fishfly

- *Sialidae*
  - Alderfly

**Odonata**

Damselflies and Dragonflies

- *Aeshnidae*
  - Darner

- *Calopterygidae*
  - Broad-winged Damselfly

- *Coenagrionidae*
  - Narrow-winged Damselfly

- *Lestidae*
  - Spread-winged Damselfly

- *Libellulidae*
  - Common Skimmer
Plecoptera
Stoneflies

Capniidae
Small Winter Stonefly

Brachycentridae
Humpless Casemaker Caddisfly

Leuctridae
Roll-winged Stonefly

Glossosomatidae
Saddle Casemaker Caddisfly

Nemouridae
Brown Stonefly

Helicopsychidae
Snail Casemaker Caddisfly

Perlidae
Common Stonefly

Pteronarcyidae
Giant Stonefly

Perlodidae
Patterned Stonefly

Taeniopterygidae
Winter Stonefly

Trichoptera
Caddisflies

Hydropsychidae
Common Net Spinner Caddisfly

Hydroptilidae
Micro Caddisfly

Lepidostomatidae
Lepidostomatid Casemaker

Hydropsychidae
Northern Casemaker Caddisfly

Leptoceridae
Long Horned Casemaker

Limnephilidae
Northern Casemaker Caddisfly

Philopotamidae
Finger Net Caddisfly

Phryganeidae
Giant Casemaker Caddisfly