# Macroinvertebrate Biotic Index

Volunteer Monitoring Factsheet Series 2023

## Why are we concerned?

- Aquatic macroinvertebrates are small animals without backbones. Their presence or absence can reflect a stream's general condition.
- Certain macroinvertebrates respond differently to the physical, chemical, and biological conditions within a stream.
- Aquatic macroinvertebrates are relatively immobile so they can't escape either short or long-term pollution exposure. This is important when assessing longterm pollution events within the stream.

**Time Needed:**
Up to 45 minutes

**When:**
Twice a year (once in spring, once in fall)

**Equipment Needed:**

- Hip boots
- D-frame kick net
- White basin (important to have white background-helps to see the critters)
- White ice cube tray
- Key to Life in the River or other identification tools
- Datasheet
- Pen/pencil
- Magnifying glass
- Picking tools (spoons, tweezers, pipettes)

### Definition of Terms

*Aquatic Macroinvertebrates:* Small animals without backbones that live in water and are visible to the human eye.

*WAV Biotic Index:* Water Quality Index for Wisconsin wadable streams using aquatic macroinvertebrates.

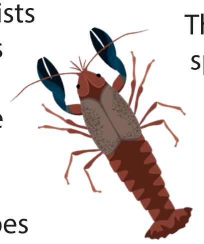
*Genus:* The category of organisms ranking below the family category, but broader than the species category.

*Leaf Pack:* Bundles of old leaves sticking together in the water.

*Riffle:* Shallow area in stream where water flows swiftly over rocks.

# Background on WAV Biotic Index

From the crayfish burrowing in the stream bed to the tiny aquatic insects skirting the water's surface, streams and rivers swarm with life. The inhabitants of this living place are affected by poor water quality just like humans are affected by an unhealthy environment. However, scientists have found that not all aquatic organisms react the same to poor water quality. Some species are pollutant-tolerant while some are very pollutant-sensitive. From this knowledge, a scale was developed to determine water quality based on the types of life found in the water. For example, streams with primarily pollutant-tolerant organisms generally have poorer water quality than those streams with many pollutant-sensitive animals. This is because poor-quality streams gradually lose pollutant-sensitive animals until only the pollutant-tolerant species are left.



A healthy stream will have many different organisms, both pollutant-tolerant and those sensitive to pollution.

Although relatively accurate in assessing stream conditions, the biotic index does have its limitations. The biotic index can indicate a problem, but it cannot specify what that problem might be. For example, manure, sewage, fertilizers, sediment and organic materials all negatively impact water quality. In order to pinpoint these possible pollutant sources, monitoring for other parameters such as habitat assessment, dissolved oxygen and temperature needs to be done. The biotic index is useful for identifying long-term pollution problems, since these organisms carry out a portion or all of their life cycle in streams. Other parameters monitored in the WAV program (except habitat) only indicate the water quality conditions at the time of testing.

### How the Biotic Index was Developed

A number of years ago, a highly respected researcher developed what is known as the Hilsenhoff Biotic Index (HBI). This index identified organisms down to the genus or species. Only experts in aquatic biology use this index to determine water quality. Although very accurate, the HBI is difficult to use outside of a lab setting, so a less complex index called the Family Biotic Index (FBI) was developed. With this index, aquatic animals are identified to the family level, which is a less specific level than genus or species. Training is necessary for scientists to use the FBI accurately.

A third index was developed so volunteers could be more involved with identifying stream health based on biotic indices. A group of Wisconsin scientists from the DNR, University of Wisconsin-Madison Division of Extension, and the University designed the WAV Biotic Index that correlates closely to the Hilsenhoff Biotic Index, but with less scientific detail. This index was created specifically for streams in Wisconsin. Monitoring groups are strongly encouraged to use this educationally focused biotic index.

## Selecting a Sample Site

You will collect a total of three biotic index samples within a 300' stream section. Rocky bottom and soft bottom streams support different kinds of organisms, so be sure to choose sites based on your stream type. Your goal is to collect as many different kinds of aquatic macroinvertebrates from as many different habitats as necessary to ensure an accurate site assessment. Be aware that each habitat type has different sampling protocols and some have a greater diversity of organisms than others. If you have many habitats from which to choose, consider sampling from those with the most diversity (i.e. riffles). If your stream has a rocky bottom, sample at two separate riffle areas and at one other habitat. If your stream has a soft bottom or does not have riffles, collect samples at submerged logs, snags or undercut banks.

| Habitat Type | Stream Type | Habitat |
|---|---|---|
| Riffles | Rocky Bottom | Most Diverse |
| Undercut Banks | Rocky, soft bottoms | ↕ |
| Snag areas, tree roots | Rocky, soft bottoms | |
| Leaf packs | Rocky, soft bottoms | Least Diverse |

# How to Collect Samples at The Different Sample Sites

**You will collect three total Biotic Index samples.** However, before you begin rinse the net and check to make certain it doesn't contain any debris from the last time it was used. Fill your white basin with about one inch of clean stream water. When sampling, if you find you have too much water or if the water is too muddy, pour the excess/muddy water through your net. If necessary, add some clean water to the original sample.

## Riffle Sampling

1. You will collect one sample in the upstream portion and one in the downstream portion of the riffle. The two samples constitute ONE BIOTIC INDEX SAMPLE.
2. Start at the downstream section of the riffle.
3. Place the net firmly on the bottom of the stream standing in front of the net so the water passes you first, then flows through the net. If a second person is with you, this person should act as a time keeper and kicker.
4. When the net is in place use your feet to kick the rocks for two minutes to dis-lodge aquatic macroinvertebrates. Alternatively, pick up each rock within an 18 inch-square area immediately in front of the net and rub thoroughly to remove all organisma clinging to it. Gently replace the rocks in the stream outside of the sample location. Continue to pick up, rub, remove rocks for two minutes.
5. Carry the net to shore and dump the contents into one basin or bucket with about one inch of water in it.
6. All organisms clinging to the net should be removed and placed in the basin.
7. Repeat steps 3-6 for the upstream portion of the riffle. Combine contents of the second sample with the first.
8. Examine the sample and check the debris for any macroinvertebrates that might be hiding.
9. Remove large leaves, sticks, rocks, plants and other debris and place them in another container to check later for organisms that crawl out.
10. You now have a biotic index sample.
11. Combine this sample with the other samples taken from riffles or other habitats.
12. When you have three biotic index samples, follow the steps on the next page to categorize your sample and determine water quality.

**Think Like a Scientist!**

Follow the directions VERY CAREFULLY! Accuracy is a must for valid data comparisons.

## Sampling Undercut Banks

1. Undercut banks have scooped out areas just below the surface of the water. This creates a bank that slightly overhangs on the surface of the water and habitat for many kinds of organisms.
2. Facing the bank, move the net in a bottom-to-surface motion, jabbing at the bank vegetation to loosen organisms. Jabbing the net about 20 times should provide you enough organisms for your sample.
3. Carry the net to shore and dump the contents into a basin or bucket with about one inch of water in it.
4. All organisms clinging to the net should be removed and placed in the basin.
5. Examine the sample and remove any large leaves, sticks, rocks, plants and other debris. Check the debris for any macroinvertebrates that might be hiding in it.
6. Place the debris in another container to check for organisms that may crawl out later.
7. You now have a biotic index sample.
8. Combine this sample with the other samples taken from undercut banks or other habitats.
9. When you have three samples, follow the steps on the next page to categorize your sample and determine water quality.

## Sampling Snag Areas, Tree Roots, and Submerged Logs

1. Snag areas are accumulations of debris caught behind logs, stumps or boulders in the water.
2. Select a three-foot by three-foot area (for uniform comparisons) around the snag, tree roots, logs or other debris.
3. Scrape the surface of the tree roots, logs or other debris with your net. You can also disturb the surfaces by scraping them with a stick, hands or your foot, or you can pull off some of the bark to get at organisms hiding underneath. Like with undercut bank sampling, 20 jabs equals one sample.
4. To remove sediment, swirl the net in the stream, being careful to keep the opening out of the water so you don't lose any organisms.
5. Carry the net to shore and dump the contents into a basin or bucket with about one inch of water in it.
6. All organisms clinging to the net should be removed and placed in the basin.
7. Examine the sample and remove any large leaves, sticks, rocks, plants and other debris. Check the debris for any macroinvertebrates that might be hiding in it.
8. Place the debris in another container to check for organisms that may crawl out later.
9. You now have a biotic index sample.
10. Combine this sample with the other samples taken from snags or other habitats.
11. When you have three samples, follow the steps below to categorize your sample and determine water quality.

## Leaf Pack Sampling

1. Look for old leaf packs that are about four to six months old. Old leaf packs are dark brown, slimy and slightly decomposed.
2. Position the dip net downstream from the leaf pack. Use your feet or hands to gently move the leaf pack into the net.
3. Swirl the leaf pack in the net, knocking off some of the aquatic macroinvertebrates.
4. Carry the net to shore.
5. Hold the net near the basin and take out the leaves one at a time to inspect for organisms. Remove any macro-invertebrates that you find, and place them in the basin.
6. Once you've finished with the leaves, remove any organisms that are clinging to the net.
7. Place the leaves in another container to check for organisms that may crawl out later.
8. You now have a biotic index sample.
9. Combine this sample with the other samples taken from leaf packs or other habitats.
10. When you have three samples, follow the steps below to categorize your sample and determine water quality.

### How healthy is the stream?

| | Score |
|---|---|
| Good | 2.6 - 3.5 |
| Fair | 2.1 - 2.5 |
| Poor | 1.0 - 2.0 |

### After Collecting Your Samples:

- Check the basin with the debris to see if any aquatic macroinvertebrates crawled out. Add these animals to your prepared sample.
- Fill the ice cube tray half-full with stream water.
- Using the picking tools, sort out the macroinvertebrates and place ones that look alike together in their own ice cube tray compartments. Sorting and placing similar looking macroinvertebrates together will help insure that you find all varieties of species in the sample.
- Refer to the Key to Macroinvertebrate Life in the River or other tools to identify the aquatic macroinvertebrates.
- On your datasheet, circle the animals that you found in your sample. Then use the online database or follow steps on the Biotic Index datasheet to calculate a water quality score.
- Safely return all macoinvertebrates to the stream and **thoroughly clean, drain and dry your equipment to avoid transporting aquatic invasive species to other waters**.

Extension
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