



Macroinvertebrates

Resource Brief

Importance

A macroinvertebrate is any animal without a backbone that is large enough to be seen by the naked eye. Macroinvertebrates that are aquatic (water-dwelling) or benthic (occupying the lowest level of a body of water) include aquatic insects, crayfish, and mussels. Crayfish and aquatic insects (including stoneflies, mayflies, and caddisflies) consume organic matter that falls into rivers and streams, while mussels filter nutrients and sediment from the water. All are a food source for other animals. Fish and other stream-dependent creatures like water turtles and salamanders consume aquatic insects; crayfish are eaten by fish, birds, raccoons, and others; and mussels provide food and habitat to other animals.

Macroinvertebrates are good indicators of watershed health and water quality because they live in the water for all or most of their life, have limited mobility, and differ in their tolerance to amounts and types of pollution.

Monitoring

Macroinvertebrate monitoring is part of a broader effort by the National Capital Region Network (NCRN) Inventory & Monitoring (I&M) program to assess the condition of streams and watersheds.

Long-term macroinvertebrate monitoring at thirty-seven park sites throughout the NCRN began in 2008 and followed a six-year rotation. Each spring 5-8 sites were visited. At Harpers Ferry National Historical Park (HAFE) monitoring is done in Flowing Springs Run. Macroinvertebrate monitoring is co-located with fish monitoring and stream physical habitat analysis.

The objectives of this combined monitoring are to:

- Determine current conditions and track long-term trends in stream condition,
- Determine trends in species composition and functional groups of fish and benthic invertebrates

At each site, monitoring teams mark out a 75 meter stream segment. Organisms are dislodged from approximately 20 square feet of stream habitats and captured in a fine-meshed, D-shaped net (see photo). Riffles and other productive spots are sampled preferentially when available. The collected macroinvertebrates are preserved and subsampled to 100 individuals. Most are identified to genus if possible, using stereoscopes (low-magnification microscopes). Chironomidae (chironomids or non-biting midges) are slide-mounted and



Photo: NPS/Nortrup

Above: A fine-meshed D-shaped net is used to scoop up macroinvertebrates from promising stream habitat.

identified using compound microscopes. A list of taxa and their abundance at each site is generated.

BIBI Scores

The number and species of macroinvertebrates present in a stream segment is used to calculate a Benthic Index of Biotic Integrity (BIBI) score. Scoring takes into account factors such as:

- number and diversity of taxonomic groups
- the proportion of individuals belonging to specific taxonomic groups
- ability of individuals present to survive short- and long-term exposure to stressors from chemical pollution, changes in water quantity, or habitat degradation
- mode of feeding including scrapers, predators, collectors, filterers, and shredders
- habit tendencies including burrowers, climbers, clingers, and sprawlers

Scores also take into account Harpers Ferry's location in the highlands BIBI region. Key macroinvertebrate community attributes of a sampled site are compared to a non-degraded reference condition. BIBI scores range from 1 to 5 and are

More Information

Megan Nortrup
Email: megan_nortrup@nps.gov
Phone: 202-339-8314

<http://science.nature.nps.gov/im/units/ncrn>



ranked as follows: 1.0-1.9 (very poor), 2.0-2.9 (poor), 3.0-3.9 (fair), and 4.0-5.0 (good).

Results

Flowing Springs Run was monitored in 2013. It was also sampled in 2004 along with 2 sites on Elks Run while monitoring protocols were under development.

Elks Run (HARP-301-N-2004)

2004 BIBI = 2.75 (poor)

Number of taxa found: 11

Most common taxa: *Ephemera* (45), *Baetis* (34), *Gammarus* (17), and *Stenonema* (3).

Elks Run (HARP-302-N-2004)

2004 BIBI = 2.75 (poor)

Number of taxa found: 12

Most common taxa: *Ephemera* (38), *Baetis* (24), *Gammarus* (19), *Cheumatopsyche* (10), and *Stenonema* (5).

Flowing Springs Run (SHEN-110-N-2013)

2013 BIBI = 1.5 (very poor)

Number of taxa found: 23

Most common taxa: *Parametriocnemus* (44), *Simulium* (16), *Tvetenia* (9), *Parakiefferiella* (7), and *Naididae* (6).

Flowing Springs Run (SHEN-110-N-2004)

2004 BIBI = 2.25 (poor)

Number of taxa found: 27

Most common taxa: *Orthocladus* (29), *Rheocricotopus* (24), *Crangonyx* (6), *Tubificidae* (6), and *Hydropsyche* (5).

Discussion

Harpers Ferry occupies a region known for karst, a geology marked by groundwater that dissolves buried limestone layers. This process not only creates springs, sinkholes, and caves, but stream waters with lower levels of acidity and more dissolved material. These stream water characteristics nega-

Taxa Explained

Baetis - genus of mayflies in the family Baetidae.

Ephemera- genus of mayflies.

Gammarus - genus of amphipod crustaceans.

Orthocladus - genus of non-biting midges in the subfamily Orthoclaadiinae of the bloodworm family Chironomidae.

Parametriocnemus- genus of non-biting midges.

Parakiefferiella- is a genus of European non-biting midges in the subfamily Orthoclaadiinae of the bloodworm family (Chironomidae).

Rheocricotopus - a genus of European non-biting midges in the subfamily Orthoclaadiinae of the bloodworm family (Chironomidae).

Simulium - a genus of blackflies.

Tvetenia - a genus of non-biting midges of the bloodworm family Chironomidae.

tively influence in particular, the presence of clingers and Ephemeroptera (mayflies).

The two sites monitored on Elks Run in 2004 had nearly identical macroinvertebrate assemblages. Both earned poor BIBI scores due to low numbers of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) [also known as EPT]. Also, low numbers of Tanytarsini (a sensitive midge), and low overall numbers of taxa were found. The sites had moderate levels of disturbance-intolerant taxa, and scrapers, and good levels of swimmers and Diptera (true flies).

Flowing Springs BIBI scores dropped from poor to very poor between 2004 and 2012. While 27 taxa were found in 2004, 23 were found in 2012. In 2012, Flowing Springs had moderate numbers of overall taxa, low numbers of EPT, Ephemeroptera, disturbance-intolerant species, and Tanytarsini. There were a moderate number of scrapers and low numbers of swimmers and Diptera. In 2004, Flowing Springs findings were similar except that overall taxa numbers were good, there were moderate numbers of Tanytarsini, swimmers, and diptera instead of low numbers.

References

- National Capital Region Network Biological Stream Survey Macroinvertebrate Data (2008-2010). Versar, Inc. National Capital Region Inventory and Monitoring Program, Washington, DC. Generic Dataset-2175665. <https://irma.nps.gov/App/Reference/Profile/2175665>.
- NCRN Macroinvertebrate webpage. http://science.nature.nps.gov/im/units/ncrn/monitor/stream_survey/index.cfm.
- Norris, M. E., and G. Sanders. 2009. National Capital Region Network biological stream survey protocol: Physical habitat, fish, and aquatic macroinvertebrate vital signs. Natural Resource Report NPS/NCRN/NRR—2009/116. National Park Service, Fort Collins, Colorado. <https://irma.nps.gov/App/Reference/Profile/662917>.