



Macroinvertebrates

Resource Brief

Importance

A macroinvertebrate is any animal without a backbone that is large enough to be seen by the naked eye. Aquatic (water-dwelling) or benthic (occupying the lowest level of a body of water) macroinvertebrates 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 macroinvertebrates provide food for other animals. Fish and other stream-dependent creatures like lizards and salamanders consume aquatic insects; crayfish are eaten by fish, birds, raccoons, and others; and mussels provide food and habitat to other animals.

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 follows a set, six-year rotation. Each spring 5-8 sites are visited. At Prince William, monitoring is done on Carters Run, Mary Bird Branch, Mawavi Run, Middle Branch of Chopawamsic Creek, North Branch of Chopawamsic Creek, North Fork Quantico Creek, Orenda Run, and Taylor 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 work within 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 micro-



NPS/Nortrup

A fine-meshed D-shaped net is used to scoop up macroinvertebrates from promising stream habitat. Left: Mayfly larvae are pollution-sensitive organisms typically found in healthy streams.

scopes). *Chironomidae* (chironomids or non-biting midges) are slide-mounted and identified using compound microscopes. A list of taxa and their abundance at each site is generated.

BIBI Scores

The species and number 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, hydrologic alteration, 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 stream locations. All monitored streams in Prince William are in the Eastern Piedmont physiographic province except for Mary Bird Branch and Carters



Run which are in the Coastal Plain.

BIBI scores range from 1 to 5 and are ranked as follows:

- (4-5) good
- (3-3.9) fair
- (2-2.9) poor
- (1-1.9) very poor

Results

All streams were all monitored in 2011. Middle Branch Chopawamsic Creek was also monitored in 2004 and North Branch Chopawamsic Creek was monitored in 2004 and 2006 (at site very close to the 2011 location).

2011 BIBI scores indicated relatively good macroinvertebrate communities for all streams except Orenda Run which was in fair condition. The 2011 scores are all improved over earlier fair scores from 2004 and 2006.

Good BIBI scores for Prince William streams stem from the presence of pollution- and disturbance-sensitive macroinvertebrates such as *Ephemera* (mayflies) and *Amphinemura* (stoneflies). Sites also had only moderate amounts of pollution-tolerant Chironomid taxa.

No exotic crayfish or mussel species were found at any of the sites monitored in Prince William.

Carters Run (QUAN-104-N)

2011 BIBI = 4.14 (good)

Number of taxa found: 21

Most common taxa: *Amphinemura* (14), *Tanytarsus* (13), *Leuctra* (6), *Tanytarsini* (6), and *Polypedilum* (5).

Mary Bird Branch (QUAN-206-N)

2011 BIBI = 4.43 (good)

Number of taxa found: 28

Most common taxa: *Constempellina* (68), *Nais* (55), *Amphinemura* (37), *Ephemera* (27), and *Rheosmittia* (7)

Mawavi Run (QUAN-101-N)

2011 BIBI = 4 (good)

Number of taxa found: 35

Taxa Explained

Amphinemura - genus of stoneflies

Constempellina - genus of non-biting midges in the subfamily Chironominae of the bloodworm family

Ephemera - genus of mayflies

Leuctra - genus of stoneflies including needleflies

Nais - subgroup of pollution-tolerant Oligochaetes (worms)

Plauditus - genus of mayflies

Polypedilum - genus of non-biting midges in the subfamily Chironominae of the bloodworm family Chironomidae

Simulium - a genus of blackflies

Taeniopteryx - family of stoneflies

Most common taxa: *Amphinemura* (55), *Leuctra* (10), *Oulimnius* (6), *Polypedilum* (6), and *Bezzia* (4).

Middle Branch of Chopawamsic Creek (CHOP-103-N)

2011 BIBI = 4 (good)

Number of taxa found: 55

Most common taxa: *Simulium* (20), *Taeniopteryx* (16), *Plauditus* (12), *Amphinemura* (11), and *Tanytarsus* (11).

2004 BIBI = 3.67 (fair)

Number of taxa found: 25

Most common taxa: *Amphinemura* (24), *Simulium* (17), *Stenonema* (15), *Prosimulium* (13), and *Polypedilum* (13)

North Branch of Chopawamsic Creek (CHOP-102-N)

2011 BIBI = 4.33 (good)

Number of taxa found: 50

Most common taxa: *Plauditus* (23), *Oulimnius* (18), *Ephemera* (13), *Gomphidae* (11), and *Tanytarsus* (11).



2006 BIBI = 3.33 (fair)

Most common taxa: *Paramatriocnemus* (25), *Polypedilum* (17), *Leuctridae* (14), *Simulium* (9), and *Oulimnius* (7).

2004 BIBI = 3.67 (fair)

Number of taxa found: 23

Most common taxa: *Simulium* (36), *Prosimulium* (35), *Aphinemura* (8), *Stenonema* (5), and *Ephemerella* (5).

North Fork Quantico Creek (QUAN-201-N)

2011 BIBI = 4.33 (good)

Number of taxa found: 35

Most common taxa: *Wormaldia* (22), *Simulium* (17), *Prosimulium* (8), *Amphinemura* (7), and *Plauditus* (5).

Orenda Run (QUAN-102-N)

2011 BIBI = 3.33 (fair)

Number of taxa found: 24

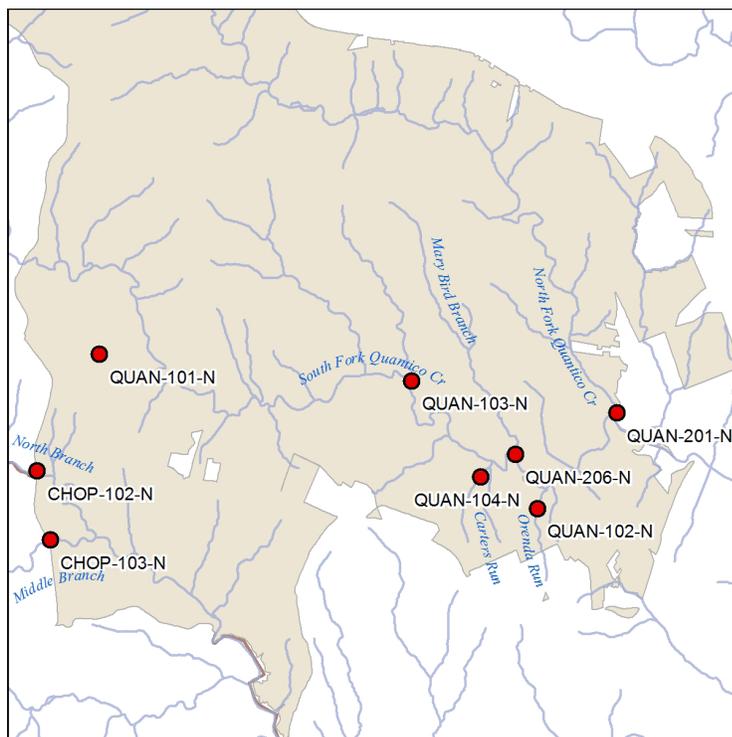
Most common taxa: *Amphinemura* (56), *Haploperla* (15), *Crangonyx* (6), *Simulium* (6), and *Bezzia* (5).

Taylor Run (QUAN-103-N)

2011 BIBI = 4.33 (good)

Number of taxa found: 38

Most common taxa: *Amphinemura* (36), *Constempellina* (30), *Ephemerella* (20), *Tanytarsus* (15), and *Leuctra* (8).



Sites in Prince William monitored for fish, macroinvertebrates, and stream physical habitat condition.

References:

- NCRN Monitoring Information for Fish, Physical Habitat, and Aquatic Macroinvertebrates. 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>.