

Benthic Macro-invertebrate Stream Sampling

Macroinvertebrate stream sampling is a technique used to monitor the health and water quality of streams. The technique depends on the fact that the insect larvae and other macroinvertebrates that live under rocks on the bottom (*benthos*) of streams can be divided into three groups depending on their sensitivity to pollution in the water:

Group #1: **Sensitive** to pollution (cannot survive in polluted water).

Group #2: **Somewhat sensitive** to pollution (can survive at low levels of pollution).

Group #3: **Tolerant** of pollution (can survive, or even thrive, in polluted water).

A stream is deemed healthy if the majority of species captured are sensitive or somewhat sensitive to pollution. Diversity (a number of different species) is also an indicator of a healthy stream with good water quality. The stream probably has pollution problems if only pollution-tolerant species are found. The procedure used at Camp Albemarle has been adapted from the Virginia Save Our Streams protocol for use with elementary and middle school students.

Procedure

1. Ask students the name of the river (Moorman). Ask why it is important to people living in Charlottesville (it flows into the Rivanna River Reservoir from which Charlottesville gets all its drinking water, etc). Have the students
2. Ask the students to observe the river from the bank and give their opinion on whether the water looks dirty or clean. Fill a glass jar with a sample of the water and hold it up. Remind students that while the water looks clean, some kinds of pollution cannot be seen. That is why we will be catching the insect larvae that live under rocks in the stream to reach a conclusion regarding the water quality.
3. Students capture a sample of benthic macroinvertebrates in the Moorman River using a net (kick seine). Two students hold the net in place while others stir up the bottom to dislodge the insect larvae. The sample is then examined on shore. Macroinvertebrates are removed from the net, placed in ice cube trays and identified with the help of the instructors. Green (sensitive), Yellow (somewhat sensitive) and Red (tolerant) cards are available to help in identifying the macroinvertebrates and determine their sensitivity to pollution.
4. A good wrap-up activity is to share the specimens collected by each group with the other groups, asking students to identify them and determine whether they are sensitive, somewhat sensitive or tolerant of pollution. Based on the results, ask the students whether they think the water in the Moorman River is relatively clean or polluted.

Field Worksheet: Calculating an Index of Water Quality

Use the *Macroinvertebrate Invertebrate Species* cards to identify each organism you collect. Write the name of each kind of macroinvertebrate on a line under the class it belongs to - Class 1, Class 2 or Class 3 - using the lists below. Perform the calculations and add up the numbers to get your Water Quality Index.

Class 1 - Pollution Sensitive

caddisfly larva
mayfly larva

stonefly larva
gilled snail

Class 2 - Moderately Pollution Tolerant

"water penny"
riffle beetle
netspinner

hellgrammite
dragonfly larva
damselfly larva

fingernail or pea clam
crayfish

Class 3 - Pollution Tolerant Organisms

blackfly larva
midge larva
horsefly larva

crane fly larva
aquatic worm

lunged snail
leech

Water Quality Index

Excellent = 23 and above

Good = 17 - 22

Fair = 11-16

Poor = 10 or below

Biological Monitoring Field Worksheet

River: _____ Temperature: _____

Weather: _____ Water Level: _____

Class 1 (Sensitive to Pollution - they need clean water!)

_____	_____
_____	_____
_____	_____

Total number of TYPES found: _____ X 3 = _____

Class 2 (Somewhat Sensitive to Pollution.)

_____	_____
_____	_____
_____	_____

Total number of TYPES found: _____ X 2 = _____

Class 3 (Tolerant of Pollution)

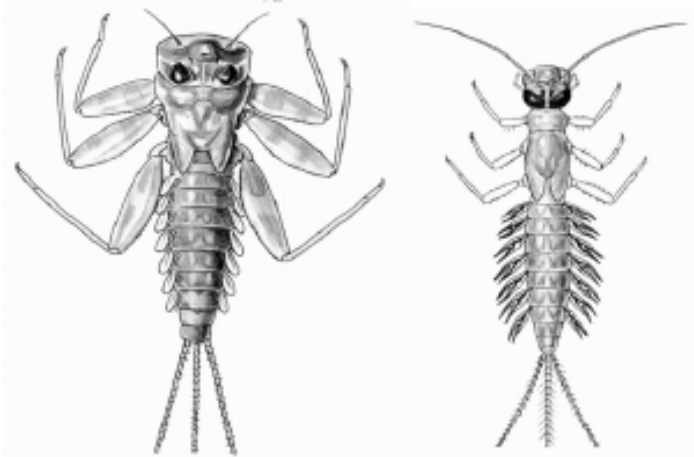
_____	_____
_____	_____
_____	_____

Total number of TYPES found: _____ X 1 = _____

GRAND TOTAL = _____

Macroinvertebrate Index Species

Sensitive to Pollution



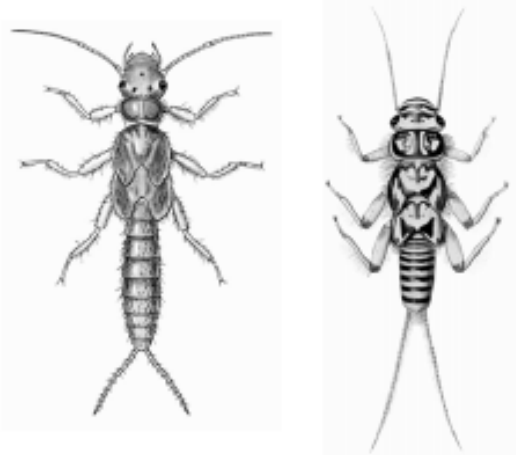
Mayflies

Feathery gills on abdomen. Three tails.
One claw on the end of each leg.



Caddisflies

Hooked legs on upper third of
body. No gills. May live in a
stick, rock or leaf case.



Stoneflies

Two claws on the end of each leg.
Two tails. No gills on abdomen
(gills on thorax).

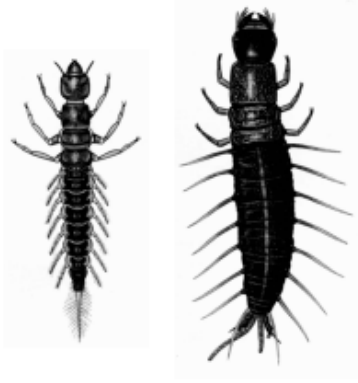


Gilled Snail

Right-handed opening.

Macroinvertebrate Index Species

Somewhat Sensitive to Pollution



Alderfly and Hellgrammite

Large pinching jaws. 8 pairs of feelers along abdomen. Alderfly has spiky tail and Hellgrammite has two hooks on tail.



Netspinning Caddisfly

Six hooked legs on upper third of body. Gills on abdomen.



Fingernail or Pea Clam

Filter-feeding bivalve. Burrows into soft sediment



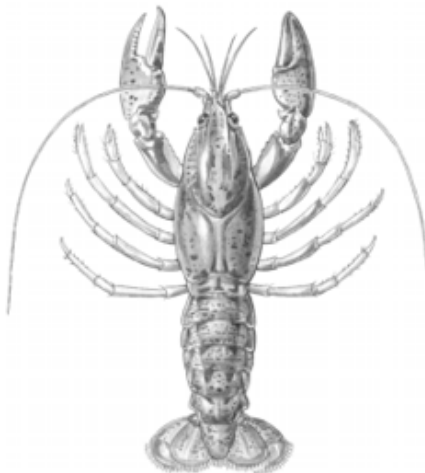
Riffle Beetle and Beetle Larvae

Adult beetle sinks and crawls around under water. Waterpenny is round and flat. Larvae has segmented body with legs at front.



Dragonfly and Damselfly

Both have large eyes and long legs. Dragonfly has large oval abdomen. Damselfly has 3 broad oar-shaped tails.



Crayfish

A crustacean which resembles a small lobster, with 8 legs and 2 large claws. Up to 6 inches.

Macroinvertebrate Index Species

Tolerant of Pollution



Midges

Worm-like segmented body with distinct head. Two leg-like projections on each side. Whitish or clear, sometimes red.



Cranefly & Horsefly

Bodies large, plump and caterpillar-like. No distinct head parts. Tail may have lobes.



Blackfly

End of abdomen wider than head. Sucker on end of abdomen.



Aquatic Worm

Thin, worm-like body. Often pink or red.



Lunged Snail

Left-handed opening.



Leech

Segmented body with suction cups on both ends. Swims through water with undulating movement

