

Aquatic Macroinvertebrate Field Guide for Georgia's Streams

Georgia Adopt-A-Stream



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Macroinvertebrate Monitoring

Macroinvertebrates include aquatic insects, crustaceans, and mollusks that live in various stream habitats and derive their oxygen from the water. These organisms are impacted by all the stresses that occur in a stream environment, both man-made and naturally occurring. The purpose of macroinvertebrate monitoring is to quickly assess both water and habitat quality based on the presence of macroinvertebrates. The diversity of macroinvertebrates found in a stream indicates the overall quality of the stream, due to the fact that some taxa are more sensitive to pollution than others. Organisms that are highly sensitive to pollution are unable to survive in degraded waters, while those which are tolerant to pollution may be dominant in such systems.

Populations of macroinvertebrates may also differ throughout the state. This biological index is based on dissolved oxygen levels, which are often impacted by pollution. However, many "sensitive" organisms that require a lot of oxygen, such as the stonefly, are not often found in warm, slow-moving streams in South Georgia. It does not necessarily mean that the stream has poor water or habitat quality, simply that streams in North and South Georgia support different populations of macroinvertebrates. For this reason, we recommend monitoring each season for several years to determine the biological trends in your stream. While monitoring, you may also encounter invasive species like the Green Mussel or Asian Clam. After documenting this information, contact our office to report your findings.

Using This Field Guide

This field guide was created to aid Georgia Adopt-A-Stream (AAS) volunteer monitors in the identification of macroinvertebrates in the field. The guide features illustrations of each macroinvertebrate along with detailed descriptions of common characteristics. With this information, volunteers will be able to identify macroinvertebrates to the order or family level.

After obtaining a representative sample according to the AAS protocols found in the Macroinvertebrate Monitoring Manual, compare macroinvertebrates to the illustrations. Pay close attention to the body shape and the number of legs and tails, as the size and color may vary.

The macroinvertebrates are divided into three categories according to their dissolved oxygen requirements: sensitive, somewhat sensitive, and tolerant. Taxa in the sensitive category require streams that have high levels of dissolved oxygen, such as mayflies and water pennies. Somewhat-sensitive taxa, such as the net-spinning caddisflies and dragonflies, can survive in streams with moderate levels of dissolved oxygen. Taxa in the tolerant category can survive in degraded streams with very low dissolved oxygen levels, such as aquatic worms, blackflies, and lunged snails. By identifying the macroinvertebrates and their tolerance category, volunteer monitors can determine the overall health of their adopted stream.

INSECTS

Stoneflies

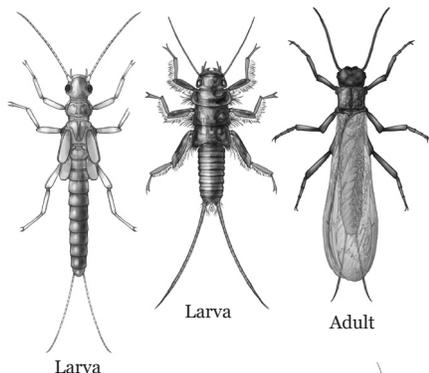
Order: Plecoptera

Size: 1/2" to 1 1/2"

Tolerance: Sensitive

Distinguishing Characteristics:

- Two hair-like tails
- No gills on rear half of body
- Structurally similar to mayfly nymphs, but have two tails instead of the usual three in mayflies
- 2 claws on each foot



Mayflies

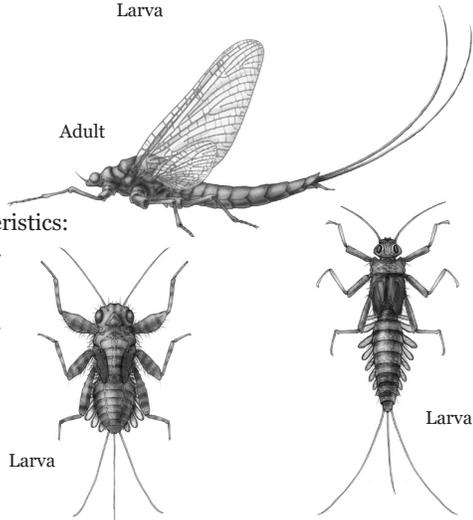
Order: Ephemeroptera

Size: 1/4" to 1"

Tolerance: Sensitive

Distinguishing Characteristics:

- Usually three long, hair-like tails (but sometimes only two)
- Gills present on the rear half of body
- 1 hook on each foot



Water Pennies

Order: Coleoptera

Size: up to 1/2"

Tolerance: Very sensitive

Distinguishing Characteristics:

- Looks like a flat, oval disc
- Plates extend from all sides
- Cannot survive on rocks covered with excessive algae or inorganic sediment



Riffle Beetles

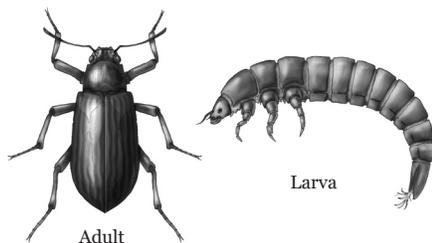
Order: Coleoptera

Size: 1/16" to 1/8"

Tolerance: Sensitive

Distinguishing Characteristics:

- Very small
- Dark colored
- Adult riffle beetles will be found walking on the bottom of the stream



Aquatic Snipe Flies

Order: Diptera

Size: 1/4" to 1"

Tolerance: Sensitive

Distinguishing Characteristics:

- Body is pale brown to green color
- Mostly cylindrical, with the front tapering to a cone-shaped point
- Larva have a number of mostly paired caterpillar-like prolegs
- Two stout, pointed tails with feathery hairs at back end



Caddisflies

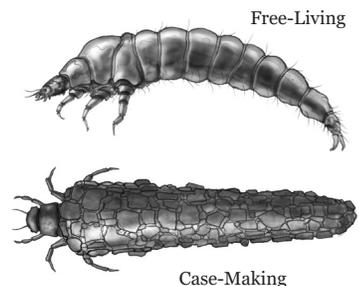
Order: Trichoptera

Size: 1/2" to 1 1/2"

Tolerance: Sensitive

Distinguishing Characteristics:

- Larva is caterpillar-like with three pairs of legs and tends to curl up slightly
- Two claws at posterior (rear) end
- May be found in a stick, rock, or leaf case with its head sticking out



Common Net-Spinning Caddisflies

Order: Trichoptera

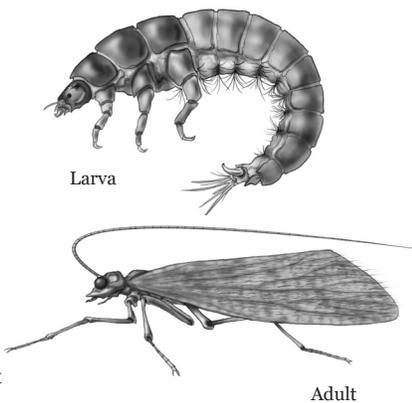
Family: Hydropsychidae

Size: up to 1"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Body is caterpillar-like with three pairs of legs and is strongly curved
- Dorsal plates (sclerites) on all three thoracic segments
- Branched gills on the ventral surface of the last two thoracic segments and most of the abdominal segments
- Usually have a bristle-like, setal tuft at the end of each anal proleg
- Color varies from bright green to dark brown



Dobsonflies/Hellgrammites and Fishflies

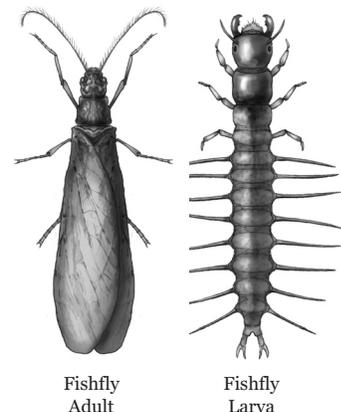
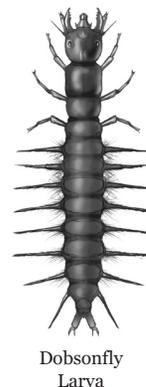
Order: Megaloptera

Size: 3/4" to 4"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Stout body with large pinching jaws
- Eight pairs of pointed lateral appendages
- On the rear end of the body, a pair of stubby, unjointed legs (prolegs), each with a pair of claws
- Dobsonflies/Hellgrammites have paired cotton-like gill tufts, fishflies lack these
- Fishflies have two short tube-like structures on the tail end



CRUSTACEANS

Damselflies and Dragonflies

Order: Odonata

Size: 1/2" to 2"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

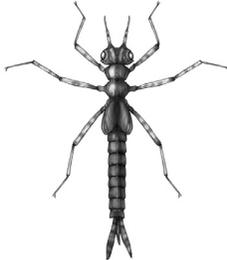
- Both have large eyes, six legs, and a large lower lip that covers much of the bottom of the head
- Damselflies are slender and have three oar shaped tails (gills)
- Dragonflies have a stocky body without tails



Dragonfly Adult



Dragonfly Larva



Damselfly Larva

Crane Flies

Order: Diptera

Size: 1/3" to 2 1/2"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Worm-like plump body
- Can be found in a variety of colors (clear, white, brown, and green)
- Segmented body with finger-like projections (gills) at the back end
- Head is usually pulled back into the front of the body



Larva



Adult

Midge Flies

Order: Diptera

Size: up to 1/4"

Tolerance: Tolerant

- They can indicate poor stream health caused by pollution if found in large numbers

Distinguishing Characteristics:

- Often whitish to clear, but occasionally bright red
- Segmented body
- Has distinct head with two small prolegs in the front of the body
- Display a spastic squirming action in the water



Larva



Adult

Black Flies

Order: Diptera

Size: up to 1/4"

Tolerance: Tolerant

Distinguishing Characteristics:

- The body is larger at the rear end similar to the shape of a bowling pin
- The distinct head contains fan-like mouth brushes
- Often curl into a "u" shape when held in your hand



Adult



Larva

Crayfish

Order: Decapoda

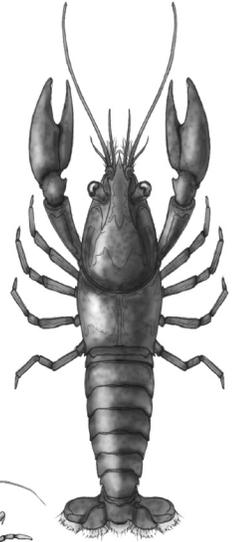
Size: up to 5"

Tolerance: Somewhat sensitive

- Can withstand large ranges of pH and temperatures and is sensitive to toxic substances

Distinguishing Characteristics:

- Resembles a lobster
- Has 10 legs and the two front legs have large claws or pincers



Aquatic Sow Bugs

Order: Isopoda

Size: 1/4" - 3/4"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Flat, segmented body
- Has an "armored" appearance
- Seven pairs of legs
- Can be confused with scuds, however they are flattened top to bottom



Scuds

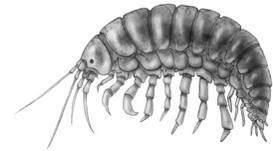
Order: Amphipoda

Size: 1/8" to 1/4"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Resemble a small shrimp
- Translucent body with silvery-gray or tan coloration
- Seven pairs of legs
- Unlike sow bugs, scuds are flattened side to side



WORMS

Aquatic Worms

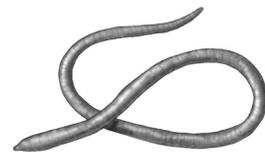
Class: Oligochaeta

Size: Usually 1" but up to 4"

Tolerance: Tolerant

Distinguishing Characteristics:

- Can be very tiny and slender or look similar to earthworms
- No legs, distinct head or any mouthparts
- Segmented body
- Aquatic worms can indicate organic pollution when they dominate the majority of the sample collection



Leeches

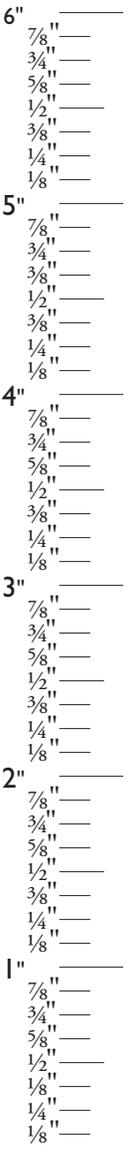
Class: Hirudinea

Size: 1/4" to 2"

Tolerance: Tolerant

Distinguishing Characteristics:

- Somewhat slimy, soft, segmented body
- Two suckers on the underside of the body, one in the front and one in the rear
- Can be confused with a flatworm, however flatworms have no suckers and leeches have fine lines (annuli) across the body



MOLLUSKS

Gilled Snails

Class: Gastropoda

Size: 1/4"-1"

Tolerance: Sensitive

- Gill breathing; therefore, they are more sensitive to low dissolved oxygen than lunged snails

Distinguishing Characteristics:

- Usually opens to the right when the narrow end is pointing upward
- Shell opening covered by a thick plate (operculum)
- When monitoring, do not count empty shells



Lunged Snails

Class: Gastropoda

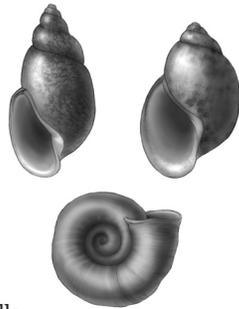
Size: up to 2"

Tolerance: Tolerant

- They can tolerate severe organic or nutrient pollution that consumes oxygen in the water

Distinguishing Characteristics:

- Usually opens to the left when the narrow end is pointing upward
- Have no operculum and breathe oxygen from the air
- When monitoring, do not count empty shells



Clams and Mussels

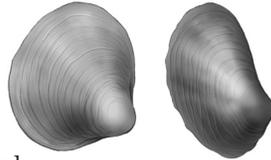
Class: Bivalvia

Size: up to 5"

Tolerance: Somewhat sensitive

Distinguishing Characteristics:

- Fleshy body enclosed between two clamped shells
- If alive, the shells cannot be pried apart
- When monitoring, do not count empty shells



SPECIAL THANKS:

This field guide draws on the experience of many professionals. Georgia Adopt-A-Stream gratefully acknowledges the following people for their advice and support:

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REFERENCES:

Brigham, A.R., W.U. Brigham, and A. Gnillka (eds.) 1982. The aquatic insects and oligochaetes of North and South Carolina. Midwest Aquatic Enterprises, Mahomet, IL.

Izaak Walton League of America, 2003. A Volunteer Monitor's Field Guide to Aquatic macroinvertebrates.

McCafferty, W.P. 1981. Aquatic Entomology. The Fisherman's and Ecologists Illustrated Guide to Insects and Their Relatives. Science Book International, Boston, MA.

Merritt, R.W., and K.W. Cummings (eds.) 1996. An Introduction to the Aquatic Insects of North America. 3rd edition. Kendall/Hunt Publishing Company, Dubuque, IA.

Thorpe, J.H. and A.P. Covich (eds.) 1991. Ecology and classification of North American freshwater invertebrates. Academic Press, San Diego, CA.

Voshell, J.R. 2002. A Guide to Common Freshwater Invertebrates of North America. The McDonald & Wood-ward Publishing Company, Blackburg, VA.

Georgia Adopt-A-Stream

Georgia Adopt-A-Stream (AAS) is the State's volunteer water quality monitoring program. AAS is housed in the Nonpoint Source Program of the Watershed Protection Branch of the Georgia Environmental Protection Division. It is funded by Section 319(h) of the Federal Water Pollution Control Act. AAS is dedicated to increasing public awareness of Georgia's nonpoint source pollution and water quality issues. To accomplish these goals, AAS encourages individuals and communities to adopt, monitor, and improve sections of streams, wetlands, lakes, and coastal waters.

There are a number of ways to get involved with AAS. After selecting and adopting a site, volunteers can choose the type of monitoring they would like to conduct. Certain procedure-based monitoring types (QA/QC), such as macroinvertebrate, chemical, and bacterial monitoring, require certification. Certification can be obtained at one of our free, hands-on workshops. Volunteers can also opt to conduct more observation-based monitoring (non-QA/QC), such as visual monitoring or the watershed survey, for which workshops are also offered, but certification is not required.

All of the data collected from AAS monitoring events are entered into our online, open-access database. These data are then used to establish baseline water quality conditions, educate the public, detect problems, and much more. AAS volunteers are encouraged to use and share their own data with their communities as well!

AAS offers support to thousands of volunteers across the state via our network of local coordinators, who can provide guidance, loan equipment, and conduct workshops. AAS also sends out a quarterly newsletter with water-related articles and program updates. If you are looking for even more ways to get involved, consider checking out the other EPD Outreach programs: Rivers Alive, Georgia Project WET, and River of Words. We invite you to join us to help protect Georgia's water resources. For more information, reach out to us using the contact information below.

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