

EXPLORING STREAMS: FUN WITH BUGS

Materials: BMI key, bucket, ice cube tray, tweezers, magnifying glass, net, smart phone for apps (*optional*)

Background: Benthic macroinvertebrates (or BMIs) are the “bugs” that you can find in streams in West Virginia. These “bugs” are large enough to be seen without a microscope (*macro*), have no backbones (*invertebrate*), and live at the bottom of streams (*benthic*). BMIs are important because they can show how clean or how polluted rivers and streams are. By investigating which types of benthic macroinvertebrates we find in a stream, we can see if the water is clean or find out if there is too much dirt, chemicals, or litter. Check out the Cacapon Institute BMI link at <http://eschool.cacaponinstitute.org/elementary.htm> for more information.

Directions: Stream scientists test how clean water is in a stream by looking for benthic macroinvertebrates. Your job will be to look for different BMIs in a stream, find out which type they are, and keep a checklist. **Remember to be safe around streams and look for sharp rocks, deep pools, broken glass, and slippery areas.**



There are three good places to look for benthic macroinvertebrates. Number one is in riffles (places in the stream where water runs over the rocks and makes little rapids) because it keeps oxygen in the water for the bugs. The number two place to look is in places with lots of sticks and leaves because this is food for benthic macroinvertebrates. The number three place is underneath rocks in the stream because this is where BMIs make a home.

WHY IS THIS IMPORTANT?

Some BMIs can only live in streams that are very clean. These bugs are “very intolerant of pollution” as you will see in your BMI packet. If you find these bugs in the stream, it means that the water is very clean and there is little pollution like chemicals or dirt. Some other bugs can live anywhere, even if the water is polluted. On the key these are “very tolerant of pollution” and if you find these BMIs, it is hard to tell if the water is clean or not. Other benthic macroinvertebrates are somewhere in the middle. Stream scientists keep notes about what types of BMIs they find to determine if the water in a stream is clean and healthy or dirty and polluted. Scientists can use this information to clean up streams and rivers in West Virginia.

The best way to catch benthic macroinvertebrates is by using a net. By moving the rocks and dirt in the bottom of the stream and holding the net downstream, all the BMIs will flow into the net with the dirt. You can also scrape the bottom of rocks into a bucket or net or look for individual bugs and pluck them with tweezers into your bucket. Make sure to keep all your BMIs in a bucket with water to keep them alive. If the water gets too hot, the benthic macroinvertebrates will not be able to breathe, so keep the bucket in the shade and after some time, release them back into the stream.



After collecting your samples from the stream, use your tweezers to go through the dirt and look for bugs. Be gentle with your tweezers when you pull out BMIs from the sample. A good tool to sort benthic macroinvertebrates is an ice cube tray. Place ones that look similar under a magnifying glass in the same sections. Take pictures of the bugs you find so you can go back to look after they are back in the stream.

Using your BMI Packet, look through the images of benthic macroinvertebrates to match



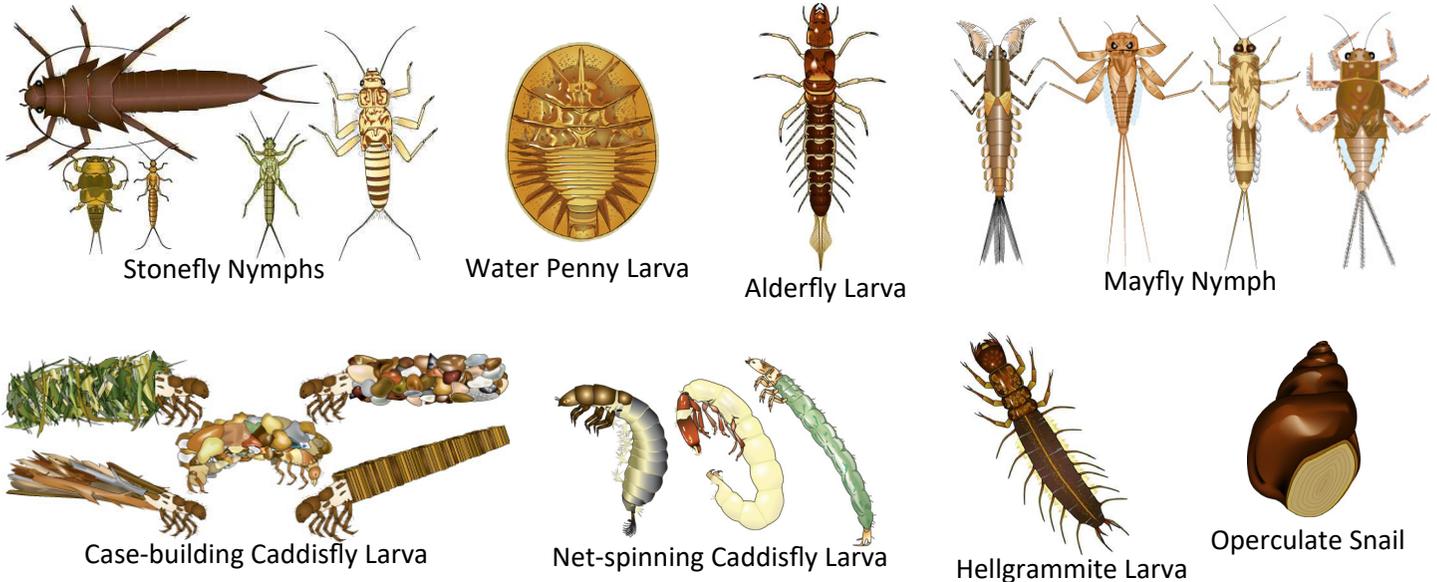
what you found to the proper name. Inside your packet is a checklist to keep track of which bugs you found. If you have a smart phone, download the Aqua Bugs or Creek Critters app to help. They will ask you questions with photos to guide you towards the correct name of the BMIs you find. Later, you can use the Cacapon Institute BMI link above to review what you were able to find and look at the photos you took to compare.

To get your summer fun box, send in a picture of your BMIs at

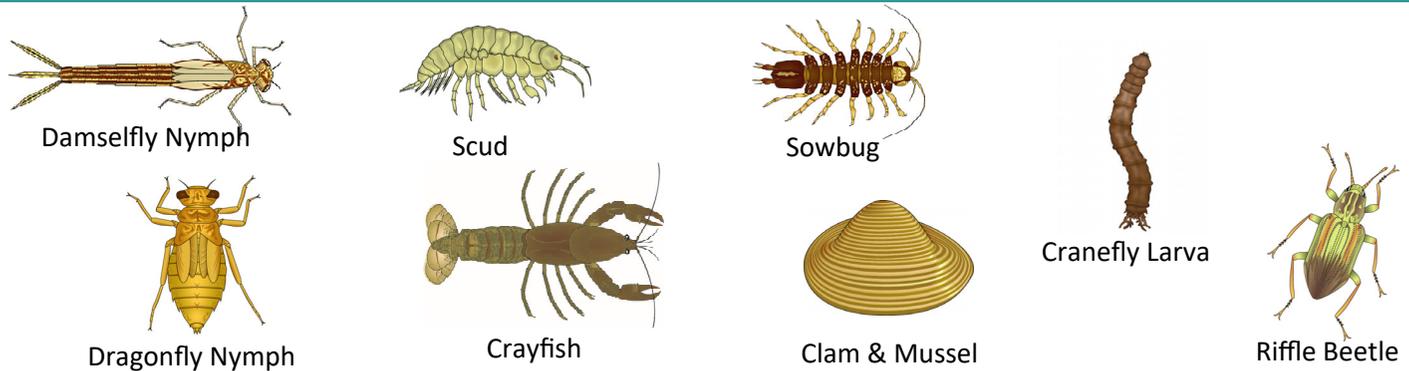
<https://www.cacaponinstitute.org/teach/stream-scholars-summer-camp/>

Benthic Macroinvertebrates

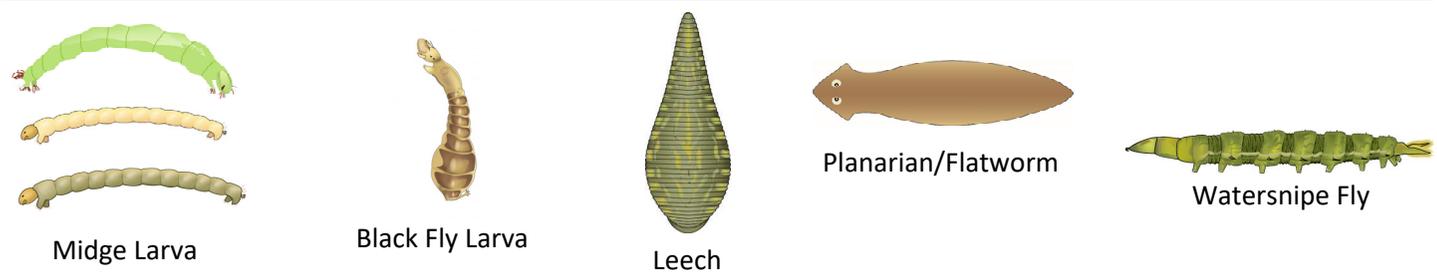
Group 1– Very Intolerant of Pollution



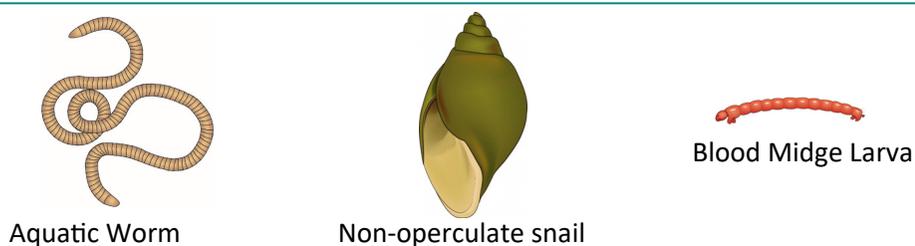
Group 2– Moderately Intolerant of Pollution



Group 3– Fairly Tolerant of Pollution



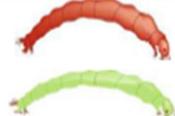
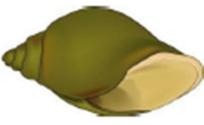
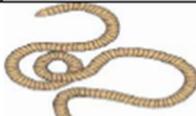
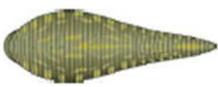
Group 4– Very Tolerant of Pollution



Data Sheet

Benthic macroinvertebrates: Use the table below to record information about your macroinvertebrate collections.

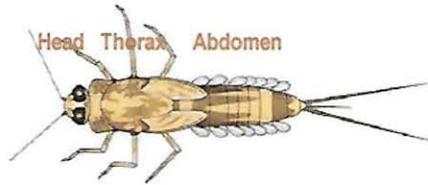
Illustrations courtesy of the [Cacapon Institute](#); Jennifer Gillies, artist

 Stoneflies	# of kinds <input type="text"/>	 Mayflies	# of kinds <input type="text"/>	 Caddisflies	Case-builders # of kinds <input type="text"/>
 Dragonflies	# of kinds <input type="text"/>	 Caddisfly	Common netspinner	 Caddisflies	Other net-spinners # of kinds <input type="text"/>
 Damselflies	# of kinds <input type="text"/>	 Riffle beetle		 Water penny	
 Fishfly/Hellgrammite		 Alderfly		 Other beetles	# of kinds <input type="text"/>
 Midges		 Black fly		 Crane fly	
 Watersnipe fly		 Other flies	# of kinds <input type="text"/>	 Crayfish	
 Clams	# of kinds <input type="text"/>	 Mussel		 Scud/Sideswimmer	
 Operculate snails	# of kinds <input type="text"/>	 Non-operculate snails	# of kinds <input type="text"/>	 Aquatic sowbug	
 Aquatic worm		 Leech		 Flatworm	

Other aquatic life observed or collected: _____

Note: Include True bugs in the "Other beetles" category

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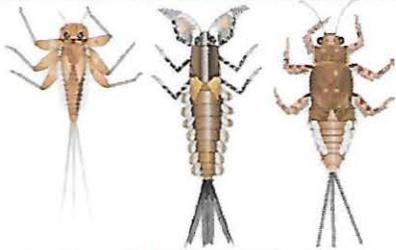


Small minnow mayfly

What is an insect? An insect is an invertebrate (an animal with no spine) that has three-pairs of legs (except Diptera) and three body divisions; the head is the location of the mouth, antenna and eyes; the thorax is the attachment site for the legs and wing pads; and the abdomen, which often has a variety of structures attached including filaments gills and tails. Gills are usually leaf-like, plate-like, or thin filaments. Tails can be long and thin, hairy, webbed or paddle-like. Most of the **benthic macro-invertebrates** you will encounter during stream surveys are aquatic larva or nymphs of insects. Most adult stages are not aquatic but the beetles are the exception. The majority of the insects are described and illustrated on page one and the top of page two; non-insect group descriptions and illustrations begin on page two.

Instructions provided at the bottom of page two

Insect Groups



Mayflies (Order **Ephemeroptera**): Three-pairs of legs with a single hook at the end; three sometimes two tail filaments; gills attached to the abdomen, which may sometimes be covered and difficult to see. Mayflies exhibit several types of move-ments (or habits); swimmers, clingers, crawlers and burrowers. (VS-M) (M)

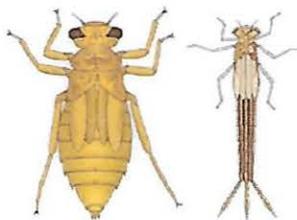


Stoneflies (Order **Plecoptera**): Three-pairs of legs with two-hooks at the end; two tail filaments; no gills attached to the abdomen but some kinds may have gills near the top of the abdomen; gills if visible, mostly on the legs and thorax. (S-VL) (M)



Case-building caddisflies (Order **Trichoptera**): Grub-like soft body and a hard head; Three-pairs of legs located on the upper third of the body; tail is small and usually forked, sometimes fringed with hairs; gills are scattered on the underside of the abdomen. The case (retreat) is a relatively solid structure made of a variety of stream-bed materials held together by silk. (VS-L) (M)

Dragonfly Damselfly



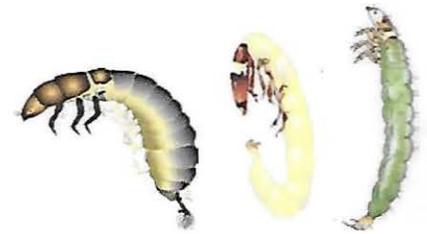
Dragonflies and Damselflies (Order **Odonata**): Three-pairs of legs; large eyes; long spoon-like jaws; no tails on the abdomen. Dragonflies have a broad shaped abdomen, while the Damselfly abdomen is much narrower. Damselfly gills are attached to the end of the abdomen, they look like tails. (M-VL) (M)

Hellgrammite Alderfly



Fishflies and Alderflies (Order **Megaloptera**): Three-pairs of legs; large pinching jaws; eight-pairs of filaments attached to the sides of the abdomen. Fishflies also called **hellgrammites** have a two-hooked tail, whereas Alderflies have a single tapered tail and are usually much smaller and lighter in color. (M-VL)

Common netspinner Finger-net Free-living



Net-spinning caddisflies (Order **Trichoptera**): Similar characteristics as above but the abdomen usually has more abundant gills, especially the **common netspinner** (family **Hydropsychidae**). The net-spinner's retreat is also made of a variety of streambed materials, which are held together more loosely by fine strands of silk. The **free-living caddisfly** (right) does not build a case or net. (S-L) (M)

Water penny Riffle beetles Whirligig beetle



Beetles (Order **Coleoptera**): Three-pairs of legs; body usually covered by a hard exoskeleton. The Most common kinds collected are the **water penny** and **riffle beetles** (left-right), but others kinds are also found. (VS-L) (M)

True flies (Order **Diptera**): Usually the body is segmented with some type of visible features either along the body, or at the head or tail regions (i.e. head, tails, prolegs, whelps etc.). This order is the only aquatic insect without fully developed legs in the larval stages. Dipterans are very diverse order with many aquatic varieties. Several common kinds are described here. (M)



Non-biting midge (Order **Diptera**; family **Chironomidae**): Segmented body with a visible head; two leg-like projections at the front and rear. Sometimes they are bright red in color. (VS-M)

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Crane fly (Order **Diptera**; family **Tipulidae**): No legs, no visible head; plump body with lobes along the segments; may have structures that look like tentacles, lobes or one bulb at the end of the body. (S-VL)

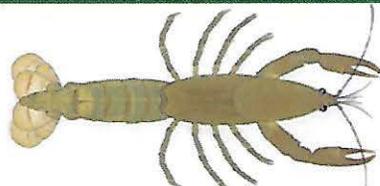


Black fly (Order **Diptera**; family **Simuliidae**): Body has a bowling-pen shape (lower is wider than the upper); there are multiple brushes/fans on the head and a ring of hooks on the abdomen. (VS-M)



Watersnipe fly (Order **Diptera**; family **Athericidae**): Plump body, looks very much like a caterpillar; on the underside there are structures that look similar to legs but are not segmented; the tail is forked and fringed with hairs. (S-L)

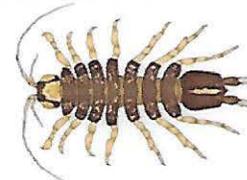
Non-Insect Groups



Crayfish (Order **Decapoda**): Five pairs of legs, the first two usually have large claws; large flipper-like structure at the end of the abdomen. (M-VL)



Scud/Sideswimmer (Order **Amphipoda**): Seven pairs of legs, the first two may be claw-like; body is somewhat higher than it is wide. Usually swims with a sideways motion. (S-M)



Aquatic sowbug (Order **Isopoda**): Seven pairs of legs, the first two may be claw-like; very long antenna; body is wider than it is high, giving the animal a fairly flattened appearance. (S-M)

Mussel Clams



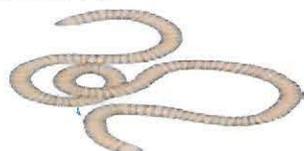
Clams and Mussels (Class **Bivalvia**): Fleishy body enclosed between two-hinged shells; the shape and ridge spacing of the shells can determine different kinds. **Mussels** are usually larger than clams and have dark colored oblong shells. (VS-VL) (M)



Operculate snails (Class **Gastropoda**; sub-class **Prosobranchia**): Fleishy body enclosed by a single shell, which is usually coiled in an upward spiral. The opening of the shell is covered by an operculum (door). (VS-L) (M)



Non-operculate snails (Class **Gastropoda**; sub-class **Pulmonata**): Fleishy body enclosed by a single shell, which is sometimes coiled upward but also may lie flat or have a conical shape. The opening of the shell is not covered by an operculum. (VS-L) (M)



Aquatic worms (Class **Oligochaeta**): Body is long with numerous segments along its entire length; has no visible head or tail. (VS-VL)



Leeches (Class **Hirudinea**): Body is long and thin or slightly widened; 34-segments along its length, but there appears to be many more. (S-VL)



Flatworms (Class **Turbellaria**): Soft elongate body without segment; head triangular shaped with eyes on top, which give the animal a cross-eyed appearance. (VS-L)

<http://www.dep.wv.gov/sos>

Sizes illustrated not proportional



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Instructions: Identification is easier when the organism is viewed in the same orientation as its illustration. Illustrations are drawn mostly in top and side views; the water penny is shown in underside view. The (M) symbol indicates that multiple kinds may be collected from the group (Order or Class). Use **morphological** features as your basis for identification; the size and color are often variable and influenced by environmental factors. Only a few of the many kinds possible are illustrated. (Size range in mm)

Size categories: > 50 Very large (VL); 50 - 30 Large (L); 29 -10 Medium (M); 10 - 5 Small (S); < 5 Very small (VS)

Note: This field guide will help you identify common aquatic invertebrate classes and orders, and a few families. You should always refer to a more complete guide for verification of family level identification. Eventually, you will be able to identify a wide variety of families in the field.