

2022 LANCASTER COUNTY MIDDLE SCHOOL ENVIROTHON AQUATICS of BACKYARD STREAMS AND CREEKS

CADDISFLIES: A caddisfly is an engineer of the macroinvertebrate world. The larvae build a shelter or case out of twigs, stones, bits of leaf, bark, or other materials in the water. They bind the parts together with a glue-like substance. They often add to the case as they grow, and eventually the larvae transform into a pupa in the shelter. Some species attach the shelter to a rock in a fast-flowing stream. After 6-10 months in the larvae stage then pupa stage, the caddisfly breaks out of the shelter and makes its way to the surface. Climbing out on a rock it sheds its exoskeleton and emerges as an adult. Its adult stage is short, only 1-4 weeks. Females return to the surface of the water or dive to the bottom to lay eggs to start the next generation. Caddisflies are somewhat tolerant of pollutants in the water and are considered facultative.



CLAMS AND MUSSELS: Nestled among the rocks in the stream or river, freshwater clams and mussels silently filter the particles from the water. They remove the silt or sediment and nutrients attached to sediment, clarifying the water and reducing particles that can cause pollution. Unfortunately, freshwater clam and mussel populations in Pennsylvania are declining due to habitat loss, invasive species, and pollution. Conservation practices to reduce sediment and build habitat are underway by like minded groups across the state.



CRAYFISH: Crayfish are one of the most endangered groups of animals in North America. Habitat loss and pollution are a threat to crayfish, but the biggest concern may be the introduction of invasive crayfish in our waterways. Invasive crayfish overtake habitat in large numbers and eat the food that native crayfish need. Many fish do not eat invasive crayfish, like the Rusty Crayfish, because it grows large and is aggressive. The best way to stop the spread of invasive crayfish is by not using crayfish as fishing bait.

There are 12 species of crayfish in Pennsylvania. Some people also call them “crawdads” or “crawfish”. They are like the army tanks of the aquatic world, with five pairs of jointed legs. They can move over obstacles and in any direction – forward, sideways, or backward. Swimmerets under the abdomen help them swim and balance. Crayfish swim backwards flipping their tail to breathe.



A hard exoskeleton protects crayfish. Crayfish shed or molt as they grow. They breathe through gills under the carapace. Their eyes are on movable stalks to allow sight in different directions. If they lose a claw, they are able to grow a new one. They are omnivores and also serve as prey to fish, reptiles, and mammals.

DRAGONFLY AND DAMSELFLY:

Dragonfly larvae are aquatic, usually drab brown with 6 legs, large eyes, and small wing buds on the back of the thorax. Gills are located at their hind end. They breathe by drawing water in and out of their hind end. By forcefully expelling this water, the dragonfly can move quickly in a form of jet propulsion. The lower jaw is scoop like and covers most of the bottom part of the head. They are fierce predators of any aquatic animal they can catch.



Damselfly larvae are aquatic slender insects with 6 thin legs, large eyes, and small wing buds on the back of the thorax. The 3 gills are paddlelike and attached at the end of the abdomen. The eyes are compound, large, but usually do not touch. The 6 legs are poor for walking but good for perching. They capture prey by shooting out the long hinged lower lip.



DOBSONFLY: Dobsonfly larvae are called hellgrammites, are aquatic, somewhat flattened, and usually some shade of black, brown, or tan. Some may have an appearance like a centipede. The head has a pair of sharp pincers that can deliver a painful bite. The thorax has 3 pairs of legs. The abdomen has 8 pairs of leg like appendages extending from the sides with hair like gill tufts at the base. There is a pair of hooked appendages at the hind end that help keep the insect from being swept away in the water current.

Dobsonfly eggs hatch in 1-2 weeks and always at night. The newly hatched hellgrammites are often buoyed by an air bubble and float until reaching a suitable site to cling to a rock. They live under stones feeding on caddisflies and blackflies. Before emerging from the water as an adult, they transition to pupa phase digging in the sediment at the stream floor.





MAYFLY: Mayflies are recognized by three tails like the three letters in the word May. There is one Mayfly with two tails but majority have three. They rapidly move feathery external gills along their abdomen to breathe. They are sensitive to pollution and if found indicate a healthy water system. Mayflies larvae feed on detritus and other plant materials. Some may also feed on insects. They spend most of their lives in the water and then emerge as adults living for only a day. In fact, as an adult, they have no mouth and will not eat or drink.



FRESHWATER SHRIMP/SCUD: Scuds like habitat in streams with a limestone bedrock. These types of streams have more calcium. Scuds are known as side-swimmers and appear to be doing stomach crunches in the water. Scuds are omnivores and eat just about any organic material they come upon. They have two pairs of antennae and lack a carapace. A young freshwater shrimp resembles an adult. It molts once every five days going through nine different evolution cycles. They are considered facultative and tolerant of pollution.



STONEFLY:

Stonefly larvae are aquatic, flattened, with 6 sprawling legs and a segmented abdomen bearing two long antenna-like tails. Gills are tuft like and attached at the base of legs on the underside of the body. Each foot has 2 claws. Usually found in cool, clean streams. They are sensitive to pollution. There are many types of stoneflies, which naturally live in different habitats. They mainly inhabit clean, flowing streams where the current is brisk with more oxygen. They will creep under rocks and other submerged objects. Their mouthparts are adapted to chewing and many eat plant materials. As adults they lose the ability to eat. Egg masses are deposited on the water's surface.



SOWBUG:

Aquatic sowbugs are omnivores and feed on fine detritus, dead animal matter, and decaying plants. They live at the bottoms of streams and springs, often found in limestone springs. These crustaceans crawl in crevices among rocks, in root masses, or tangles of aquatic vegetation. Young look like small adults. They shed their exoskeleton several times. They have 2 pairs of antennae and 7 pairs of legs. Their gills are located under their abdomen. They are somewhat tolerant of water pollution and cope with organic waste. For this reason, they are a reliable indicator of the zone where streams are beginning to recover from sewage pollution.



PLANARIANS:

Planarians are flatworms found in freshwater streams and creeks. The body is soft and elongated. The spade shaped head has two eyes. The tail is pointed. The mouth is on the lower side more than half way toward the tail. In North America they are black, gray, or brown. Tolerant of pollution in water, they are an indicator of fair to poor water quality.

Planarians swim with an undulating motion or creep like slugs. Most are carnivorous nocturnal feeders. They eat protozoans, tiny snails, and worms. They have a remarkable ability to regenerate lost parts including their head or tail.



CRANEFLY:

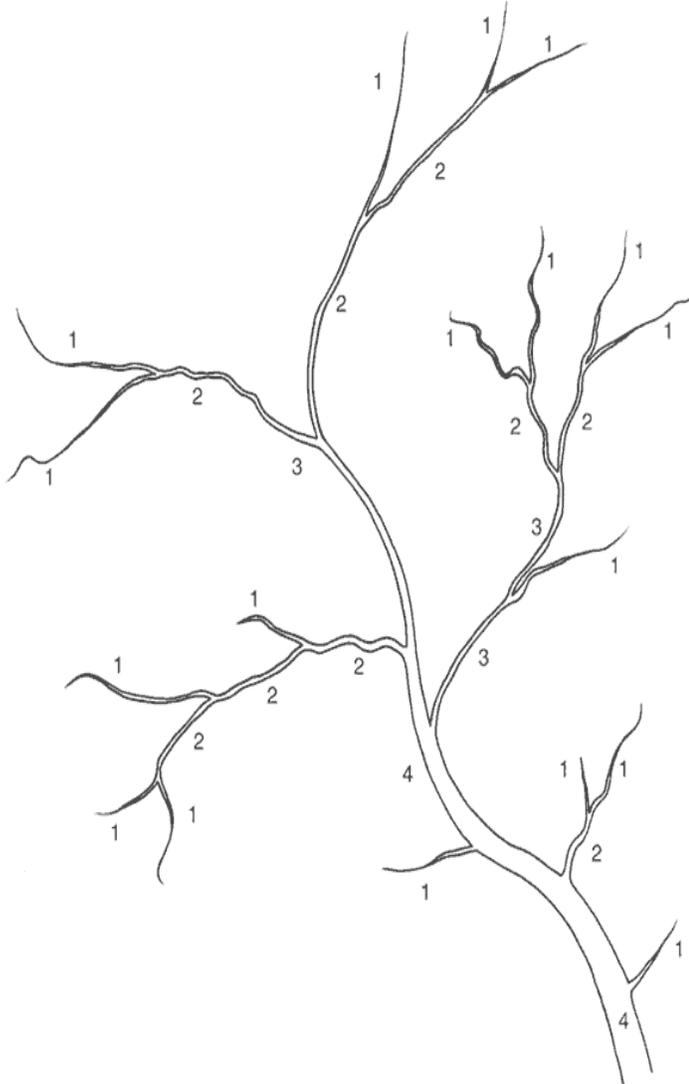
There are hundreds of species of crane flies in North America. The larvae are essentially tan, gray, or greenish grubs: plump, segmented caterpillars with a definite head and with tiny, fleshy projections at the hind end. They lack legs. Sometimes you can see the dark line of their digestive tract under the translucent body covering. Female crane flies have thicker abdomens, which have a pointed (and harmless) tip for egg-depositing. Males have pincerlike claspers at the tip of the abdomen.

Adult crane flies look like giant mosquitoes. They have slender bodies, very long legs, and one pair of wings that are often held out at a 45-degree angle to the body. Just behind the wings, attached to the body, are two small, antennae-like appendages called halteres. These function like gyroscopes during the crane fly's weak and wavering flights. They are not mosquitoes and will not bite as they have no mouth and will only live for a day.



STREAM ORDER:

The concept of stream order assigns numerical designations that indicate where in a watershed drainage system a certain stream segment lies. The smallest flows from upland areas, as well as springs and seep sources that maintain defined stream beds throughout the year are first-order streams. Where two first-order streams combine, a second-order stream is designated; and two second-order streams combine, a third-order stream is designated; and two third-order streams join creating a fourth-order stream. The hypothetical stream system at left has been labeled to indicate the stream order of the various segments. As a 'real world' example, consider Bobs Creek which, upstream of the State Route 869 bridge near Pavia, is a 3rd order stream and downstream is a 4th order stream because Wallacks Branch, a third-order stream, joins the flow immediately downstream of the bridge. At Reynoldsdale, Bobs Creek joins Dunning Creek, itself a 4th order stream at this point, to create a 5th order stream from there downstream. Typically, 3rd and 4th order streams comprise the majority of our quality trout streams.



States, the Mississippi.

The Raystown Branch is a sixth-order stream which joins with others to form the 7th order Juniata River. The Susquehanna River, the longest river along the East Coast, is an 8th order stream. There is but one 10th order river in the United

WHAT IS A MACROINVERTEBRATE?

"Aquatic" means water, "macro" means big (or big enough for us to see without using a microscope), and "invertebrate" means without a backbone, so an aquatic macroinvertebrate is a water bug that we can see with our naked eye.

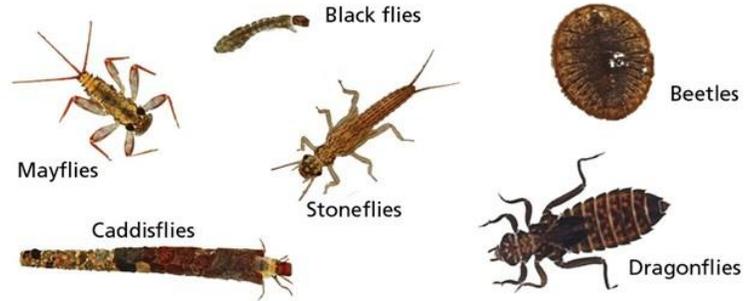
Some aquatic macroinvertebrates spend their entire lives living in water, although many just live in the water when they are immature. As they reach maturity, larvae metamorphose and leave the water, spending their adult life on land. In many cases, the insects are adults for a

very short time. For example, many mayflies live in streams for months to years but last on land for just a few days. During this time, they mate and lay their eggs in or near water so the cycle can continue.

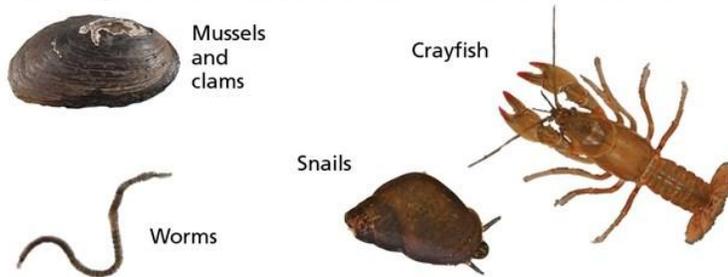
The larval and adult forms do not look alike, as can be seen with these dragonfly images above. However, in some ways they're quite similar. For example, dragonfly larvae and adults are both skilled predators.

Aquatic macroinvertebrates live in many different types of aquatic habitats. Some live in fast moving streams, consuming leaves, twigs, and other plant material that falls into the water. Others live in wider, sunnier rivers or shallow ponds, scraping algae off rocks or on the surfaces of large aquatic plants. Many are predators, and prey upon other macroinvertebrates. Some live within the soft sediments at the bottom of lakes and ponds and others capture food that is drifting along in the current. In all these settings, macroinvertebrates provide an important food source for fish and other predators.

Examples of insect macroinvertebrate larvae



Examples of non-insect macroinvertebrates



Because different types of macroinvertebrates tolerate different stream conditions and levels of pollution, their presence or absence is used to indicate clean or polluted water. For example, most larvae of caddisflies, mayflies, and stoneflies cannot survive in polluted water so streams with these bugs are assumed to have good water quality. The absence of these organisms in a water body, however, does not necessarily indicate that the water quality is poor. Other natural factors, such as temperature and flow, also come into play.

NON-POINT SOURCE POLLUTION:

Non-point source pollution results from land runoff, precipitation, and drainage into a stream or creek here in Lancaster County. Non-point source pollution, unlike pollution from industrial and sewage treatment plants, comes from many different sources. This type of pollution could be caused by rainfall or snowmelt moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and ground waters.

Nonpoint source pollution can include:

- Excess fertilizers, herbicides and insecticides from agricultural lands and residential areas
- Oil, grease and toxic chemicals from urban runoff and energy production
- Sediment from improperly managed construction sites, crop and forest lands, and eroding streambanks
- Salt from irrigation practices and acid drainage from abandoned mines
- Bacteria and nutrients from livestock, pet wastes and faulty septic systems

Non-point source pollution is the leading cause of water quality problems. The effects of nonpoint source pollutants on specific waters vary and may not always be fully assessed. However, we know that these pollutants have harmful effects on drinking water supplies, recreation, fisheries and wildlife. There are conservation practices that can reduce or prevent non-point source pollution.



ELETFISHING:

Electrofishing is a technique used by fish biologists to collect fish in freshwater streams, rivers, and lakes.

This tool uses an electric field, emitted from a pulsar, to temporarily stun fish. The fish can then be collected via dip net for identification. Data collected from electrofishing can be used to determine abundance, density, species composition, and health of fish populations.

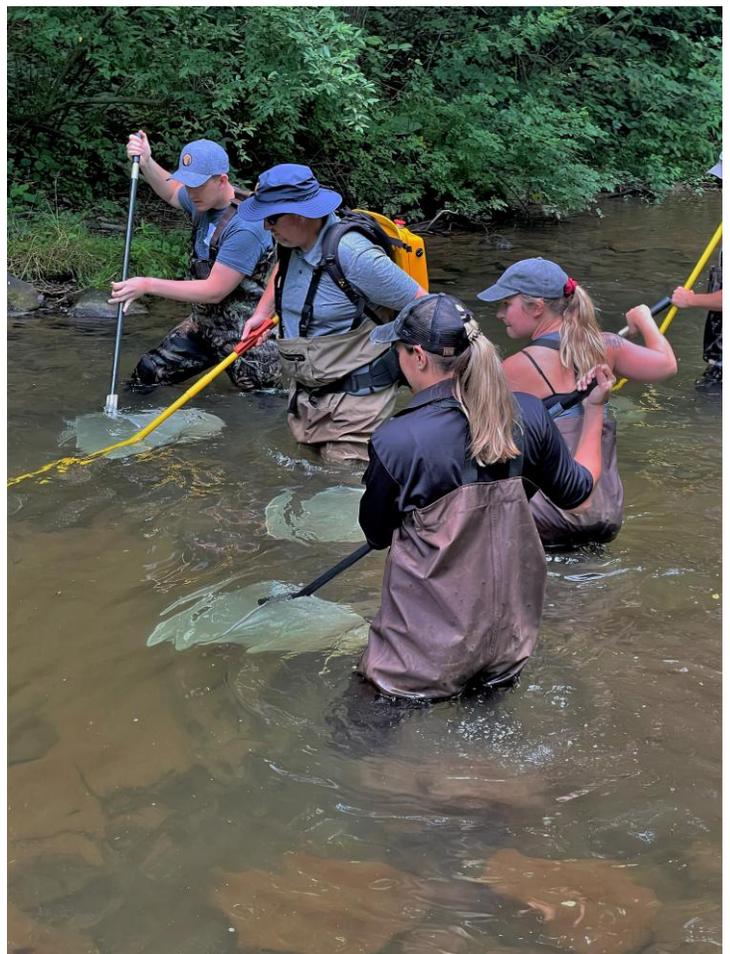
There are several methods of electrofishing:

- In smaller streams, biologists use backpack units.
- A floating raft unit is often used in larger streams and rivers.
- Electrofishing boats are used in lakes, reservoirs, or freshwater portions of rivers.

How does electrofishing work?

Electrofishing uses direct current electricity flowing between electrodes, one of which is an anode. When the proper amount of current is applied to the water, fish are drawn toward the anode through involuntary muscle movements. Upon reaching the anode, fish are stunned.

Batteries supply the electrical current in backpack units. The anode is located at the end of a long pole held by the operator and the cathode is a cable that trails behind the operator. In larger streams and rivers, the method is similar, with a generator helping to



provide electrical current on a floating raft or boat instead of a battery in a backpack.

Does electrofishing harm fish?

No. Fish are very rarely injured. When electrofishing is performed correctly, the fish are temporarily stunned, allowing biologists to collect them using dip nets. Fish recover fully in a matter of minutes, sometimes in seconds, and are returned to the water quickly.

Recovery time varies with species, water temperature, and amount of current used. Biologists are careful to use the least amount of current possible to ensure fish are stunned but not harmed. If scientists are electrofishing from a boat, fish are collected and held in a tank until they are released.

What safety precautions are in place during electrofishing operations?

Power output generated by electrofishing can cause serious damage to humans so safety is the priority during electrofishing operations. Operators wear rubber waders and gloves to protect against shocking. Backpack units have safety features that shut down the unit when the anode is out of the water or if the operator falls into the stream.

With output on electrofishing boats possibly reaching up to 1,000 volts, safety is especially important. Boats feature emergency shut-off switches if the power needs to be turned off quickly. Crews usually consist of a captain, who is driving the boat and controls the emergency shut-off switch, and two people at the bow of the boat, who apply electricity to the water using a foot pedal. Electrofishing boats are recommended to cease operation within 100 feet of another person in the target area.

Electrofishing scientists follow a strict set of safety guidelines created by the U.S. Fish and Wildlife Service