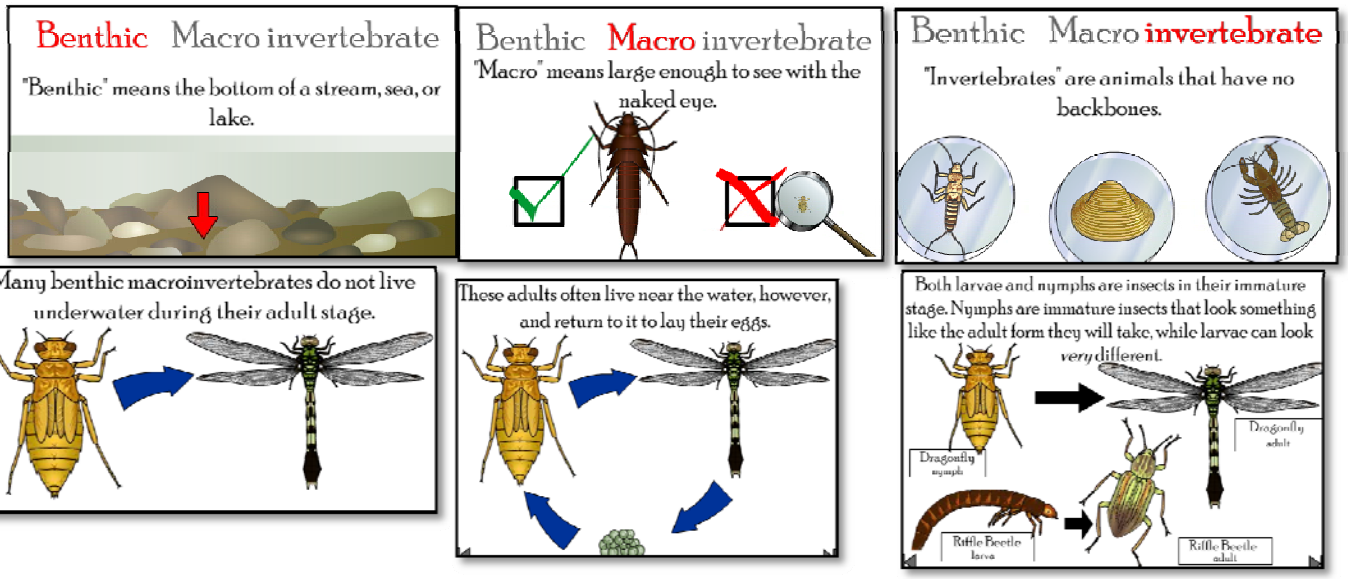
Station 4: Biology: **Questions to stimulate discussion.**

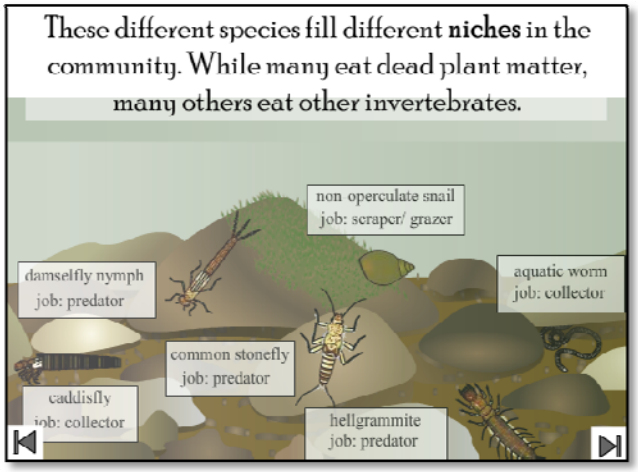
1. What is a Benthic Macroinvertebrate?

Most are Insects, others are worms, mollusks (clams, snails), crustaceans (crayfish)….



2. Why do we want to sample Benthic Macroinvertebrates?

Although chemical monitoring is useful, it is important to monitor the biological community **because they respond to their environment**. This means that if something in the water changes, like a chemical flows in or the temperature increases because lots of warm rain water has flowed across hot pavement before entering the stream, you might miss this if you were only doing chemical sampling once a month. BUT, you would see a change in the aquatic community when you check which critters are/are not present.



Chemical monitoring will only record the contaminants that you choose to measure **at that time**, but living organisms may respond to many other, unmeasured chemicals.

Algae (periphyton or phytoplankton), macroinvertebrates and fish are all indicators of aquatic ecosystem health. These organisms can serve as early warning indicators of underlying problems that may take years to fully understand.

To better understand the health of this stream/pond, today we are going to look at the benthic macroinvertebrates.

3. Looking at lake/stream, ask where they would expect to find macroinvertebrates & why?

Remind them that small and larger fish, turtles and other animals are invertebrate predators. Ask again where to find them. (Hopefully they mention hiding places, like under leaves, attached to or under rocks, within the sediment, on aquatic plants..)

4. Demonstrate how to use the dip net & collect organisms

a. Always carry the net upright when not dipping. Dragging it on the ground, or using it as a walking cane will easily tear it.

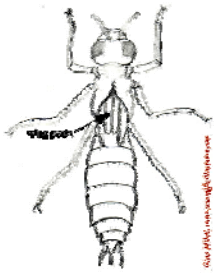
b. Fill bucket with some clear water from stream or pond. Animals collected will be placed in this or water will be poured into trays for separating out different inverts.

c. When gently dipping into the water, gently push up against plants and leaves where invertebrates may be living. Pull net up, let it drain into stream and then carry it away from the edge to pick through it. If using leaf packs, demonstrate how to carefully open them and search each leaf for attached or crawling invertebrates.

d. Remind them that when they first pull out net, animals will 'freeze' to avoid predation. They usually start squirming again within 20 seconds.

e. Remind students that inverts are very small—look carefully for any movement on each and every leaf. All students in groups should help find inverts. Collect for about 8-10 min. Rotate the net use amongst students (e.g. each student gets 2 dips).

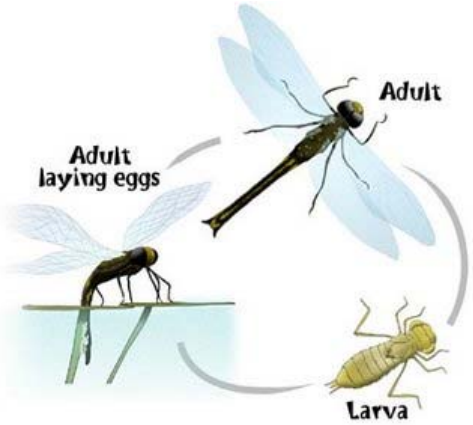
f. With wet hands, have students gently transfer each invert to bucket or tray. Transfer individual inverts the viewer for identification.



g. To encourage timid students to look, ask them questions like: Can you see the wing pads on its back? How large are its eyes? Does it have paddle-shaped feet? What do you think is the function of those hairs?

h. Have student record findings on worksheet. Direct students to release collected organisms back into water.

To keep students engaged (one warm days, when insects are out) Ask students to carefully observe any flying insects around the pond (dragonflies, mosquitoes, craneflies etc..). What are they doing? Many of these adults lay their eggs near the water's edge. The larvae feed, grow, and molt repeatedly underwater. They eventually emerge from the water as winged adults. They search for mates and lay eggs. Thus water quality has a great effect on their life.



Closure:

Have students make predictions about water quality based on the types of organisms they found. What other factors my dictate presence or absence of organisms? (The season, the sampling time, disturbance caused by other students, etc.)

Image credits: http://www.cacaponinstitute.org/e_classroom.htm
Invertebrates: cviewer: www.binbin.net

Organic Loading refers to poop of all sorts, leaves, grass, branches that flow or fall into streams.

Exotic Species Exotic or Invasive species are non-native (a.k.a. alien, or nonindigenous) plants, animals, and diseases that cause or are likely to cause ecological and economic harm. Invasive plants in the Potomac Watershed include Garlic Mustard, Japanese Stiltgrass. English Ivy, japanese honeysuckle. Animals include the Northern Snakehead fish. Zebra

Thermal Loading refers to warm water flowing into bodies of water. Colder water can hold more dissolved oxygen.

Riparian areas are the vegetated areas along the edge on of streams, rivers, and lakes. They have many important ecosystem functions including removing sediments and other contaminants; reducing the risk of flooding; reducing stream channel and streambank erosion. Healthy riparian zones support a diversity of plant and wildlife species.

Table 1. Major pollutants (stressors) in urban or suburban areas and their effect on streams.

Stressor	Source	Environmental Effect
Nutrients (Nitrogen and Phosphorous)	Improper use (over application) of lawn fertilizers.	Stimulate algae blooms. May reduce sunlight reaching stream bottom, limiting plant growth. Rapid accumulation of dead algae decomposes aerobically, robbing other stream animals of oxygen.
Toxics	Various. Underground storage tank leakage, surface spills, illegal discharges, chlorine from swimming pool drainage, etc.	Can have an immediate (acute) affect on stream biota if levels are high enough. May be chronic, eliminating the more sensitive species and disrupting ecosystem balance over time.
Sediment	Poorly managed construction areas, winter road sand, in-stream erosion, bare soils.	Clogs gills of fish and insects, embeds substrate, reducing available habitat and potential fish spawning areas.
Organic Loading	Sewage leaks, domestic and livestock wastes, yard wastes dumped into streams.	Human health hazard (pathogens), similar oxygen depletion situation as Nutrients. Causes benthic community shift to favor filter feeders as well as organisms with low oxygen requirements.
Exotic Species	Human transportation and release (intentional and unintentional).	Invade ecosystem and out compete native species for available resources (food and habitat). Some introduced intentionally to control other pests.
Thermal Loading	Water impoundments (lakes or ponds). Industrial discharges and power plants. Removal of riparian tree cover. Runoff from hot paved surfaces.	Biological community structure altered, shift to species tolerant of higher temperatures, sensitive species lost. Dissolved oxygen depletion.
Channel Alteration	In very urban areas, concrete, metal and rip-rap stabilization of stream banks. Stream channelization, flood erosion control.	Major habitat reduction/elimination, changes flow regime dramatically. Dramatic alteration of biological communities, can cause Thermal Loading and Sediment problems. Transfer erosion potential downstream.
Altered Hydrology	Conversion of forested/natural areas to impervious surfaces. Increases amount and rate of surface runoff and erosion.	Overall channel instability, habitat degradation or loss.
Riparian Loss	Development. Clearing or mowing of vegetation all the way up to stream banks.	Increase water temperature, greater pollutant input, less groundwater recharge, greater erosion potential from streambanks. Alters community composition.