



Pondering the Pond

**Grade Level:**

Upper Elementary, Middle School

Subject Area:

Ecology – Aquatic Invertebrates and Freshwater Systems

Duration:

Subject Introduction: 5 to 10 minutes

Activity Time: 30 to 40 minutes

Wrap Up: 5 to 10 minutes

Location:

Outdoors—freshwater pond or stream

Objective:

1. To illuminate the invertebrate life that exists in the benthos (bottom of a water body) and water column of a freshwater system.
2. To demonstrate the relation between certain aquatic invertebrates and water quality.

NYC Performance Standards:

Science: Life Sciences- S2c, S2d, S2e

Earth and Space Sciences- S3d

Scientific Connections- S4d

Scientific Thinking- S5a, S5e, S5f

Scientific Tools- S6a

Scientific Communication- S7b

Scientific Investigation- S8b

English Language Arts:

Reading- E1c

Background Information:

Aquatic invertebrates are key organisms in the ecology of any freshwater system. Many aquatic invertebrates are essential to freshwater food webs by breaking down dead plants and animals, and as a main food source for many larger organisms. Dredge up a handful of mud from a pond bottom, or throw a net out into a stream riffle, and one is bound to catch a variety of spineless critters. These include, but by no means are limited to, mollusks, various beetles, a wide array of crustaceans, and a plethora of larval insects.

The varying depths and activity levels of a pond or stream provide distinct habitats for different organisms. Invertebrates, however, occur in all levels of freshwater systems, through the water column to the benthos (bottom of a body of water), from the shoreline to the open water. They also vary quite dramatically in size, ranging from microscopic amphipods and zooplankton to palm-sized crayfish. Varied collection methods are essential to capture the greatest diversity and number of aquatic invertebrates.

Certain aquatic invertebrates are water quality indicator species, meaning that the presence or absence of these critters help to define a pond or stream's overall level of human pollution. Mayfly nymphs and dobsonfly and stonefly larvae, for example, are easily killed by pollution, but mosquito larvae and gilled snails are very pollution tolerant. Using invertebrates as a gauge of pollution would be just the first step in a scientific



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assessment, but one could infer that a pond that usually supports young mayflies, dobsonflies, and stoneflies, but suddenly has none, may indicate a polluted system. Without a balanced habitat for their larval stages, many common insect populations will presumably decrease.

Vocabulary:

Invertebrate—An animal lacking a backbone or spinal column.

Life Cycle—The course of developmental changes through which an organism progresses.

Benthos—The bottom under a body of water.

Water Column—The middle and upper regions of a body of water.

Detritus—Accumulated organic debris from dead organisms, often an important source of nutrients in a food web.

Indicator Species—Refers to various types of aquatic invertebrates whose presence or absence can help in assessing the quality of the body of water.

Materials:

Dipnets
Plankton Net (for streams/ rivers only)
Waders (for seining or large pond)
Invertebrate Traps
Tripod Microscopes
Slides and slide covers
Tanks

Discovery Kits:

- *hand lens
- * magnifying box
- *discovery scope
- *pipette

Small dishes

Buckets

Aquatic Invertebrate Identification and Indicator Species Keys

Freshwater Ecology Display Board

Turkey Basters

Procedures:

Pre-Activity Set-up:

1. About a week before the activity is scheduled to happen, set up invertebrate traps (one per group of 5-8 students) at various sites to ensure a good catch for the class.

2. Have a few buckets of pond water and pre-caught invertebrates for the students to get started with.

Warm Up:

1. Introduce general freshwater ecology, using examples and illustrations from the type of system you will be working in with the students (pond, stream, river). Use a display board or draw a picture of a generalized diagram of the system, and have the students tape or draw on pictures of organisms that live there. Distinguish between the benthos and water column and identify detritus. If using a stream, discuss riffles and the effect of movement on the system. If using a pond or stationary system, point out the great diversity of habitats that exist and, therefore, the organisms that



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depend on it. Also incorporate the idea that invertebrates exist in all realms of a freshwater system (ie, not just the benthos or just the water column)!

flooding of nutrients into a body of water). Based on the invertebrates they have discovered, do the students think their pond or stream is polluted?

Main Activity:

1. If necessary, split the students in three to four groups. The first two groups head to the active pond/stream station, pulling up the pre-set traps, and using the dipnets, buckets, and plankton nets to collect water and invertebrates. If the pond/stream is shallow enough, they can also dredge up a small bucket of mud and detritus from under rocks. Discuss how the different methods of collection are infiltrating vastly different habitats and so they will trap many different kinds of invertebrates.
2. Using the tanks, microscopes, and discovery kits to check out the water samples and critters! Identify larger invertebrates with a simple illustrated aquatic invertebrate key. Start to bring in the indicator species concept by having a key that also shows what having certain species indicates about the water quality.
3. If there are multiple groups of students, the other groups begin by checking out the pre-caught invertebrates and water samples. Once the first set of groups has finished collecting (about ten minutes), have the groups switch out.

Wrap Up:

1. Discuss what they found! Talk more in depth about the concept of aquatic invertebrates as indicator species for human pollution or eutrophication (the



NYRP Education Worksheet

Aquatic Science- Pondering the Pond



Name:

Teacher:

Date:

I. Vocabulary Words – Define the vocabulary words below

- a) Invertebrate
- b) Life Cycle
- c) Benthos
- d) Detritus
- e) Indicator Species



II. Pondering Your Data...

Picture of Your Critters	What is it?	Where does it live?
		Water Column or Benthos
		Water Column or Benthos

III. How is the Water?

You are an aquatic scientist for the Environmental Protection Agency. Rachelle and Elaine hire you to help us decide if we should use our pond as a swimming pool. You know that aquatic invertebrates are indicator species, so you can tell how good (or bad!) our pond water is by the critters you found today. On the next page is a key showing invertebrates that can live in really polluted water, and others that die from pollution. Using this and your data from class, write a paragraph about the quality of our pond. If you think the water is good enough to swim in, how can we keep it that way? If the water is too polluted, how do you think it got that way, and what can we do to improve our pond?



Apply your knowledge, what you remember about our water quality activity in the spring, and everything else you have learned with NYRP over the school year!

