Lesson: "1-Inch Ponds" & The Private Eye® (NGSS & CCSS)

(a system model / ecosystem model)

This student is exploring a 1-inch pond using two loupes, nested, for a 10x view of a system in action.

NGSS

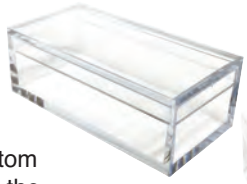
Crosscutting concepts:
- Systems and System Models
- Scale, Proportion and. Quantity
- Structure and Function
- Energy and Matter: Flows, Cycles and Conservation
- Cause and Effect

Disciplinary Core Ideas:
• LS2 Ecosystems: Interactions, Energy, and Dynamics • LS4 Biological Evolution: Unity and Diversity (Adaptations); ESS3 Earth and Human Activity (Human Impact on Earth Systems)

Scientific & Engineering Practices...
using TPE questioning strategy + loupes

What is a 1-inch pond?

It's a dramatic, surprising way to engage anyone in an introduction to pond studies!



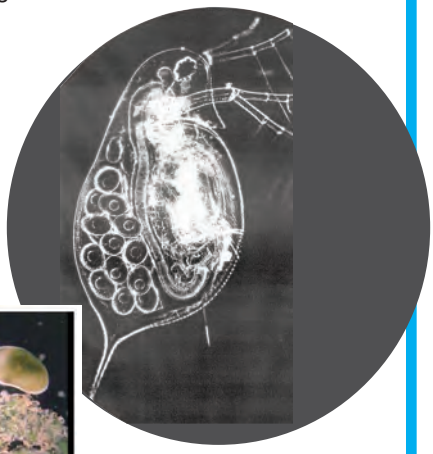
"Box C", top.
"Box D", right.

The Pond Boxes: These are the only small boxes we know of that are virtually leak-proof for observing salt or fresh water organisms under the loupe or microscope. They feel like a small aquarium! (You can find them on The Private Eye Store — under "Kits and Collections".) To insure an effective seal, when making your pond, keep the lip of the box bottom and box lid DRY! Any drop of water on the lip allows a pathway for a leak. The secret is to fill the boxes by using an eye dropper or pipette to move pond water and critters from a holding container gently into the "pond box." Please don't air-drop your critters into the box. And don't top off the pond box with too much liquid. Leave room for an air bubble (see photo above). Too big a bubble in the box can be distracting to the eye. If a drop of water gets on the lip, we usually dab it off with a Q-tip or tissue and let it air dry a bit. (Of course you can use this box for dry specimens as well.)

Who? What? Investigation: Instead of telling students who/what's in the pond box

and before handing out a Pond Key (see attached page) **...**

First use a true investigative approach with The Private Eye 4-Question sequence to structure your investigation. Start with the 1st TPE Question: "What else does each critter (or plant) remind you of? What else? What else? In a group, in pairs, or individually, try for 10 answers per critter or plant. Add: "Why *does* it remind you of that?" — to explore characteristics and properties. You may want to reveal the names and some of the natural history of the players in this miniature pond... but then weave in The Private Eye's theorizing questions, such as: "Why is this critter shaped the way it is? Why does it move the way it moves? Based on what else it reminds me of, could any of the functions be similar?



Daphnia (top right) are called "Water Fleas" because they are flat as fleas and "hop" like fleas. They don't bite.

Freshwater Ostracods (above left) are as small as seeds. Hence the common name: Seed Shrimp.

Now... names, and a little background.

And how do the critters help keep the pond system in balance?

THE CRITTERS and pond plants in our workshops and conferences:

- Daphnia ("water fleas") are crustaceans. They eat algae, bacteria and fungi. In turn, they're a food source for larger critters: fish and animals (salamanders, newts).
- Ostracods ("seed shrimp") are crustaceans, too, related to shrimp. They eat detritus, including dead daphnia! They are to the pond or river as earthworms are to the soil, recycling nutrients back into the pond or river system. (There are also marine ostracods.)
- sometimes a copepod, amphipod, blood worm, planaria, hydra, or caddishly nymph
- occasionally mosquito larvae (very cool acrobats)

Why a plant? What kind? What is its role in the system?

- Elodea (pronounced *e-**low**-dee-a*) or Hornwort (depending on what's available)

We put a small plant segment in the box: this oxygenates the water and takes up carbon dioxide given off by the critters. It also acts as a nursery for babies. And, as plant parts decay, they are to ostracods as tasty as a pizza is to us. Ah... a system in balance!

continued on back

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(a system model / ecosystem model) *continued*

How long do they live (in the box without removing lid)?

As long as you keep your “pond” at about 50 — 70 degrees F, Daphnia usually live a few days up to a week, provided they were healthy to start. But we’ve had ostracods live for months in the sealed box! We open the boxes after a workshop and lower the residents into our home “aquariums” (clean plastic salad containers). Use bottled water (a brand with NO SALT added!) or use chlorine remover from pet store if using tap water.

Now with personal investment and curiosity roused...

Students make their own 1-inch ponds!

Student Research Reading:

• Have students research more about the life cycles of pond critters and plants.

Student Experiments:

• Students can run experiments in which they change variables in the pond model to reflect climate changes or human impact on the ecosystem, e.g., change temperatures the pond critters are exposed to, or change the chemistry of the water to model impact of farm fertilizer run-off, or change other variables. Students chart and discuss results and draw tentative conclusions.

Change Scale:

• After 5x and 10x, loupe-leap to the microscopic! Observe pond life with 20x and higher powers of microscopes, using TPE Questions to help students look more closely and develop analogical thinking as investigative habits of mind.

Where to get critters and plants?

Collect them: We collect from ponds, ditches, lakes, streams, and rivers using that highly scientific tool: a turkey baster(!) and large clear Solo cups with lids as temporary homes (ideal viewing chambers). Yes we have a plankton net and have used that, too, but along the shallow edges of vernal pools, ponds, or lakes and/or from quiet spots at river’s edge — especially near plants growing underwater or with their feet in the water — we find the turkey baster is usually enough. On a cool day the “seed shrimp” might be keeping warm in the silt or soil so collect some of that, too. When silt settles out of the water — which might take until the next day for water to really clear — you’ll usually find really cool critters. Some look like Dr. Seuss characters. Others are sci fi-ish. Be sure to collect some of the pond plants, too, as you may discover a hydra or snail or planaria. All the pond critters are marvelous and essential to the larger life cycle we ourselves depend upon!

or...

Order from Biological Catalogues: If you don’t have time to collect, order pond critters from biological catalogues (e.g., Wards or Carolina). This is what we do during winter or when our supplies are low.

Note from Biological catalogues: Don’t release the pond critters you order from them into wild ponds, rivers, lakes.

Instead of pond boxes: Use Solo cups with lids, etc.

Common Core Literacy Connections — a few examples:

• Students can write Private Eye “Sandwich Poems”, Reflections, or 3+3 Research Writing Projects starting with their loupe-analogy lists. They meet many categories of standards at once, including Craft and Structure, Key Ideas and Details, Integration of Knowledge and Ideas, Text Types and Purposes, and all standards relating to figurative language, metaphor and simile, etc.
For more: see the Common Core Correlations on The Private Eye website per grade level.