

River and Pond Exploration – Online Version – Field portion requires open water collection

Key Points:

- Invertebrates are a group of animals without vertebrae – including insects
- Insects go through metamorphosis – complete or incomplete – our subjects for study are in the larvae or nymph stage. (they are a lot easier to catch)
- Presence of certain insects indicate the health of the body of water; is the river or pond an ideal habitat or polluted?

Vocabulary:

Aquatic	Printing this page will allow the student to look up the definitions. relating to water, for this lesson - a life form that lives in water
Invertebrate	lacking vertebrae (no spine) this lesson - arthropods (insects, spiders, crayfish).
Macro vs micro	macro = visible to the naked eye, vs micro = needing magnification
Metamorphosis	change in physical form, which also changes eating habits and life activities
Larva & complete metamorphosis	active larval stage is followed by quiet metamorphosis in a pupa or cocoon the adult “hatches” from the pupa or cocoon (example : butterflies)
Nymph & incomplete metamorphosis	nymph stage is followed by several molts of the exoskeleton until adulthood nymphs resemble the adults they will become

Introduction:

Have you ever gone wading in a pond, floated down a river, or splashed beneath a spillway? You have been having fun with hundreds of “animals” all around you. The aquatic life in our rivers, ditches and ponds is also fun to explore. We will be studying the health of a river, or pond or irrigation ditch, by investigating how many and what type of macro-invertebrates are living there.

But what is a macroinvertebrate? Let’s break down the word into its components.

You know what a vertebrate is, right? It is an animal with vertebrae or a backbone like a horse or fish.

An invertebrate is an animal without a backbone, like a jellyfish, but also like a crayfish or any insect.

You also know what micro means: (very small, example words: microfilm, microscope, microbiology). A microscope is need to see microscopic things.

So macro means large. Things seen without a microscope. Many insects living in bodies of water can be seen with just our eyes, and with a magnifying glass or lens, we can see parts like eyes and gills.

The things we will be looking for are the early stages of several insects that are food for other animals, especially fish. Examples include Caddis fly larvae (pic); Stone fly (pic) and Mayfly nymphs (pic), worms, dragonfly and mosquito larvae. When these insects are present, they indicate good conditions for all animals in the river. Stoneflies are especially sensitive to changes in water quality; they need cold, highly oxygenated water with lots to eat. Their presence indicates good conditions for a freestone river. They are an indicator species for healthy, cold-water rivers.

Macro-invertebrates we look for in shallow areas of the river:

Stonefly (Shuffle side to side) Mayfly (undulates, dolphin-like) Caddisfly (Legs go out & back) Riffle Beetle (Bubble)



None of these are to scale

These insects are found in the riffles of a river. The riffles are the shallow areas that are rocky with fast moving water. You catch them by putting a net downstream from rocks that you then turn over, more instructions page 3.

Macroinvertebrates we look for along the edges of a pond:

Mosquito larvae



Dragonfly larvae



Damselfly nymph



Water Mite

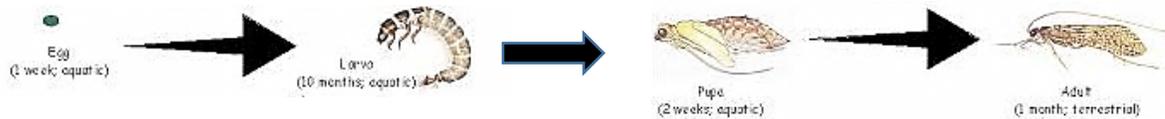


You may also find mayflies, water beetles (same as riffle beetle), worms, etc. There is a good resource for pond invertebrates here: https://extension.usu.edu/waterquality/files-ou/whats-in-your-water/aquatic_macroinvertebrates/pond_macroinvertebrate_guide.pdf We have many of the same, but no leeches!

Additional Notes:

Metamorphosis – the short version:

Complete metamorphosis = egg > larvae > pupa > adult A good example is Caddisfly



Incomplete metamorphosis = egg > nymph > adult

A good example is a stonefly.



How to use a key to identify the organisms

- Look for major features like legs and body parts and compare them to the dichotomous key found here: <https://extension.usu.edu/waterquality/files-ou/macroinvertebrate-key/macrokeyforUtah.pdf> Each clue gets more specific, work through the steps – watch out for short cutting and guessing

Pro Tips for figuring out what you are seeing:

- Count legs and tails. Note: mites are an arachnid (with spiders and ticks) which have 8 legs. (no mites on the key)
- Stoneflies and Caddis flies are carnivores and have larger mandibles (jaw pinchers)
- Riffle/Water beetles carry bubbles.
- Midge larvae “ghost worms” have dark eyes and almost clear bodies and resemble mosquito larvae (but are found in fast moving water). Clouds of insects floating in the spring air in the evening are often midge flies.

How to determine if your sample is plant material (algae) or animal (macro-invertebrate) – chlorophyll

- Chlorophyll is green and used to photosynthesize, which only plants can do. If there's green inside = plant

How to build your own collection equipment for \$3 or less



You need a collection net, a magnifier, a white background for observation & sketching (the jar lid or white plate), and transport jar if you want to do the worksheet at home. All can be purchased from a Dollar Store or collected from home.

Form a loop and handle in a wire hanger, fold the top of a nylon stocking several times over the loop edge and staple or wire in place. It should look like a small butterfly net. If you make the handle the length of the height of the collection jar, you can transport it all without any wet gear to carry.



River and Pond Exploration – Aquatic Life Lab Worksheet

Be Careful, always have a second person with you when going collecting.

To collect a sample:

1. First rinse out the jar with pond or river water. Fill the bottom 4-6 inches with pond or river water.
2. Collecting from a pond: use your small net to stir up some water near the base of some aquatic plants. In a river, put your net downstream from rocks or gravel, then turn over the rocks and stir the gravel.
3. Pull your net up slowly to let the water drain out. Try not to pick up dirt or muck, the net will break.
4. Turn the net inside out into the collection jar and swish the net in the water that is in the jar. Repeat.
5. Look in your jar and see if you caught anything. If yes, swish gently and pour some water out into the jar lid or on a white plate to be able to see your macroinvertebrate(s) and complete this worksheet.

Collection Date _____ AM or PM (circle one)

Location (where sample was taken) _____

Sketch one organism chosen for detailed study, use your magnifying lens and refer to the pictures you have.

A Describe what your organism looks like; how many legs, tails, color, shapes, size, spots, etc.

B How does your organism move?

C What do you think is the name of your organism?

D Are you looking at a larva or a nymph? Remember nymphs more closely resemble the adults.

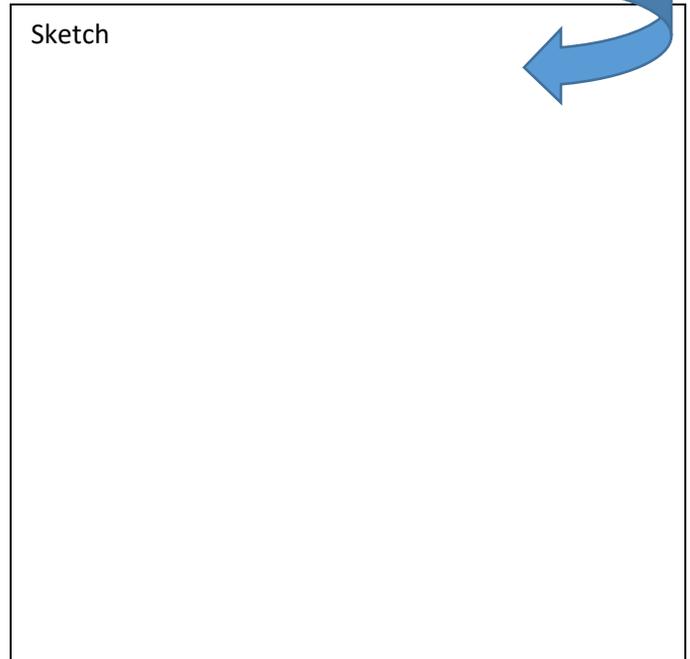
What type of metamorphosis does this creature go through? Circle one: Complete or Incomplete

List the life stages:

E What else did you find in your sample?

F Do you think the river is healthy? Why?

Sketch



Extension: If you collected a sample from a river, collect another sample from a pond – they are very different. Ponds are generally warmer, with lower levels of oxygen. What other differences will you find?

Additional Notes for the Instructor:

This lesson plan was adapted from our Macroinvertebrate Lab station within our Urban Wilderness Field Trip program. This field trip is designed for 4th and 5th grade students. Please check for age and grade appropriateness before sharing with your student(s).

Read the entire lesson before giving to your student(s). You will see that there is supporting information throughout the lesson.

If you plan to go out to collect a water sample, decide where to go beforehand and present the lesson with a destination in mind.

Recommendations:

River's Edge Natural Area, there are several ponds and also river access on the northeast side near the recreation trail

Wilson Avenue Big Thompson Bridge just south of Hwy 34 – there is river access under the bridge and the pond near the recycling center.

Pro-tips for net building: start attaching the net/stocking at the top, then do the bottom, sides are last; sewing works better than staples if you have time.



Tie a knot 5-6 inches below the rim to make emptying easier. Bend extra hanger back to make a stronger handle. Attaching net to a broom handle will need to tape or zip ties.

Reinforced knee-high nylons with thicker tops are best.

Printing out the lesson versus having a student complete it on the computer screen may give you a few more options:

1. The vocabulary definitions will not print out in a readable form – they are too light. The student may then be tasked with finding the definitions in the rest of the lesson or from other sources.
2. The printed lesson can be taken to the field for collection and worksheet completion, not to mention to a dollar store for shopping for the collection supplies. You can make the lesson “mobile”.

Additional Resources:

USU Utah State University posted the dichotomous key used in this lesson (link given in the lesson). They have additional resources for older and younger students and several other good lesson plans. You can access those resources here: <https://extension.usu.edu/waterquality/educator-resources/lessonplans/macro>

Caution: there are some insects mentioned in their lessons that we do not find on our field trips in Colorado – dobsonfly, crane fly and leeches for example.

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