Aquatic Ecosystems with Scope-On-A-Rope

By: Adrienne Lopez, LSU SOAR Coordinator

What's in the Water?

OBJECTIVES

- To use Scope-On-A-Rope to heighten students' senses, hone their observation skills, and strengthen concepts such as magnification and scale.
- For students to gain an appreciation for the myriad of life forms on our planet and how they interact in their environments.
- For students to gain an understanding of life science concepts: classification of organisms; life cycles; variation among organisms; adaptations; ecosystems; aquatic food chains/webs.

MATERIALS NEEDED

Scope-On-A-Rope (with aquatic set-up and stand)*
Droppers, forceps, Petri dishes or deep well slides*
Water sample (see "Water Collecting Tips")
Copies of "Macroinvertebrate Key" (attached)
Copies of "Pond Life Worksheet" (two versions attached)

*The Scope-On-A-Rope and other aquatic collecting materials can be borrowed from LSU.

WATER COLLECTING TIPS

Locate a body of water that you would like to sample; this can be a pond, lake, ditch, stream, or large puddle. For comparison studies, collecting water from several locations is ideal. You may want your students to bring in their own water samples.

Look for signs of life, such as algae, plants, and animals. Use a scooper (such as a large soup ladle) to collect a sample of water. Make sure to collect plants (tongs work great for this purpose), especially algae, and get a couple of scoops off the bottom. A good water sample has lots of green (plants) and some brown (dirt/substrate). This is because different organisms live in different microhabitats in the pond.

Water samples can be stored in any type of container; I recycle plastic food tubs. **Be sure not to leave a lid on your container for very long!** Organisms need oxygen to survive. You can keep this water sample for a few weeks or more if there are enough plants to produce oxygen and it gets some light. You will find that the array of organisms found in the sample will change over time.

Other tips can be found at: www.microscopy-uk.org.uk/index.html

A LITTLE HISTORY: THE "DISCOVERY" OF MICROORGANISMS

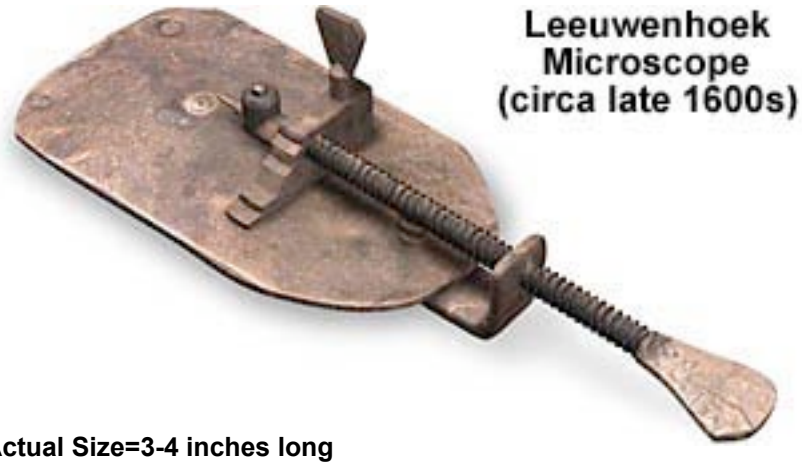
Before the invention of the microscope, people did not know the diversity of life that existed hidden from view. Protozoans, bacteria, viruses were just some of the organisms that affect people (for better and for worse), but cannot be seen with the naked eye. Although many scientists built compound microscopes as early as the 16th-17th Century, one stands out as the "Father of Microbiology" - Anton van Leeuwenhoek. He was unschooled in science, but he was a keen observer and taught himself how to grind lenses that could magnify items over 200 times! (The compound microscopes used previously by Hooke and Galileo did not achieve magnifications nearly this great.) Leeuwenhoek's simple microscopes only had one tiny lens like a magnifying glass, but they allowed him to see the first single-celled animals, which he dubbed "animalcules". He discovered protozoans, bacteria, blood cells, and much more!

In order to explain what he was seeing to scientists and other people at the time, he had to come up with a frame of reference. The smallest thing he could think of that a person can see with the naked eye, and that would be familiar to most everyone in the 1600's, was the eye of a body louse. He used this measurement to tell people how small his organisms were. Some microorganisms he observed were more than 1,000 times less in size than a louse eye!

Leeuwenhoek introduced a whole new idea into science – that unseen critters could be the cause of disease and other maladies. He paved the way for modern medicine. This is a great example of how the development of a technological tool has altered the way we interact with the world.

Websites for more information on Anton van Leeuwenhoek:

www.microscope.org/micro/sm101.htm
www.ucmp.berkeley.edu/history/Leeuwenhoek.html



Actual Size=3-4 inches long

SETTING UP SOAR TO VIEW AQUATIC SAMPLES

There can be a wide range of sizes of the organisms you collect. I like to start by viewing and identifying the larger ones first, then move on to the smaller organisms. This will help your students gain an appreciation of scale and magnification concepts.

A. "1X" INVESTIGATIONS

1. Look through your water sample(s). Can you see anything relatively large? Anything over a few millimeters long can be spotted. Use magnifying lenses, if desired. Try pouring your sample into a larger, shallower dish if you need to get a better look. Examples of large organisms include fish, water insects and their larvae, and snails.
2. Try to capture a few of these animals and isolate them in smaller vials. You may be able to simply scoop them up into the vial, or you can use a small net or a spoon. Students may have fun doing this.
3. Put the SOAR in the **1x stand-and-view** set up. (See photo or refer to the SOAR How-to book and website: www.scopeonarope.lsu.edu)
4. View each collected critter and have students try to identify it. Use the attached Macroinvertebrate Key and the clues/websites listed below. This can be a good opportunity for older students to learn or practice their knowledge of classification.
5. **Encourage and ask questions**: Is it a plant or animal? Does it have legs? How many? How does it move/swim?

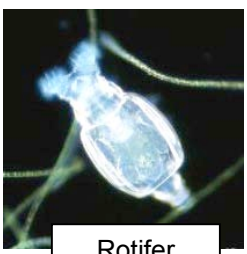
Dragonfly nymph

B. "200X" INVESTIGATIONS

Now it's time to investigate the tiny organisms that are not visible (or barely visible) to the naked eye. Before viewing a water sample, it's important to make sure your students understand what 200x means.

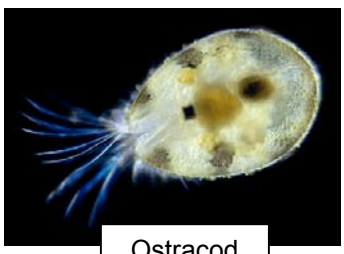
<u>What is the "field of view" when using the 200x lens?</u>

1. If you teach elementary students, begin by asking them to visualize how big a millimeter is (or ask them what is the smallest unit they can measure). You can scan and copy a ruler to give to students. You can then scope a ruler with the **30x lens** for better viewing.
2. Try scoping some common objects that students think may be a millimeter long/thick and measure them with the 30x of SOAR. You can press *REC* too take a picture of the ruler, then press *REC* again to take a picture of the item you want to measure. Press *PLAY* three times to see both items on a split screen. You can also make a mm grid using a transparency (see SOAR website and/or How-To book). Examples of objects that are one mm: the tip of a ballpoint pen, the width of a dime, the head of a straight pin.
3. With the **200x lens** on the SOAR, scope this same millimeter ruler. What do you see? You should only be able to see about one millimeter at a time. Use this activity as a reminder when viewing water sample at 200x – the field of view is VERY SMALL and any critter that fits on the screen must be less than a millimeter long!



Rotifer

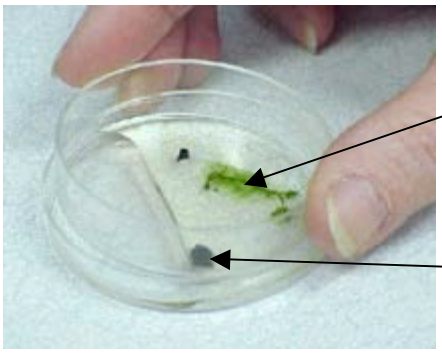
"Scud"



Ostracod

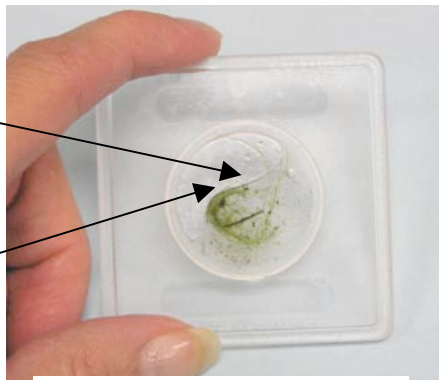
Preparing a 200x aquatic slide:

4. Remembering that you can only see about one millimeter of area at a time with the 200x lens, it is important that we only try to view a small amount of water at a time. There are two good ways to prepare an aquatic sample for viewing with the 200x of SOAR; you can use a **small Petri dish** or a **deep well slide**. If using the Petri dish, place the sample inside the lid of the dish, then "sandwich" the bottom on top to make a slide.



Include a little bit of "green stuff"

…and a little bit of "brown stuff" from the bottom



Petri dish "sandwich"

Deep well slide

5. Once you've prepared your sample, set up the SOAR in the **200x invert-and-view configuration** (see photo and directions below, and/or refer to the SOAR How-to book or website).
6. View samples by placing them on the stage over the lens. You may have to focus the lens quite a bit to see through the plastic of the dish and into the water. [TIP: You can focus using the black collar.]
7. You will also need to use the **lamp** to give you more light. You can move the lamp closer to or farther away from the scope to give you the image that looks best (dark-field or bright-field). Don't forget to attach the lamp shade.
8. Move the dish around until you see something that looks interesting. Leave it in one place for a while and watch closely as organisms swim on and off the screen.
9. For identifying purposes, **connect the SOAR through a VCR and record what you see on a videotape.**

200x Invert-and-view Set Up

1. Place the scope, facing up, in its cradle.
2. Put the black collar* over the 200x lens.
3. Place the stage* over the scope, with the hole over the lens tip and the prongs fitting into the groove on the collar.
4. Velcro the stage in place so you have a stable working surface.
5. Place the sample on top the stage, and focus the lens by turning the collar.

*See the "SOAR Parts List" for more photos.

IDENTIFYING ORGANISMS WITH SOAR

Refer to the "Macroinvertebrate Key" for assistance in identifying aquatic organisms. There are also some great websites to aid in identification:

http://www.microscopy-uk.org.uk/index.html
http://www.silkentent.com/gus1911/RonPond.htm
http://micro.magnet.fsu.edu/moviegallery/pondscum.html
http://microscope-microscope.org/applications/pond-critters/pond-critters.htm
http://www.k12science.org/curriculum/bucketproj/identification.html
http://www.naturegrid.org.uk/pondexplorer/pond3.html

Great identification guides include:

1. Rainis, Kenneth G. and Bruce J. Russell. *Guide to Microlife*. Franklin Watts. Connecticut. 1996. (extensive guide to identifying everything, with keys)
2. Reid, George K. *Pond Life*. St. Martin Press. New York: 2001. (kid-friendly)
3. Voshell, J. Reese, Jr. *A Guide to Common Freshwater Invertebrates of North America*. McDonald & Woodward Publishing Co. Virginia: 2002. (for identifying different types of insect larvae and snails)

LOUISIANA GRADE LEVEL EXPECTATIONS

	K	1st	2nd	3rd	4th	5th	7th	10th
Science As Inquiry	4, 10	1, 5, 11	1, 6, 8, 12	1, 6, 8, 15	1, 7, 9, 17	6, 29, 39	6, 29, 39	14
Life Science	24, 25, 28	26, 32, 34	27, 30, 35	35, 38, 39	41, 48, 52, 53	27, 29	23, 26, 27, 34	18, 19
Science and the Environment			45, 46	57	71		36	8, 11

Two high school students examine pond water with Scope-On-A-Rope as part of an ecosystems unit.

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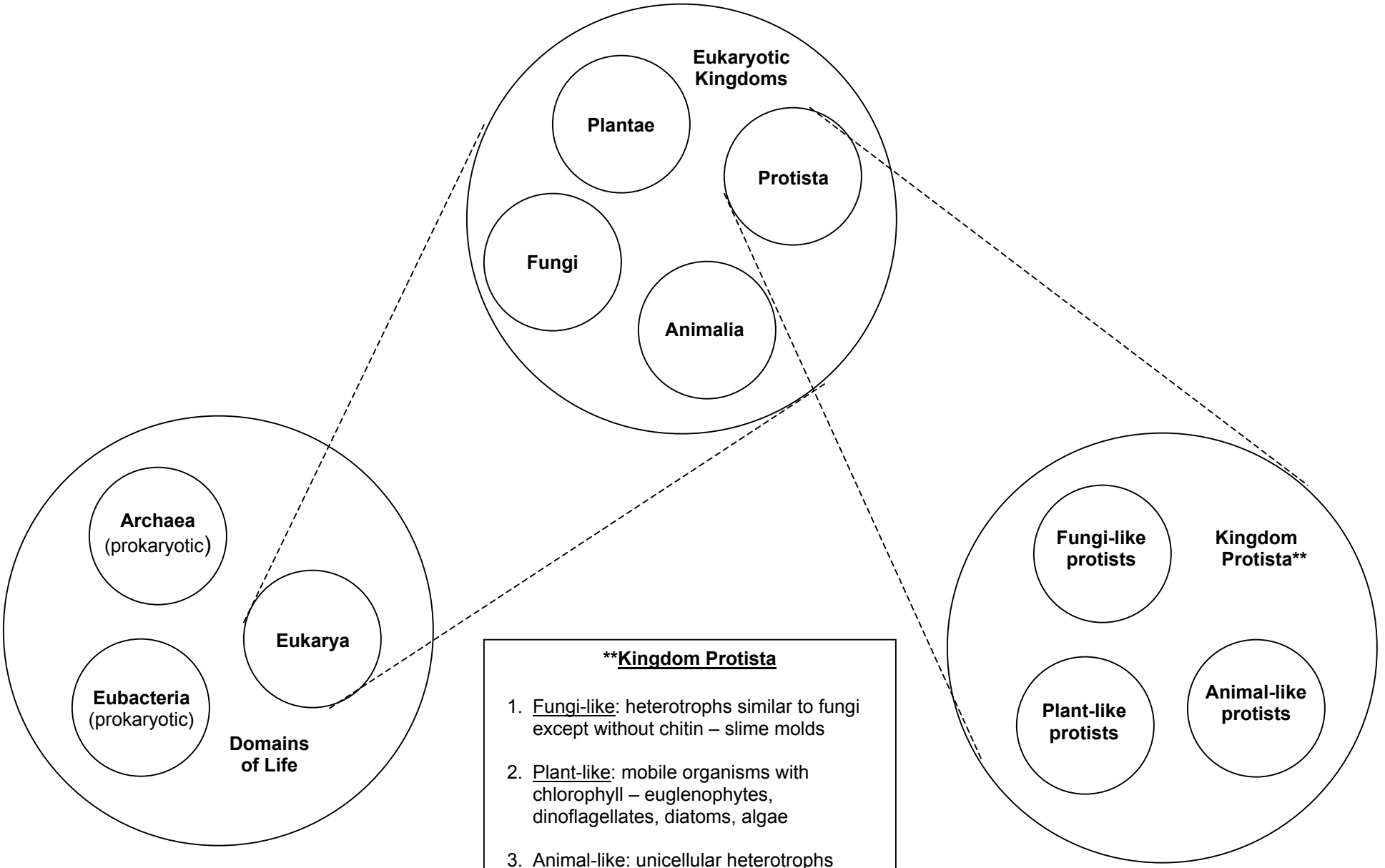
Classification of Life – Concept Circles



**__Kingdom Protista__

1. __Fungi-like__: heterotrophs similar to fungi except without chitin – slime molds
2. __Plant-like__: mobile organisms with chlorophyll – euglenophytes, dinoflagellates, diatoms, algae
3. __Animal-like__: unicellular heterotrophs called protozoans – ciliates (*Paramecium*), zooflagellates, sarcodines (*Amoeba*), sporozoa (*Plasmodium*)

Scope-On-A-Rope Key to Macroinvertebrates in Louisiana Freshwater Systems

1x; 30x and 200x refer to SOAR lenses best used to observe specimen

- Green
  - Leaves
    - Stemmed, with hairs on leaves
      - *Salvinia minima* (1x)
    - Not Stemmed, with no hairs on leaves
      - Duckweed (1x)
  - No leaves
    - Filamentous
      - Green, nonmotile
        - *Spirogyra* (200x)
      - Blue-green, motile
        - *Oscillatoria* (200x)
    - Not filamentous
      - Crescent-shaped
        - Desmid (200x)
      - Spherical
        - *Volvox* (200x)
- Not green
  - Shell or exoskeleton
    - Shell, no legs
      - Single shell
        - Flattened coil
          - Orb Snail (1x)
        - Conical coil
          - Apple Snail (1x)
      - 2-part shell
        - Clam (1x)
    - Exoskeleton, legs
      - 3 Pairs of legs
        - Insects
          - No wings, immature forms
            - (30x)
            - Larva
            - Pupa
            - Mosquito
          - Wings, mature forms
            - Membranous wings
              - True Bugs (1x)
                - Water Strider
                - Water Boatman
                - Giant Water Bug
            - Hard wings
              - Beetles (1x)
                - Whirligig Beetle
                - Water Crawler
      - More than 3 pairs of legs
        - 4 Pairs of Legs
          - Arachnids
            - Body elongated, 2 divisions
              - Fisher Spider (30x)
            - Round body
              - Water Mite (30x)
        - More than 4 pairs of legs
          - Crustaceans
            - Macroscopic (1x, 30x)
              - Large pincers
                - Crawfish (1x)
              - No large pincers
                - Horizontally flattened
                  - Isopod (30x)
                - Vertically flattened
                  - Amphipod (30x)
            - Microscopic (200x)
              - Oval shaped body, small head or no head visible
                - Small legs visible
                  - Ostracod (200x)
                - Large first pair of legs over head
                  - Daphnia (200x)
              - Elongated body, large head end
                - Copepod (200x)
  - No shell or exoskeleton
    - Free-swimming
      - Single-celled
        - Protozoans
          - *Paramecium* (200x)
          - Ameoba
        - Euglenid
      - Multi-celled
        - Tube-shaped body
          - With bristles, movement not whiplike, clear body
            - Bristleworm (200x)
          - Without bristles, whiplike movement, body opaque
            - Nematode (200x)
        - Flattened body
          - Segmented
            - Leech (30x)
          - Unsegmented
            - Planaria (200x)
    - Attached to substrate
      - Rotating cilia on “head” end
        - Rotifer (200x)
      - Tentacles on “head” end
        - Hydra (200x)

Sheri Wischusen, LSU/HHMI Program, Louisiana State University

Name _____ Date _____

Pond Life Worksheet

Draw an animal or plant in each box and describe what it looks like, how it moves, and what you think it might be.

What does it look like? _____

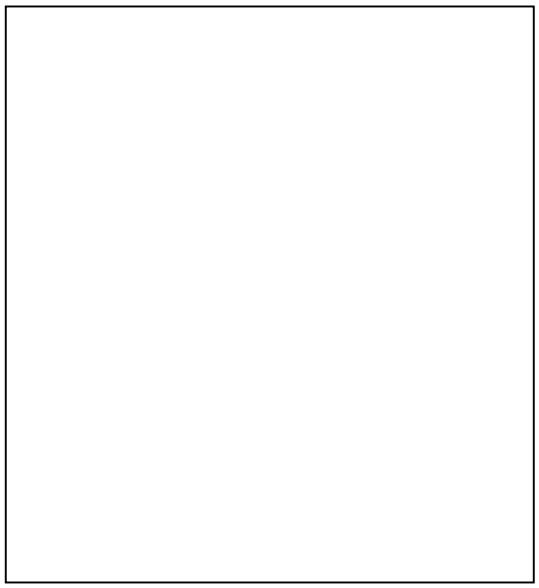
_____

Does it move? How? _____

_____

Producer -or- consumer? (circle one)

What is it? _____



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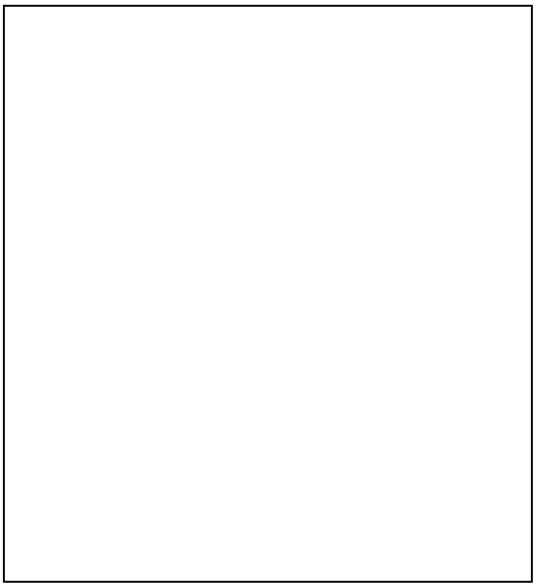


Name _____ Date _____

Pond Life Worksheet

From where was your water sample collected? _____

Choose an organism(s) to draw in each box and describe its movement, appearance, and other characteristics. Use the key to try to identify the organisms seen. You can estimate size of an organism by using the letter "A" on the screen. With the 200x lens, the A is 75μm (micrometers) wide - that's 0.075mm!

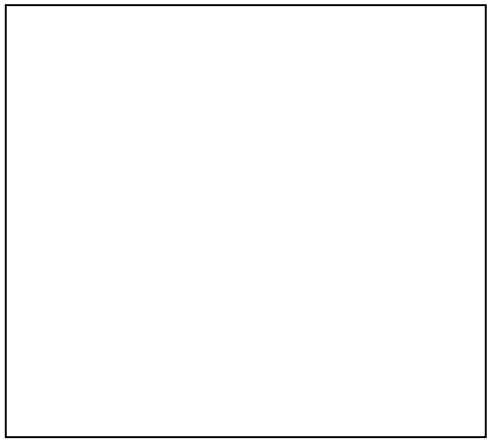
Identification: _____

Classification: _____

Size estimate: _____

Population estimate: _____

Locomotion: _____



Other behaviors/characteristics: _____

_____

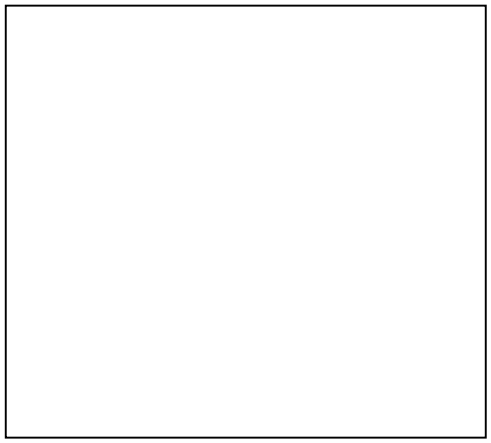
Identification: _____

Classification: _____

Size estimate: _____

Population estimate: _____

Locomotion: _____



Other behaviors/characteristics: _____

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