

## Table of Contents

Philosophy and Structure	ii		
Overview	1		
Overview Chart	2		
Materials List	3		
Schedule of Activities	4		
Preparing for the Activities	5		
Background Information			
Advance Preparation			
Materials Management			
Activity 1	7	Activity 12	81
Ecosystems and Habitats		Investigating Pond Life	
Activity 2	13	Assessment Activity	87
Using a Magnifier		Glossary	91
Activity 3	19	References and Resources	92
A Visit to a Pond		Activity and Assessment Sheets	93
Activity 4	27		
Building a Pond Ecosystem			
Activity 5	35		
Macroscopic Pond Life			
Activity 6	41		
Microscopic Pond Life			
Activity 7	49		
Life in a Hay Infusion			
Activity 8	57		
Observing Pond Snails			
Activity 9	63		
Observing Fish			
Activity 10	69		
Investigating Duckweed			
Activity 11	75		
Aquatic Food Chains			

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## Overview

This Delta Science Module is designed to introduce students to the plant and animal life found in a pond. Aquariums set up in the classroom provide models for studying the various levels of interaction between different organisms and between the organisms and their environment.

Activity 1 introduces students to the concepts of ecosystems and habitats. The students first distinguish between natural and human ecosystems; then, using their neighborhood and a pond as examples, they identify the various habitats within these ecosystems.

In Activity 2, students experiment with different-powered lenses and learn the vocabulary associated with their use. Now familiar with the proper use of a magnifier, the students will be able to use one effectively in later activities.

The class takes a field trip to a nearby pond in Activity 3. The students explore the various habitats that make up a pond ecosystem. Then, back in the classroom, they view pond samples and use reference materials to try to identify the plants and animals they observe.

In Activity 4, students set up classroom aquariums containing organisms typically found in a freshwater pond. They compare the aquarium ecosystem to the pond ecosystem that they observed in Activity 3.

Next, the students turn their attention to the macroscopic organisms in the aquariums. In Activity 5, they observe the general characteristics of the larger organisms and the ways in which they are adapted to pond life. The students then use reference materials to try to identify the organisms.

In Activity 6, students observe the microscopic organisms living their

aquariums. As with the macroscopic organisms, students note the ways in which these organisms are adapted to life in water, and use reference materials to try to identify them.

Students make further observations of microscopic organisms in Activity 7 when they view the community in a hay infusion. They compare the populations found in the hay infusion with those found in their aquariums.

Activities 8, 9, and 10 focus on specific organisms in the aquariums. In Activity 8, the students observe the structure and behavior of a pond snail. In Activity 9, the students examine the structure and behavior of a fish: the platy. They identify the parts of the fish, observe how it moves, and test its response to sound and light.

The students turn their attention to duckweed in Activity 10. They observe the reproduction of duckweed by budding and investigate the effect of light on the growth and reproduction of the plant. Finally, they discuss how each of these organisms is adapted to its environment.

Activity 11 focuses once again on the pond water community as a whole. Students observe the interactions between organisms in their aquariums to determine the food chains that exist in a pond. Students distinguish between producers and consumers.

In the final activity, students have an opportunity to apply what they have learned and to think creatively and independently. They develop a hypothesis of their own about some aspect of pond life. Then they plan and carry out an investigation designed to prove or disprove their hypothesis.

## Materials List

<b>Qty</b>	<b>Description</b>
8	aquariums, 1-gallon
1 c	bulb, 100-watt
16	containers, small
1	cover slips, p/100
8	cups, plastic, 1-oz
2	dip nets
8	droppers
1 c	fish food, 1 oz
1 c	lens paper, p/50
2	lids, for containers
1	light, aquarium
16	magnifiers
1 c	methylcellulose, 2 oz
1	<i>OBIS Pond Guide</i>
8 c	paper, graph
8	petri dishes
4	Pocketscopes™
8 c †	sand, 2 lb
1	slides, depression, p/40
1 c	tape, masking
1	teacher's guide
1 c	Living Material Order Card
	Shipment includes:
1	algae, 16-oz jar
10	anacharis, sprigs
16	damsel fly nymphs
400	daphnia
1	duckweed, 8-oz jar
25	platys
8	pond lilies, bulbs
18	pond snails

<b>Qty</b>	<b>Description</b>
<i>Teacher provided items</i>	
1	aquarium, spare
1	clock, with second hand
1	container, plastic
11	crayons, green
11	crayons, red
-	field guides to pond life
1	first-aid kit
1	flashlight
- c	hay or grass
1 c	insect repellent
1	jar, large
- c	newspapers
40	pencils, colored
32	pencils, regular
8	rulers, metric
1	tape, transparent
- c	water, spring

† = in separate box  
 c = consumable item

## Activity 4

# Building a Pond Ecosystem

### Objectives

*In this activity, students set up an aquarium containing pond organisms. They compare this ecosystem to the pond ecosystem they observed in Activity 3.*

#### The students

- set up an aquarium to simulate a pond water ecosystem
- compare and contrast their classroom pond ecosystems with the natural ecosystem they observed in Activity 3

### Schedule

About 40 minutes

### Vocabulary

aquarium  
community  
population

### Materials

#### For each student

1 Activity Sheet 4, Parts A and B

#### For each team of four

†algae  
†anacharis  
1 aquarium  
†duckweed  
1 petri dish  
1 †pond lily bulb  
1 bag sand

#### For the class

1 \*aquarium, spare  
1 bulb, 100-watt  
1 \*container, plastic  
†damsselfly nymphs  
†daphnia  
1 dip net  
1 cont fish food  
1 light, aquarium  
†platys  
†snails, pond  
1 roll tape, masking  
\*water, spring

\*provided by the teacher

†in Living Material Shipment

### Preparation

1. Make a copy of Activity Sheet 4, Parts A and B, for each student.
2. Read the sections titled "Living Materials" and "Immediate Care" in the Advance Preparation. They provide you with instructions on how to care for the living organisms used in this activity.
3. Keep on hand a supply of bottled spring water. The water will be used to rinse plants and animals before they are added to the aquariums, and to replace aquarium water that becomes cloudy.
4. Rinse the aquarium sand with spring water.
5. Prepare an area of the classroom for storing the aquariums. They should be kept out of direct sunlight. An aquarium light and a 100-watt bulb will serve as the primary light/heat source for all of the aquariums.

6. Set up a distribution station with the materials needed for the activity. Each team of four will need an aquarium, a bag of sand, some spring water, a petri dish, and two pieces of masking tape. You will need a dip net to transfer the platys from the shipping container to the aquariums.

All teams will receive one pond lily bulb and some algae, anacharis, and duckweed.

Half of the teams will receive daphnia, damselfly nymphs, and pond snails; the other half will receive platys and pond snails (see Figure 4-1). (Note that the platys and daphnia must be kept separate, as the fish will quickly eat all of the daphnia, leaving none for study.)

Set aside half of the daphnia in a plastic container filled with spring water. They will be used throughout the module, both as food for the damselfly nymphs and for individual study. Feed the daphnia by adding several droppersful of algae water to their container every day.

Keep all other extra organisms in a spare aquarium. Feed the fish a pinch of fish food every few days. Remove any food not eaten within 15 minutes.

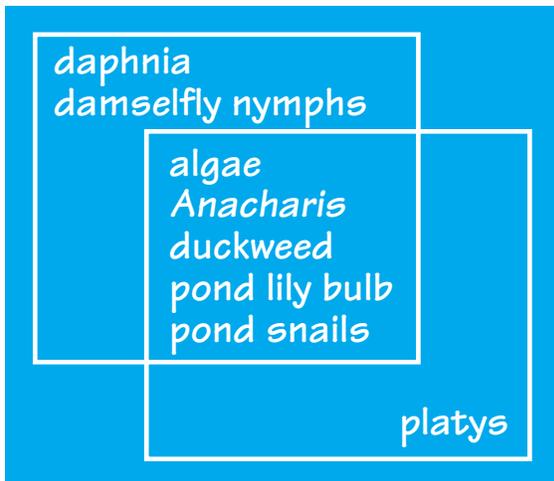


Figure 4-1. Who gets what.

## Background Information

A group of organisms of the same species living in the same general area make up a *population*. A population is defined in terms of time and space, as well as type of organism. One may, for example, refer to the population of moose in Maine in 1994, or the population of mosquitoes living near a swamp during a particular summer.

A population does not live independently, however. Every population, whether moose or mosquitoes, oak trees or algae, interacts with other populations. A *community* is an interacting group of populations in a common location.

In this activity, the students will create a community made up of various pond water populations in the environment of the aquarium—in other words, an ecosystem.

Name \_\_\_\_\_ Activity Sheet 4, Part B

### Building a Pond Ecosystem

Draw a picture of your team's completed aquarium. Include plants and animals as well as nonliving features. Identify the various populations in your aquarium community.

How is your aquarium like a pond?  
They are both ecosystems. They contain similar types of organisms and share some of the same nonliving features.

How is your aquarium different from a pond?  
The size and variety of populations in a pond are much greater. The size of the nonliving features is also much bigger in a pond. As such, the pond contains more habitats than an aquarium. Also, ponds occur naturally. Aquariums are artificial.

## Teaching Suggestions

If the students have not noticed the materials set out for establishing the aquariums, point them out. Then write the word *aquarium* on the board and ask, **Who can tell me what an aquarium is?**

Ask, **What is the purpose of setting up an aquarium in the classroom?**

Ask, **What materials do you think you will need in order to set up an aquarium?** As the students answer, list their suggestions on the board.

## Materials Needed for an Aquarium

1. clear container
2. water
3. sand
4. plants that live in water
5. animals that live in water

Figure 4-2. Materials for building an aquarium.

Distribute a copy of Activity Sheet 4, Parts A and B, to each student. Divide the class into teams of four, and give each team an aquarium, a petri dish, a bag of sand (rinsed in spring water), a pond lily bulb, and two pieces of masking tape.

Instruct the students to follow the directions on Activity Sheet 4, Part A, to construct their aquariums.

When they are finished, have each group affix a masking tape label with their names on it to the outside of the aquarium.

## Additional Information

1

A water-filled container in which fish and other aquatic animals and plants live.

Students may mention that they could use an aquarium to study pond life.

Answers will vary, but the students should mention a clear container (the aquarium itself), sand, water, and plants and animals that live in water. They may also propose other materials that they saw at the pond, such as rocks. Show them any materials they have not mentioned.

2

Do not tell the students what the bulb is; let them speculate. However, make sure that they plant it with the pointed end up.

**Note:** Do not let students use limestone or shells to decorate their aquariums, as the chemical composition of these items will throw off the pH of the water and harm the living organisms.

Have each team fill its aquarium with spring water to within 3 cm (about 1.2 in.) of the top. In one corner of the aquarium, have them mark the water level with a piece of masking tape.

**3**

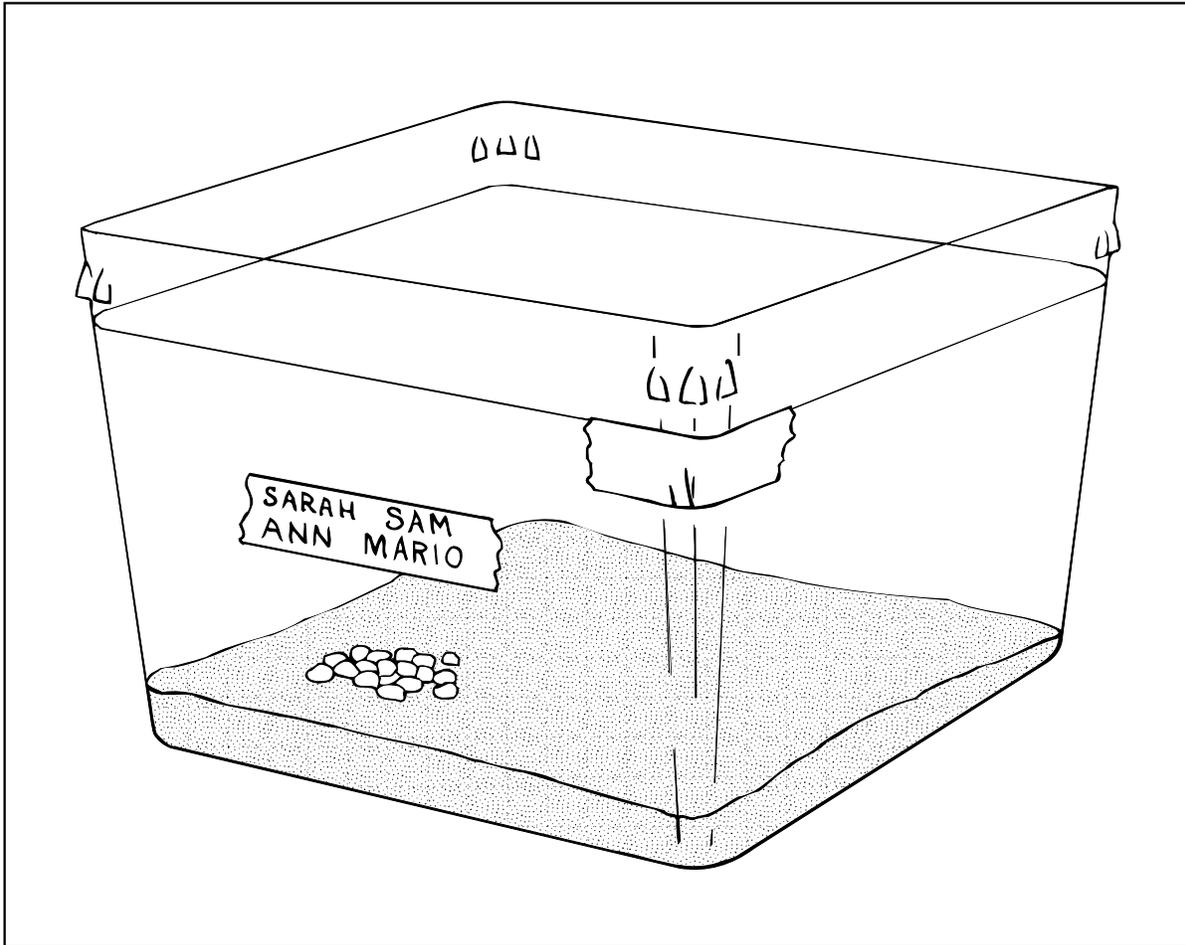


Figure 4-3. The aquarium setup.

Distribute the water plants to each team, placing them in the petri dishes. Have the students add these to their aquariums.

**4**

Again, do not tell the students the names of the plants. In later activities, they will attempt to identify all the organisms in their aquariums.

Ask, **Is your pond system complete? What else is needed?**

The students will probably realize the system is incomplete without animals.

Without telling students the names of the animals, distribute daphnia, damselfly nymphs, and pond snails to half of the teams, and platys and pond snails to the other half.

Rinse the pond snails in spring water before adding them to the aquariums. Remove the platys from their shipping water using a dip net, and transfer them directly to the aquariums. Dump the shipping water down the drain.

Give the students time to observe their aquariums and those of the other teams. Tell them to draw a picture of their completed aquariums on Activity Sheet 4, Part B.

5

When they are finished, write the word *population* on the board. Ask a volunteer to try to define the term.

A group of one kind of organism living in the same area at a given point in time makes up a population.

Ask, **How many different populations are in the aquariums?**

In all, students should be able to count three plant populations and four animal populations in the aquariums. (They should not include the bulbs in their count. Within a single aquarium, this plant cannot be considered a population because a population must interact; in other words, there must be more than one in order to be a population.)

Write the word *community* on the board. Tell the students that a community is different from both an ecosystem and a population. Ask a volunteer to try to define it. Ask, **How can the term community be used in relation to the pond? In relation to the aquarium?**

6

A community is an interacting group of populations in a common location. A pond contains a community made up of many populations that occupy its various habitats. The aquarium contains a community made up of only a few different populations.

In random order, write the terms *organism*, *population*, *community*, and *ecosystem* on the board. Invite a volunteer to come to the board and number the terms in order of increasing complexity.

7

The words should be numbered: 1 = organism, 2 = population, 3 = community, and 4 = ecosystem.

Ask, **In the context of a pond, what does each of these terms describe? In the context of an aquarium?**

An organism in the pond might be an individual plant, such as a grass or an algae, or an animal, such as a frog or a snail. In the aquarium, it would be any one of the plants or animals that the students put in. A population could be all of one kind of organism. A community would be all the populations of plants and animals in the pond (or aquarium). An ecosystem would be the community plus the surrounding environment—in other words, the entire pond or the entire aquarium.

Ask the students to recall their visit to the pond. Ask, **What were the habitats that you identified there?**

8

The pond habitats included the surface of the water, the air above the water, the open water, the bottom of the pond, and the shallow water along the edges.

Ask, **What habitats can you identify in the aquarium?**

The aquarium habitats include the surface of the water, the open water, the sand at the bottom, and the walls of the aquarium.

Ask, **What nonliving things are in the aquariums?** List the students' answers on the board.

9

The nonliving things are water, sand, the aquarium containers themselves, and any other materials, such as stones, that the students may have added.

Ask, **What are some ways in which living things in the aquarium interact with these nonliving things?**

Answers will vary. Students may have observed the snails crawling on the sides of the aquarium or resting in the sand. They may mention that the fish swim in the water.

Remind students that the definition of an ecosystem is a group of living things and the environment in which they live and interact with one another, and with the nonliving things in their environment.

Encourage a discussion to compare the ecosystem of the pond with the ecosystem of the aquarium. Ask students to use the terms *organisms*, *populations*, *communities*, and *habitats* and to mention nonliving features of the environment as well as living features when they make their comparisons. Tell them to record their ideas at the bottom of Activity Sheet 4, Part B.

10

Students should state that both ecosystems have similar types of organisms and some similarities in the nonliving features of their environment. However, the size and variety of the populations are much greater in the pond ecosystem. Also, the size of the nonliving features differs. As a result, the pond contains more habitats than the aquarium. Both ecosystems contain communities, but of different sizes and complexities. If students do not mention it, point out that their aquarium ecosystem was purposefully constructed, whereas the pond ecosystem occurs naturally.

Place the aquariums (including the spare aquarium and the container of daphnia) together in the area that you have set aside for them. Set up the aquarium light so that it shines over all of the aquariums.

11

Students may wonder why a light is needed for the aquariums. Explain that the green plants in the aquariums require light in order to make food. Remember, however, that a light source also gives off heat that can build up inside the aquarium container.

To determine if an aquarium is becoming too warm, touch the back of your hand to the outside wall. If it feels uncomfortably warm, the aquarium has become overheated. Move the aquarium to a cooler place or raise the light away from the aquarium. There is an optimal temperature for each organism. However, none of the organisms supplied with this module will be harmed if you keep the temperature of the aquariums between 10°C and 25°C (between 50°F and 80°F).

### Reinforcement

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Cut out different-sized circles from colored construction paper. Use a different size for each color. Cut out a large one and label it *Ecosystem*. Cut out a slightly smaller one and label it *Community*. Cut out several medium-sized ones and label them *Habitat*. Cut out a dozen smaller ones and label each

**R** one *Population*. Cut out a lot of tiny ones and label them *O* for organism. Have a group of students arrange the smaller circles of paper on top of the larger ones to represent the increasing levels of complexity in an ecosystem.

### Cleanup

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Rinse the petri dishes and the dip net, allow them to air-dry, and return them to the kit.

**C**

## Connections

### Science Extension

Ask students to begin identifying and obtaining science textbooks, library books, and other resources to use for their research on pond organisms. Books listed in the References and Resources section at the end of this guide may be particularly helpful.

Have students begin their research with birds and mammals, including any they may have observed on their trip to a pond and others such as those listed below. Make sure students understand that many birds and mammals do not actually live in the pond but depend on it for food and water and thus are regular visitors.

beaver	marsh wren
bittern	moose
deer	muskrat
ducks	raccoon
geese	red-winged blackbird
heron	star-nosed mole
kingfisher	water shrew

Identify another type of ecosystem besides a pond—for example, a forest, a saltmarsh, a meadow, or a desert—and ask students to identify the living and nonliving things in the ecosystem. List students' suggestions on the board. Then ask them to identify the organisms, populations, habitats, and communities in the ecosystem. Circle and label these groupings on the board. Then ask students to identify another type of ecosystem, and repeat the procedure.

### Science and the Arts

Have students add pictures of birds and mammals to the bulletin board display of a pond ecosystem. Since birds and mammals are generally much larger than other types of organisms found in or around a pond, suggest that students place them in the

background or to the side, to leave room for smaller organisms that will be added to the display in later activities. Encourage students to use their imagination and creativity in devising ways to incorporate these larger animals into the display. For example, instead of placing drawings of birds directly on the surface of the bulletin board, students could suspend them from thread taped to the ceiling or tape them to sturdy wires attached to the bulletin board.

### Science, Technology, and Society

If there is an aquarium in your area, arrange a class visit or ask an aquarium staff member—someone from the department responsible for educational programs—to visit the classroom. As an alternative, ask the owner or manager of a pet store that sells tropical fish to speak to the class. Ask the tour guide or visitor to explain how tanks are set up and maintained. What specific conditions are required by different types of fish and other aquatic organisms? What equipment or materials are needed to provide these conditions?