

## WRAP-UP

To wrap-up the investigation, bring your students together for a group discussion to help them understand why and how they achieved their results. It is important to share results so that everyone has a clear picture of what happened. To help you facilitate the discussion, review the explanation in "The Why and The How" using the Group Discussion questions as a guide.

### GROUP DISCUSSION

Explain to students that scientists learn from each other through discussion, and they build upon the work of others to make new discoveries. Just as scientists come to conclusions based on the findings of their experiments, students will now come together as a group to share their results and make conclusions about the investigations they've conducted. Have students record their final results and the explanation in their journals.

Ask students:

- When we remove certain elements from the ecosystem, what is the impact on the living and non-living elements of the ecosystem?
- What did you learn about water in this investigation?
- Why is water important in an ecosystem?
- How do biotic elements interact with water?
- How does water affect abiotic elements?
- What surprised you?
- What new questions do you have?

### The "Why" and the "How"

Abiotic elements are those non-living physical and chemical parts of an ecosystem which affect the ability of organisms to survive and reproduce. Chemical and geological elements such as rocks and minerals, and physical elements such as temperature and weather are considered abiotic. The abiotic elements of an aquatic ecosystem include water, nutrients, weather, gravel or sand, sunlight, cloud cover and oxygen levels.

The biotic elements in an active aquatic ecosystem include wildlife, aquatic plants, fungi and microscopic soil organisms. Biotic elements also include the stuff that living things leave behind or feed upon. As organisms go through a life cycle and leave behind things such as leaves, sticks, shells, skin or hides, feces

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<http://www.estuaries.gov/pdf/EstuaryParty.pdf>

or waste, teeth and bones. Even though these things are no longer living, they are biotic elements because they came from living things and are used as food by other living things such as scavengers and decomposers. A pile of earthworm dung is considered biotic because it is the waste of a living organism. A rotting log and leaves are biotic elements because they came from a tree that was once living.

Aquatic plants and animals are interdependent (rely on each other), and they provide for each other's needs. For example, plants need water, sunlight and nutrients from biotic waste to create their own food; and plants provide oxygen, food and shelter for wildlife. Biotic and abiotic elements in all ecosystems interact in a number of ways. Since living things are dependent on abiotic elements, such as water, sunlight, air and nutrients to survive, the more abiotic factors are available in an environment, the more biotic factors there are likely to be.

Not all environments have the same abiotic factors. Some environments have warmer temperatures than others. Some aquatic habitats have more salt than others. Some environments may have rockier terrain than others. These abiotic factors affect the organisms that live in those environments. To survive, these organisms must adapt or adjust to these abiotic conditions. For example, polar bears have thick coats of fur, black skin and layers of fat to insulate them from the cold temperatures. Because a polar bear is adapted to cold climates and cannot survive in warm climates, temperature is an important abiotic element.

The abiotic elements of an aquatic ecosystem are equally as important as the biotic elements. All of the parts of an aquatic ecosystem are essential to its health and sustainability.

## Curriculum Match-Up

- Define the following terms in your own words: ecosystem, biotic, abiotic.
- Make a data table of the biotic and abiotic elements found in a local body of water and the source of pollutants in the water.
- Write a poem about the biotic and abiotic elements found in your favorite aquatic ecosystem.
- Make a web of biotic and abiotic elements in an estuary.

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# What's in the Water?

## Biotic & Abiotic Elements in Aquatic Ecosystems

### Learning Objectives

Students will:

1. Identify abiotic and biotic elements of an aquatic habitat.
2. Explain the relationship between abiotic and biotic elements in an ecosystem.
3. Identify variables that affect the sustainability of an ecosystem.

### Vocabulary Ventures

- abiotic
- aquatic
- biosphere
- biotic elements
- ecosystem
- terrestrial

An ecosystem is an area that contains living things such as plants, animals and microorganisms (bacteria, for example) that interact with one another and the environment in which they live.

Ecosystems can be of any size – small like a rotting log, or large like a beach or a forest. Ecosystems are identified as either aquatic (water) or terrestrial (land). The biosphere is the parts of the Earth and the atmosphere that contain living organisms. Every ecosystem is a part of the biosphere.

The organisms that make up the living part of an ecosystem are called **biotic**, which means "living or having lived".



*T. scripta* (yellow-bellied slider)



aquatic ecosystem

Some examples of biotic elements in an ecosystem include snails, flowers, butterflies, leaves, or a piece of wood. Living things are affected by the physical conditions in the environment and by other living things in an ecosystem.

Nonliving things found in an ecosystem are called **abiotic**, which means "non-living, or never having lived". Abiotic elements have an effect on the type and number of organisms living in an ecosystem. Examples of abiotic elements in an ecosystem include soil, rocks, water, air, temperature and sunlight.

Water plays a special role in every ecosystem, interacting with all of the biotic and abiotic elements. As a result, these elements affect the quality and amount of water in the biosphere.

We are going to examine biotic and abiotic elements in an aquatic ecosystem.



*L. terrestris* (earthworm)

### Time Needed to Conduct Investigation

*This investigation has two parts.*

- Organize and set up materials: 10 minutes
- Introduce the lesson: 5 minutes
- Conduct the investigation: 30 minutes
- Student journaling/group reflection: 10 - 15 minutes
- Total estimated time: 55 - 60 minutes

# Investigation: Exploring Aquatic Ecosystems

## Materials

For the entire group of students  
Student journals and writing tools

### Part 1

- Flipchart or chalkboard
- 4 - 5 pictures of an aquatic ecosystem

### Part 2

- Shoebox or plastic bag
- 30 index cards, each labeled with a biotic and abiotic element given on the chart on page 3
- Ball of yarn or string
- Clock or watch with a minute hand

## Part 1 Biotic and Abiotic Identification

In this investigation, students will identify biotic (living) and abiotic (non-living) elements in an aquatic ecosystem.

### GET READY!

Remind students to use their student journal to document their predictions, observations and findings. Divide students into groups of three or four. Provide several photos of aquatic ecosystems for each group of students, such as a freshwater ecosystem; or an aquarium with sand, plants, water, fish or snails.

**NOTE: Photos are provided in the Appendix.**

How do you know that something is alive? Share the following characteristics of biotic elements with students. Have students record these characteristics in their student journals:

#### Biotic Organisms:

- Live, grow and die (i.e. they have a lifespan)
- Reproduce
- Use resources such as food and water for energy
- Interact with their environment
- Are made up of small units called cells
- Use respiration (exchange gases to get oxygen to the blood)
- Produce waste

Ask students to examine the photo examples and document the following observations in their student journals. As the groups are brainstorming, record their ideas on a flipchart or chalkboard.

Ask students:

1. Which elements in each of these is living, or biotic? What evidence supports your answer?
2. Which elements in each of these examples is an abiotic (non-living) element?
3. Did everyone in your group agree with your description? What did you agree on? Disagree on?
4. Based on previous investigations, what are some factors that impact an aquatic ecosystem?

*Answer: pollution, pH levels, destruction of habitats, climate change, salinity levels.*

5. What do you think is needed for the living organisms in an aquatic ecosystem to survive?

*Answer: food, shelter, oxygen, suitable pH levels, clean water, etc.*

6. What is the relationship between the living and non-living elements of these ecosystems?

Ask students to think of other characteristics that are unique to living organisms.

## Part 2 Making Connections

Students will now participate in an activity that shows the connections between all of the elements of an aquatic ecosystem.



#### TIP

This exercise may generate healthy discussion and debate among students. Encourage critical thinking instead of "right" or "wrong" by asking students to support their findings.

### PROCEDURE

Encourage students to think about the relationships between living and non-living elements of an aquatic ecosystem.

1. Place the nametags labeled with biotic and abiotic elements into a shoebox or plastic bag.
2. Have each student choose one of the nametags.
3. Have students form a circle in the middle of the room and place their nametags on their shirts or in front of them in the circle.
4. Next, give a ball of yarn or string to one student. Have that student identify the element that he or she has chosen and pass the ball of string to another student while still holding on to the string.
5. As the ball of string moves through the circle, each student should state whether his/her element is abiotic or biotic and then identify the connection between his/her element and the next student's element.

*For example, one student with a seed tag (biotic element) passes the string to another student with a sunlight tag (abiotic element) and explains that seeds need sunlight to grow.*

6. Students should continue passing the ball of string for 5 to 10 minutes making as many connections as possible.

As students are passing the ball of yarn around the circle, ask students to share how they decide where the ball of yarn should travel in the ecosystem. What do they consider to make their decision?

### OBSERVE

After 10 minutes, encourage students to make and discuss their observations. Ask students:

1. How does the circle look?
2. Has every element made a connection? Why or why not?
3. Which element has the most connections? Why do think this is?
4. Which element has the least connections?
5. What does this investigation demonstrate?
6. How do you think pollution affects these connections?
7. What would happen if we removed an element from this ecosystem?

To demonstrate what happens when an element is removed from an ecosystem, have students decide as a group which biotic or abiotic element to remove from the ecosystem. When the element is identified, have the student representing that element pull gently on the ball of yarn.

Ask students:

- Who felt the pull on the string?
- How are you affected by the removal of this element?
- What factors are you taking into account to determine if the removal of an element will affect you?

Continue removing or adding elements or other ideas suggested by the students. Remind students to share and record their findings in their student journals.

BIOTIC AND ABIOTIC CARDS

Sunlight	Temperature	Air	Rain	Tadpoles
Mosquito	Tree	Weather	Banded Sun Fish	Garter Snake
Bacteria	Phytoplankton (floating plant)	Saltwater	Freshwater	Sunflower seeds
Aquifer	Clouds	Snail	Soil	Tree
Plant	Sand	pH Level	Venus Flytrap	Clam
Acid Rain	Pollution	Heron (bird)	Nutrients	Rotting log