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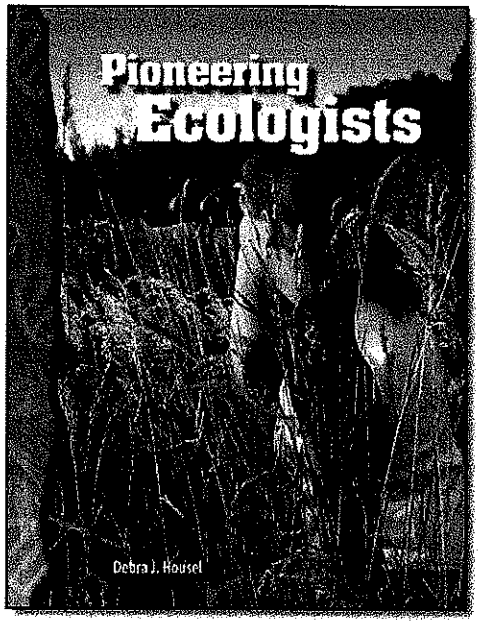
Science Readers

Lesson Plans for

Pioneering Ecologists



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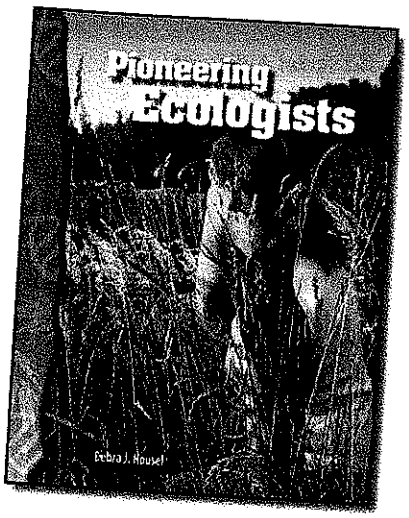
Pioneering Ecologists Reader



Learning Objectives

Students will relate new information to prior knowledge. (Nonfiction Reading Objective)

Students will write journal entries, reflecting knowledge of the topic. (Writing Objective)

Students will explore concepts of ecology. (Science Content Objective)

Materials

- writing paper (or journals) and pencils
- *Seeing Red* activity sheet and transparency (page 130)
- *Protection with a Purpose* activity sheet (page 131)
- *Clean Water* activity sheet (page 132)
- materials for Lab (see page 118)
- *Reader Quiz* (page 133)

Before Reading

Complete the Introductory Activity (page 114) with the whole class. Then divide the students into reading groups. The students who read this book should be reading on or below level.

Begin the lesson by reviewing major concepts and new vocabulary students will encounter in the reader, such as:

- ecosystem
- environment (environmental)
- habitat
- global warming

Remind students that they have been reading about different kinds of scientists in other readers. Then ask if they know what an ecologist is. Point out that an ecologist is a kind of scientist, but what does this scientist study?

Open the reader—*Pioneering Ecologists*—and read aloud the first two paragraphs on pages 4 and 5. Then ask students again if they know what an ecologist studies. Finally, read aloud the next paragraph to clarify that an ecologist studies the connections between living things and their surroundings.

Explain to students that good readers think about the topic before reading and reflect on the things they know about it. Distribute paper to each student and have each student draw a line down the center to make two columns. In the first column, have the student record what he or she knows about ecologists, the topic of ecology, environmentalism, and ecosystems.

Before Reading *(cont.)*

Prompt the students with questions, such as:

What are some animal habitats you know of?

What habitats exist near where you live?

What do you know about environmental issues?

What concerns do people have about the environment?

What is global warming?

As students record their prior knowledge, remind them that thinking about these things will assist them as they read and learn new information.

During Reading

Have students divide into pairs to read *Pioneering Ecologists*. Encourage pairs to work together to discuss words or concepts that are new or confusing to them.

As students read, have them record new information they find in the text. They should record new information in the second column of their charts.

Ask if any students have ever had food poisoning or ate bad food (moldy, out of date, etc.). Reread pages 8–9 about algae and algae blooms. Ask students to imagine a whole ecosystem with food poisoning.

Display the transparency. Discuss the difference between red and green algae, and what happens when red algae bloom. How does this compare to when green algae bloom? Reread pages 22–23 about food webs. Discuss how marine life is part of a food web that eats red algae.

Distribute *Seeing Red* (page 130) to students. Read the information together, then allow students to complete the activity sheet. Have students research additional coral reef fish that may be affected by the consumption of red algae to add to their page.

After Reading

After reading, ask the students to consider how their prior knowledge helped them to better understand new information. For example, ask a student to share one piece of new information recorded on the chart. Then ask the student to look at his or her list of prior knowledge. Did any of this knowledge relate to what was learned? Explain that reading this nonfiction text helped to increase their overall knowledge of the topic by adding to what they already knew.

Instruct each student to write a journal entry about a section of information in the reader. The student should share both prior knowledge and new information learned from reading.

The students read how the addition or removal of one species can affect other species in an ecosystem. Review examples of this from the book. Reread pages 10–13 about Aldo Leopold's involvement with game laws and how his work led to the Endangered Species Act of 1973.

Distribute *Protection with a Purpose* (page 131) to students. Have students work in pairs to consider ways to help increase the animal populations. Ask the students if they believe laws protecting animals are effective. Have the pairs research an additional animal that is endangered and report to the class in an "on the scene" news report to explain what's being done to protect the species and if these efforts are effective.

Water sample kits are available through most science education catalogs. They measure the pH level, hardness, dissolved oxygen level, and presence of contaminates in water. Discuss these factors with students. Reread pages 14–15 about Ruth Patrick and her use of diatoms to test the health of water.

Distribute *Clean Water* (page 132) to students. Read the information and data chart together. Then students may answer the questions independently. If possible, have students conduct their own water tests and chart the results. Or have students research possible ways they can get involved in local water quality projects.

A *Reader Quiz* is provided (page 133). Use this to assess your students' understanding of the reader.

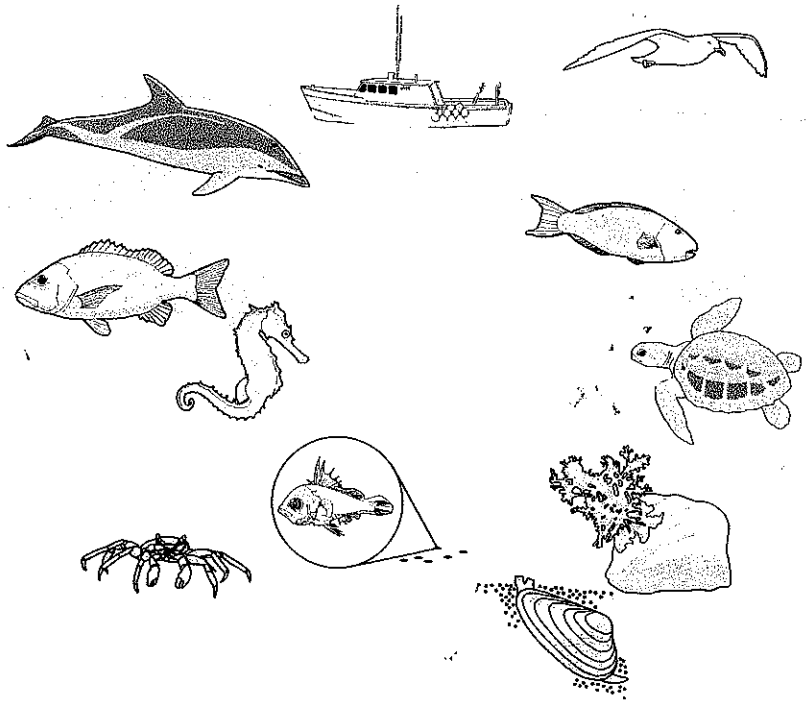
Finally, gather the students back together in a whole group to have them complete the lab activity (pages 117–118) and the Concluding Activity (page 115).

Seeing Red

Red algae are important to the ecology of coral reefs. Fish, shellfish, and other sea life eat them. So do people. Red algae is used in a number of dishes in Japan. The Welsh use them to make lava bread. Like green algae, they are also used to produce food and gels. Since people harvest red algae for industry, this makes them important to the economy of those cultures.

Scientists are not sure how many species of red algae inhabit the world's oceans. Estimates range from 2,500 to 6,000. Red algae are an important part of the food web. But when they grow too fast or "bloom," they can be deadly. They can be seen from the sky as patches of red blankets on the ocean's surface. People call this "red tide." When fish eat them, they get sick and die. This also affects species higher on the food chain.

Directions: Use the clues to draw arrows showing how a harmful red algae bloom can affect marine life in the food chain. Use a red pencil to show species that eat algae directly. Use a blue arrow to show species that eat other species.



1. Color the algae red.
2. Fish larvae and clams eat algae.
3. Crabs eat clams.
4. Zooplankton eat harmful algae. Draw them in red by the algae. A baby sea turtle and parrot fish eat the zooplankton.
5. A red bass eats fish that eat plants.
6. A seahorse eats small shrimp and other animals like crabs.
7. A dolphin eats fish and other sea animals.
8. A seagull eats crabs, clams, and fish that may wind up onshore.
9. People eat all the plants and animals listed. Color the boat blue.
10. Look at the arrows. Are there more red or blue arrows? What does this tell you about the amount of plant life in the world's oceans?

Protection with a Purpose

The Endangered Species Act of 1973 protects plants, animals, and their environments from being destroyed or becoming extinct. Currently, a little over 1,300 species are listed as being threatened or endangered. The act has increased populations of the American bald eagle, the grizzly bear, and California's southern sea otter, to name just a few successes.

Species	Data Before		Data After	
American Bald Eagle	417 pairs	1963	9,250 pairs	2006
Grizzly Bear	271	1975	580	2005
California's Southern Sea Otter	1,789	1976	2,735	2005

Directions: Read the situations below related to endangered animals. List at least two ways changing human actions could help improve the chance of survival for these two animals. Answer the questions.

Situation One

The Florida panther is on the endangered species list. It used to inhabit most southern states. Now it lives in swamp and marsh areas of south Florida. Most Florida panthers die from attacks by other Florida panthers. Males do not tolerate other males on their territory. Human development of the lands they inhabit has forced them to share territory. They also die when they are hit by cars when they cross roads and highways. Many are being saved by living in national and state parks, and private land reserves.

Situation Two

Sea turtles live in all the world's oceans. They use shorelines on subtropical beaches to lay eggs. All species of sea turtles are endangered. Several situations threaten them. First, people have developed the shorelines which the turtles use to nest. This would not be a problem since the buildings are so far back from the shore. But newly hatched turtles use nighttime light to guide them. They get confused by the lights of the buildings and mistake them for the light of the moon. The fishing industry also affects sea turtles. Turtles become entangled in fishing line, or are hit by boats. Turtles also fall victim to human pollution such as plastics, rubber, and metals. Likewise, sea turtles and their eggs are hunted for their meat. The oil, skin, and shells are also used. Some efforts, such as disallowing netting by fishermen, have helped increase sea turtle populations.

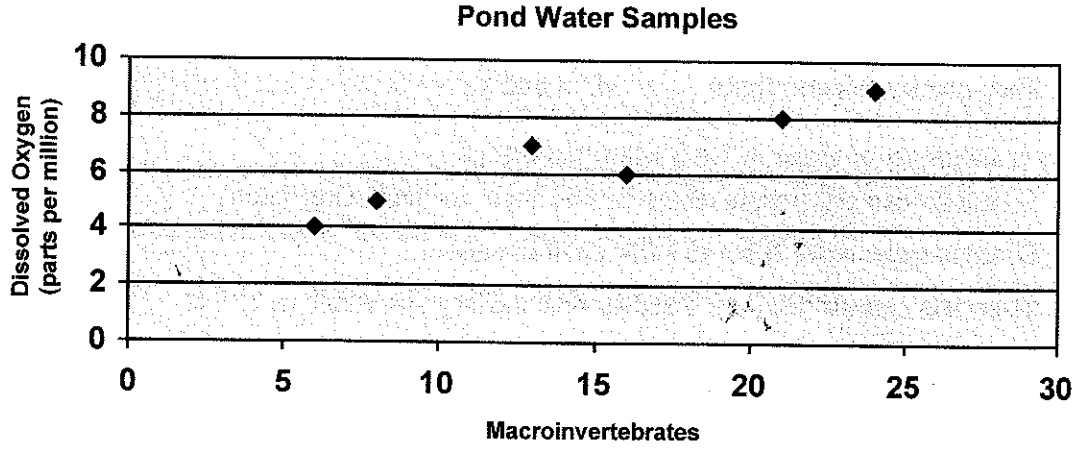
1. How are these animals' situations similar to the passenger pigeon or dodo bird?
2. Which of the animals in the table above do you think is the greatest success? Explain.
3. Do you think the animals in the chart would have increased their population without the Endangered Species Act? Explain.

Clean Water

Water quality can be measured by the number of macroinvertebrates in a sample of water. These small animals are low on the food chain. If there are more of them, greater numbers of other animals can use the water to find food and use it as drinking water.

Many things can affect water quality, such as temperature, pH levels (how acidic the water is), and dissolved oxygen (oxygen in the water). If there is not enough dissolved oxygen in a stream or pond, zooplankton and fish cannot breathe. Many things can affect the amount of dissolved oxygen in a pond or stream. Too much bacteria, which uses oxygen to decompose matter, is one of them.

Gerald and his friends tested three ponds in their town and three ponds in a neighboring town. They used a DO probe and meter to measure the amount of dissolved oxygen in a sample of water from each pond. Dissolved oxygen levels range on a scale of 0 to 10 ppm (parts per million). They used a hand lens to count the number of macroinvertebrates in each sample. They plotted their findings on a scatter plot chart, below.



Directions: Use the information from the chart and what you read in *Pioneering Ecologists* to answer the questions.

1. What is the relationship between the amount of dissolved oxygen and the quantity of macroinvertebrates?
2. What does the number of macroinvertebrates tell the boys about the quality of the pond water?
3. Circle the data point that seems to indicate the healthiest pond.
4. What might be causing the low levels of dissolved oxygen in two of the ponds?
5. How could the boys help the ponds with the least dissolved oxygen become healthier?

Reader Quiz

Directions: Use what you learned from reading *Pioneering Ecologists* to choose the best answer for each question.

1. Imagine two plants. The first plant has sand with few nutrients. The second plant has soil rich with nutrients. Which of these plants will grow better?
   a. The plant in sand because sand holds water better.
   b. The plant in sand because it absorbs more sunlight.
   c. The plant in soil because all plants grow better in soil.
   d. The plant in soil because the plants grow better when soil has nutrients.

2. What do algae need to bloom?
   a. nutrients b. soil c. water d. light

3. How do the National Environmental Policy Act of 1969 and the Endangered Species Act of 1973 help nature?
   a. They protect land. b. They protect living things.
   c. They protect human rights. d. a and b

4. Why is the study of algae in fresh water important?
   a. Scientists can tell people where to find them for producing foods.
   b. Scientists can move them to safer environments.
   c. Scientists can use them to discover how healthy the water is.
   d. Scientists can use them to discover how healthy the Earth is.

5. Why are wetlands important?
   a. They filter water before it gets to the ocean.
   b. Sea life depends on them.
   c. They prevent flooding.
   d. All of these

6. Why do scientists refer to the connection of what animals eat as a food web?
   a. All animals eat plants.
   b. Animals belong to more than one food chain.
   c. Animals need to hunt for food.
   d. All animals share their habitats with other animals.

7. How do humans affect the balance in a natural ecosystem? Use details and examples from the book to explain your answer.

Pioneering Ecologists Answer Key

Seeing Red

Check student page. Students should have colored the algae red, and drawn three red arrows to fish larvae, clam, and zooplankton. All other arrows are blue.

10. blue; Oceans must have much more plant life than animal life to feed the plant and meat-eating species.

Protection with a Purpose

Students should have included at least two ways people's actions can help increase the populations of the Florida panther and the sea turtle.

1. Answers will vary. Examples: Sea turtles and the birds were all killed intentionally. Sea turtle eggs and dodo eggs were used as food.
2. Answers will vary.
3. Answers will vary.

Clean Water

1. The greater the dissolved oxygen, the more macroinvertebrates there are in the water.
2. The pond water is healthy when there are many macroinvertebrates.
3. Check students' charts. They should have circled the last data point.
4. any of the following: too much pollution; too much algae; too much bacteria
5. Answers will vary.

Reader Quiz

1. d 2. a 3. d 4. c 5. d 6. b
7. Answers will vary. Example: People cause algae blooms. Farmers use fertilizer in their crops, which ends up in lakes and oceans as run-off. This can cause an algae bloom, which can make animals sick and die, and can cut off light that water plants need to grow.

Lab Lesson Plan: Creating an Algae Bloom

Before the Lab

Review with students what they learned about the balance between plants and animals in a biome.

Ask the students to give examples, either personal knowledge or from the reading, which show how one population of plants and animals affects another.

Introduce the Lab

Read the introductory information with students. Review what students are recreating in the lab.

Read the list of materials. Provide each lab group with the necessary materials. Or, have them ready to complete as a demonstration lesson in front of the class.

Read through the procedures at least once completely (not the conclusion) before having students engage in the lab. Check for understanding of the required steps.

Have students predict what they think they will observe in each jar. They should justify their responses.

Conduct the Lab

Allow time for lab groups to conduct the lab, or follow the steps as a class if conducting a demonstration lab.

Instruct students to record their descriptions in Steps 6 and 8 on a sheet of notebook paper, or in their science journals.

After the Lab

Read the conclusion. Have students compare their results with the text.

Assign each lab group a different biome to study: tundra, temperate forest, tropical rain forest, grassland, desert, riparian, and pelagic. They research and report on what the energy pyramid looks like in their biome and explain how the population of one plant or animal may affect another.

Lab: Creating an Algae Bloom

Materials

- freshwater from a pond or a lake (can use tap water, but it will slow down the experiment)
- two clean clear glass jars with a screw-type metal lid (16 oz. jar is ideal)
- liquid lawn or crop fertilizer
- floating water plants (tablespoon of algae from a pond works best)
- $\frac{1}{4}$ teaspoon measure
- masking tape
- pen

Procedure

Fill the two glass jars with pond or lake water.

Place a floating water plant or some algae in each jar.

Use the masking tape and pen to label one jar Pond Water and the other jar Fertilized Water.

Place $\frac{1}{4}$ teaspoon of liquid lawn fertilizer in the jar labeled Fertilized Water. Stir it thoroughly with the measuring spoon.

Place both the jars in sunlight.

Observe the jars daily, and record what you see in each.

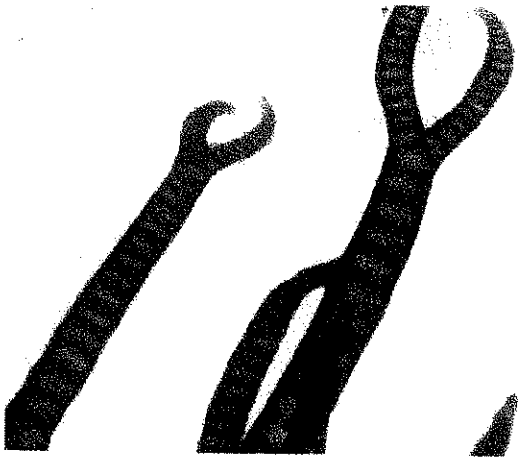
After one week, place another $\frac{1}{4}$ teaspoon of liquid lawn fertilizer in the Fertilized Water jar.

Observe the jars and record your observations at the end of the second week.

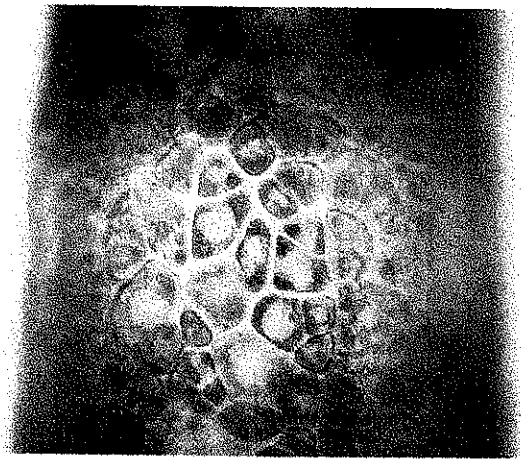
Conclusion

You will see that the pond plants in the Pond Water jar are growing at a normal pace. The water beneath the plants is relatively clear. The pond plants in the Fertilized Water jar are growing rapidly and taking up all the space. The water below them is cloudy and murky. If there were fish in that jar, they would die due to the plant overgrowth.

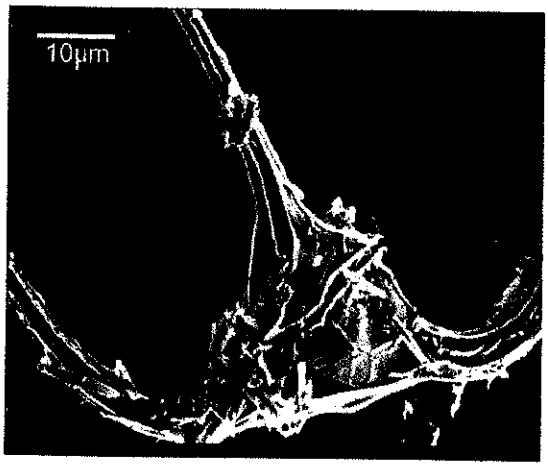
Seeing Red Transparency



ceramium thallus



ceramium pericentrals



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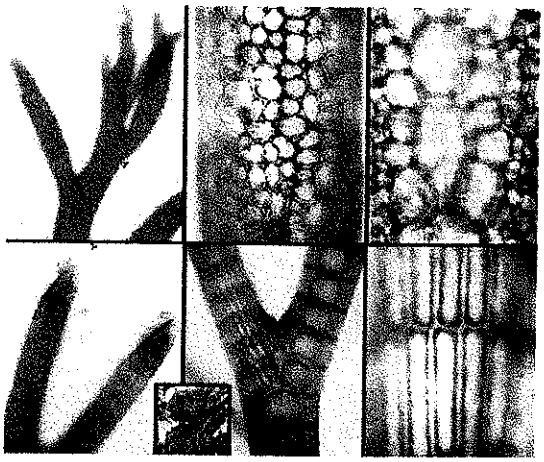
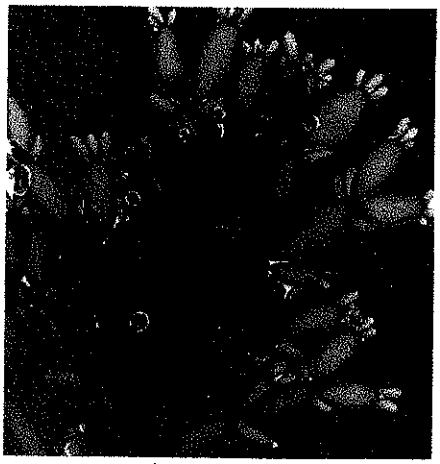


filamentous red seaweeds

lithophyllum crustose thallus section



lomentaria