



WETLAND *LŌKAHI*

How do plants and animals in a wetland need each other to survive?

HAWAII DOE STANDARD BENCHMARKS

Science 1: The Scientific Process: SCIENTIFIC INVESTIGATION

- **SC.3.1.1** Pose a question and develop a hypothesis based on observations.
- **SC.3.1.2** Safely collect and analyze data to answer a question.

Science 3: Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT

- **SC.3.3.1** Describe how plants depend on animals.

Math 11: Data Analysis, Statistics, and Probability: FLUENCY WITH DATA

- **MA.3.11.1** Pose questions, collect data using surveys, and organize the data into tables and graphs
- **MA.3.11.2** Organize and represent data in more than one way (e.g., tallies, chart, tables, bar graphs, line plots, line graphs)

KEY CONCEPTS

- Plants depend on animals for carbon dioxide and nutrients needed for survival.
- Animals depend on plants for oxygen, habitat, and food.
- There is *lōkahi* (balance) in the relationships between plants and animals.

ACTIVITY AT A GLANCE

Students conduct an experiment with plants to investigate how plants need animals. They record their observations in bar graphs and add them to the “Mathematical Marsh” from the previous activity.

ASSESSMENT

Students:

- Complete a data sheet that includes their question, method, data and results.
- Make bar graphs to summarize their data.
- Draw a picture that summarizes the *lōkahi* in the relationships between plants and animals.

TIME

2 class periods with periodic follow-up over 10 - 14 days

SKILLS

questioning, predicting, making, selecting and testing a hypothesis, observing, measuring, recording, inferring, graphing, using scientific vocabulary

MATERIALS

Provided:

- ✓ Learning Logs 3 and 4

Needed:

- ✓ 1 bag potting soil (Use soil without perlite)



- ✓ 12 3-inch pots or empty milk cartons and a tray to hold them*
- ✓ 12 wetland plant seedlings (see Resources)
- ✓ watering can
- ✓ fish emulsion fertilizer
- ✓ measuring cups
- ✓ old newspapers
- ✓ masking tape
- ✓ permanent marker
- ✓ rulers
- ✓ colored paper (for bar graphs)

*Consult with the source of your plant seedlings before deciding on pot size. Some plants will need 6-inch pots or one-half gallon size cartons.

VOCABULARY

carbon dioxide – a gas that is taken in by plants during photosynthesis

ho'okanu – to plant

hulu – feathers, sometimes fur

kanu – plant or bury

lepo – soil, dirt

lōkahi – harmony, balance

TEACHER BACKGROUND INFORMATION

Plants and animals are interdependent in a number of ways, the most basic of which is in the exchange of oxygen and carbon dioxide. Through the process of photosynthesis, plants use energy from the sun to combine carbon dioxide and water to produce carbohydrates. Plants have very tiny openings on the underside of their leaves (stomata) through which they absorb carbon dioxide from the air. The carbon they absorb is converted to a form the plant can use and oxygen is released. Animals breathe the oxygen into their lungs where it

makaloa - type of plant called sedge

nā meakanu – plants

nā holoholona – animals

nutrients – a substance that is necessary for life and growth

oxygen – a gas that is released by plants during photosynthesis

photosynthesis – the production of carbohydrates using sunlight energy to combine carbon dioxide and water in the presence of chlorophyll

ADVANCE PREPARATION

- Gather the materials for the plant experiment. See Resources listed at the end of this activity for a source of native plants. If students use milk cartons for planting containers, be sure the cartons are washed thoroughly and poke a few small holes in the bottom of the cartons for drainage.
- Make copies of the Learning Logs for each student.



picks up carbon. They exhale carbon dioxide, which the plants take up.

Plants are dependent on animals for the nutrients that they provide for their growth. When plants and animals die, decomposers in wetlands such as crabs or prawns, help to break down decaying tissues to a form



where they can be converted by smaller organisms into nutrients that plants absorb. Animal wastes also add nutrients for plants. In addition, animals help disperse some plant seeds that attach to feathers, fur, or mud on feet. They also ingest and eliminate some seeds in their wastes.

Animals are dependent on plants for food and habitat. In the wetland, herbivorous fish, such as the *awa* (milkfish), feed on algae. Some of the wetland birds, such as the *koloa* (Hawaiian duck), '*alae ke'oke'o*' (Hawaiian coot), and '*alae 'ula*' (Hawaiian moorhen), eat plants (Shallenberger, 1986).

The relationships between plants and animals in an ecosystem, such as a wetland,

create *lōkahi*. This balance is evident in the exchange of oxygen and carbon dioxide, the dispersal of plants, and in the feeding relationships that help to keep plant and animal populations in check. Without the herbivores to feed on plants, plant populations can grow too large. Similarly, the carnivores help to keep the herbivore population in balance with the environment.

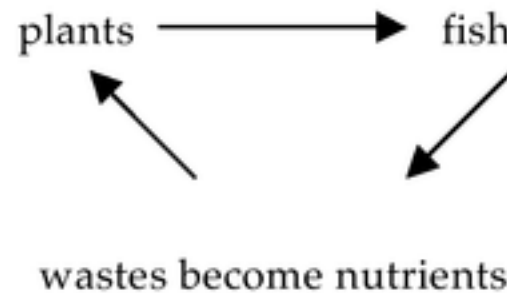


TEACHING SUGGESTIONS

- 1. Post the essential question for students to consider:** How do plants and animals in a wetland need each other to survive? Discuss and record students' ideas on the board or a flip chart.
- 2. Discuss the role of wetland plants and what the plants need to survive.**
 - Hold up one of the wetland plants that students will be propagating. Explain that this plant helps provide a habitat for wetland birds.
 - Ask students to describe what the plant needs to survive (water, soil, sunlight, carbon dioxide).
 - Review or introduce the process of photosynthesis so that students understand that plants use energy from the sun to make simple sugars that animals need to survive.
- 3. Discuss the basic cycle of oxygen and carbon dioxide between plants and animals.**
 - Have a student hold the plant and take a deep breath.
 - Explain that we take in oxygen that the plant gives off from very tiny holes (stomata) on the underside of the leaves.
 - Ask the student to *hā* (exhale) onto the plant, which gives the plant the carbon dioxide it needs.
- 4. Introduce the concept of plants needing nutrients from animals.**
 - Ask students if they can think of any other ways that plants might need animals.



- Show them the wetland plants and the commercial fish emulsion fertilizer.
- Discuss how fish wastes and decayed fish help plants to get the nutrients they need.
- Challenge students to design an experiment to test if the fish emulsion helps the plant to grow.
- Explore how this could demonstrate a natural process, where plants take up nutrients from fish wastes, fish feed on plants and then add more nutrients through their wastes and when they decay.



5. Distribute Learning Log sheet 3.

- Divide the class into six groups and give each student a data sheet.
- Ask students to pose the question they want to answer with the experiment and record it on their data sheets.
- Guide students to see the value of having a “control” plant that does not receive the commercial fish emulsion. See example below:

Question: How might plants depend on animals for survival?

Hypothesis: Plants fertilized with fish emulsion will grow faster than plants that do not receive fertilizer. This will happen because the nutrients in the fish emulsion will help the plants to grow.

6. Set up the experiment.

- Give each group two seedlings, some soil, and pots.
- As they plant their seedlings remind them to give the plants their *hā* (breath).
- Have groups use masking tape and permanent markers to label each pot with their group number and plant 1 and 2.
- Have students measure the height of their plants and record this on their data sheets.
- Have students place their plants on a tray in a sunny area of the classroom and water them.

7. Fertilizing

- Read the directions on the fish emulsion fertilizer and discuss safety and proper use.
- Have students record on their Learning Log sheet the method they will use—how often they will water the plants, fertilize them, and measure them. (Before the weekend, add water to the tray so that the plants do not dry out.)



8. Measuring

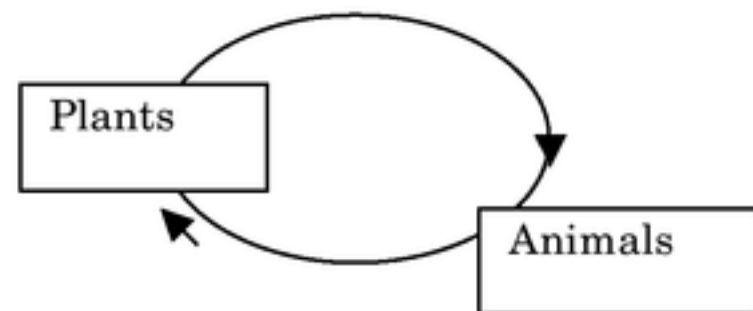
- Have students use rulers to measure the height of their plants and record the plant heights on their Learning Log sheet.
- During the experimental period, have students measure the height of their plants every few days and keep a record of plant growth in cm. on their data sheets.
- After 2-3 weeks, have students take final measurements and record their results.

9. Graphing: Distribute Learning Log sheet 4

- Show students how to make bar graphs to summarize the results of their experiments.
- Have each group make a large bar graph with colored paper to add to the “Mathematical Marsh” in the next activity.

10. Discuss the *lōkahi* that exists in the relationship between plants and animals.

- Ask students to draw a picture and include a caption to explain how plants and animals need each other.



11. Caring for the plants.

- Explain that students will have a chance to plant the wetland plants they have grown when they visit a marsh on their field trip, so ask them to *mālama* (care for) the plants.
- They may want to fertilize their control plants to make them stronger before they are planted.

ADAPTATIONS/EXTENSIONS

Science 3: Organisms and the Environment: Discuss ways to explore how animals depend on plants through observations students could make when they visit the wetland. Help students to pose questions that they could answer through their observations. Sample questions:

- How are birds using plants for habitat?
- What are the birds eating?
- Which fish will we be likely to see?
- What kinds of invertebrates live in the wetland?



Fine Arts 5: Have each student create an awareness poster that summarizes the importance of *lōkahi* in the relationships between plants and animals in the environment. Students should then respond to their own artwork and discuss works of others in terms of qualities and attributes.

Science 3: Organisms and the Environment: Have students play a game that demonstrates the interdependence of plants and animals in a wetland. See “Making Marsh Connections” in the *‘Ōhi‘a Project, Grades K-3 Guidebook*. In the game, students assume the roles of *ae‘o* (stilts), prawns, and fish in a wetland and attempt to tag their source of food.

REFERENCES

Shallenberger, Robert J. (Editor). 1986. *Hawaii's Birds*. Hawaii Audubon Society. Honolulu, HI.

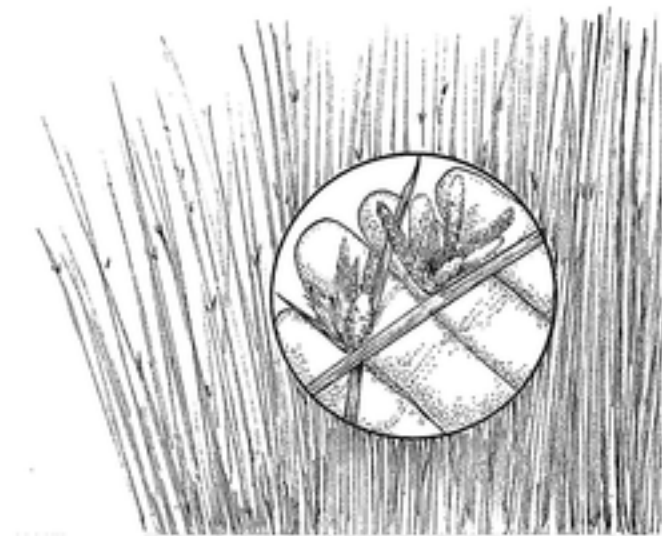
RESOURCES

Koob, Gregory. 2000. Propagation of Hawaiian Native Wetland Plant Species. U.S. Fish and Wildlife Service. Retrieved on June 22, 2005, from <http://www.fws.gov/pacific/pacificislands/worg/wetlandplantspecies.pdf>

O'Connor, Maura (Editor). 1990. *‘Ōhi‘a Project, Gr. K-3*. An Environmental Education Guidebook for Hawai‘i. Bishop Museum and Moanalua Gardens Foundation. Honolulu, HI.

On O‘ahu, native wetland plants are available from: Hui Ku Maoli Ola. They have a nursery in Ha‘ikū Valley. Call: 259-6580 or visit their Web site at www.nativehawaiianplants.com

Rainy Side Gardeners. © 1998-2006. *How a Fish Becomes Fertilizer*. Retrieved January 24, 2005, from <http://www.rainyside.com/resources/fishfert.html>



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