



# MATH IN THE MARSH

How do different plant and animal structures help organisms to survive in wetlands?

## HAWAII DOE STANDARD BENCHMARKS

### Science 4: Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS

- **SC.3.4.1** Compare distinct structures of living things that help them to survive.
- **SC.3.5.1** Describe the relationship between structure and function in organisms.

### Math 5: Geometry and Spatial Sense: PROPERTIES AND RELATIONSHIPS

- **MA.3.5.1** Compare the basic properties of isosceles, equilateral, and right triangles.
- **MA.3.5.2** Classify shapes as congruent or similar.

### Fine Arts 1: VISUAL ARTS

- **FA.3.1.3** Use observational skills in creating an original work of art.

### KEY CONCEPTS

- Plants and animals have distinct structures that help them to survive in wetlands.
- Geometric shapes and the relationships among them can help us to compare and classify wetland birds.

### ACTIVITY AT A GLANCE

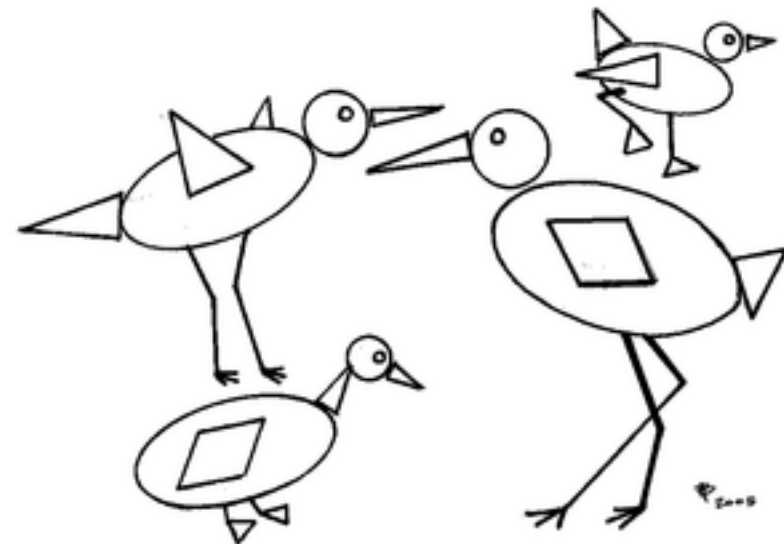
Students create a “Mathematical Marsh” using geometric shapes to make

representations of plants and animals and the structures that help them to survive.

### ASSESSMENT

Students:

- Compare and contrast structures that help wetland plants and birds survive.
- Classify wetland birds and plants according to their different features and write a description of their adaptations.
- Combine geometric shapes to create an original work of art representing a wetland bird.
- Write a statement about the bird describing which types of triangle shapes they have used in their representation.



### TIME

3 - 4 class periods

### SKILLS

creating, analyzing, comparing, classifying



## MATERIALS

### Provided:

- ✓ PowerPoint wetlands presentation (on photo CD)
- ✓ geometric shapes
- ✓ Learning Log 5 (3 pages)

### Needed:

- ✓ Collect wetland “survival” items (e.g., flippers, bathing cap, body board, mask, snorkel, bathing suit, wetsuit, raincoat, tabi, boots, umbrella)
- ✓ colored oak tag or heavy weight paper (black, red, white, green, pink)
- ✓ scissors
- ✓ rulers
- ✓ masking tape
- ✓ index cards
- ✓ floating water plant in clear container
- ✓ reference book: *Hawaii's Birds* (see Resources section)

## VOCABULARY

congruent – corresponding; coinciding exactly when superimposed

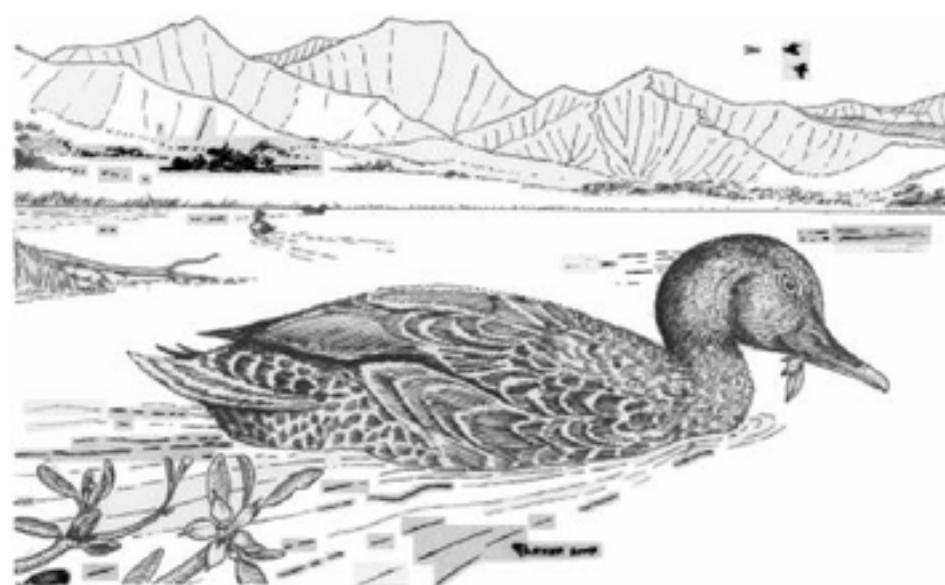
## TEACHER BACKGROUND INFORMATION

Wetland plants are adapted to survive in water. Plants growing in this environment are able to withstand intense sunlight, wind, and having their roots saturated with water. At Nu'upia Ponds Wetland Management Area, the native 'ākulikuli and the alien pickleweed ('ākulikuli kai) growing on the edge of the ponds are salt-tolerant and have fleshy stems and narrow, succulent leaves to retain fresh water. On

equilateral triangle – a triangle with three sides of equal length  
 isosceles triangle – a triangle with two sides of equal length  
 right angle – a 90° angle formed by the perpendicular intersection of two straight lines  
 right triangle – a triangle that has two sides forming a right angle

## ADVANCE PREPARATION

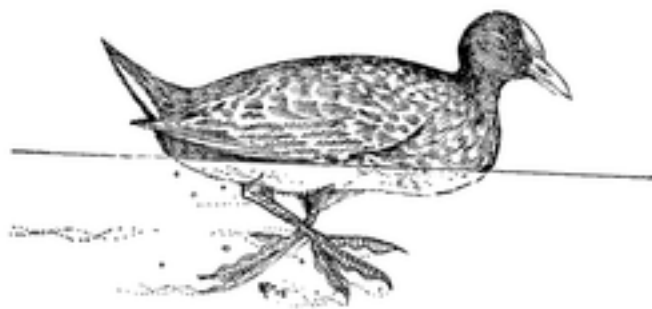
- Preview the PowerPoint presentation.
- Obtain a floating plant from a garden center and bring it to class in a clear container.
- Clear a classroom wall space for students to create their “Mathematical Marsh.”
- Place some green and blue paper on the wall for the marsh habitat.
- Cut out geometric shapes on different colors of cardstock paper (or have the students make their own cut-outs).
- Make a copy of the Learning Log sheets for each student.





the open water, the alien water lily has flat leaves that float on the water's surface and long stems to transport water and nutrients from its roots in the mud.

At Kawai Nui Marsh, the *uki* (sedge) and *hau hele* (hibiscus) are adapted to grow in wetland conditions. Unfortunately, the alien mangrove and California grass are well adapted to the freshwater marsh conditions and are crowding out the natives.



*'alae ke'oke'o* (Hawaiian coot)

Wetland birds are also uniquely suited to this environment. The Hawaiian coot has webbing on its toes that helps prevent the birds from sinking into the mud. This

webbing also helps them to dive and move through the water.

The wading birds such as the *'auku'u* (black-crowned night heron) and *āe'o* (Hawaiian stilt) have long bills for digging in the mud and seizing their food. The *āe'o* and *'auku'u* have longer legs than the birds that



spend more time diving and swimming, such as the *koloa* (Hawaiian duck) and *'alae ke'oke'o* (Hawaiian coot). These swimmers have webbed feet for paddling in the water. The *koloa* has a bill that is best suited to scooping food as it dives beneath the water's surface.

## TEACHING SUGGESTIONS

### Part I: Comparing Structures

1. Show the PowerPoint presentation with pictures of wetland habitats and birds.
  - Discuss the pictures and the body structures of the birds that help them to survive in the marsh.

#### Discussion Questions

- How would you describe the marsh habitat?
- Which body structures help the wetland birds to get food? (sharp beaks for poking fish, rounded beaks for scooping plants, claws for grasping food)
- Which body structures help the birds escape from danger? (wings to fly, camouflaged feathers to hide, long legs to run)
- If you were to live in a marsh habitat without a boat or shelter what would you need to survive?



**2. Simulate survival in the wetland.**

- Divide the class into four groups.
- Assign a wetland habitat to each group: in the open water, on a tiny island in the middle of the water, in the grass, or in the mud.
- Display the wetland “survival” objects (such as flippers and tabi) you have collected and challenge student groups to complete tasks below:

<p>Select 3 objects that would help you survive as wetland creatures in your habitat. (You may list objects other than those displayed.)</p>	<p>Describe how each object would help you to survive.</p>	<p>Decide on a name for your new wetland identity.</p>	<p>Show your classmates how these objects would help your group survive in your wetland habitat.</p>
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**3. Summarize with a class discussion.**

Discussion Questions

- Which objects are most useful in each habitat? Why?
- Which objects could help you to find food, or stay warm, or move quickly?
- What would be the most challenging part of living in a wetland?
- Which of these objects could be compared to an actual body structure of a wetland animal? How are they similar?

**4. Study plant structures related to wetland survival.**

- Show students the floating plant you have brought to class and discuss its properties.
- Have students look closely at the plant and describe structures that might help it to survive in a wetland.
- What properties of the leaf allow it to float on water? (light weight, large leathery, flat surface)
- How does it take up nutrients? (through the long stem that attaches roots to soil)

**5. Distribute Learning Log 5 (3 pages) to check wetland survival comprehension and application.**

- Review the directions on the Learning Log sheets.



- Challenge students to classify the organisms on their activity sheets according to similar structures. For example, which are the floaters (water lily), divers (coot and duck), and waders (moorhen, stilt and heron)?

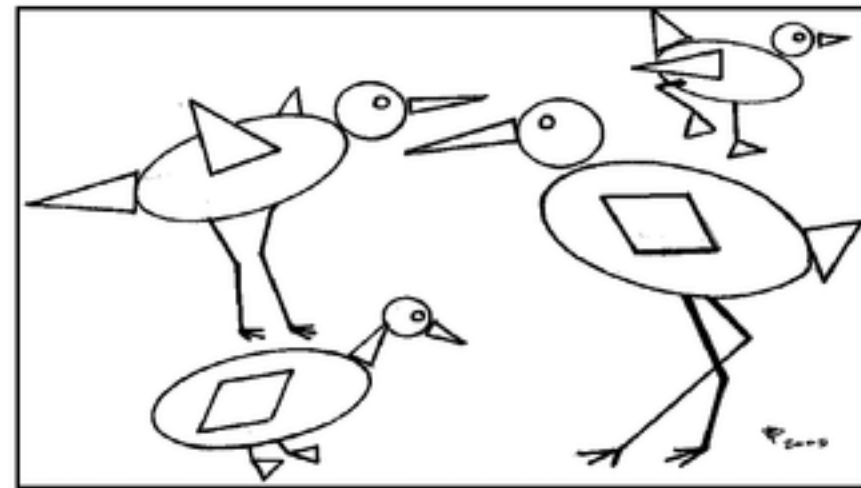
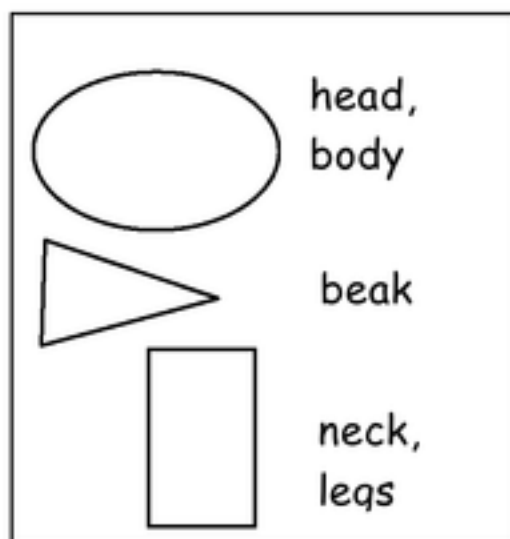
### Part II: Geometric Shapes - Make a "Mathematical Marsh"

#### 6. Challenge students to see how many geometric shapes they can find in bird images.

- Project one of the images of the wetland birds (provided on CD) or refer to a drawing on the Learning Log.
- Ask students to point out the triangles, ovals, rectangles, or circles they see.

#### 7. Identify different triangle shapes in wetland birds.

- Draw pictures of the different types of triangles and discuss how they are different.
- Ask students to find the isosceles, equilateral, and right triangle shapes in the bird images.



#### 8. Introduce the concept of congruency.

- Give each student a set of geometric shape cut-outs.
- Have students flip and slide the shapes around to superimpose them to find congruent shapes.

#### 9. Challenge students to combine cut-outs of geometric shapes to make an original work of art representing a wetland bird. Explain that they should use all three types of triangles in their designs.

- Have them sketch a rough draft of their bird and show the sketch to you before they cut out their shapes.
- If desired, have students follow up on their work on scale from Lesson 1 and have them create a bird that is scaled to be roughly half of life-size.
- Show students how to use the recommended reference book to look up the information they need on the bird.



**10. Have students create labels for their bird.**

- Distribute index cards for bird labels.
- For each bird they create, ask students to write a label that includes the Hawaiian name of the bird and one statement about the triangle shapes they have used to create their bird.

**11. Have students work together to make a “Mathematical Marsh” mural.**

- Ask students to present their wetland birds and their labels with their math statements as they place the birds on the mural.

### ADAPTATIONS/EXTENSIONS

**Math: Properties and Relationships:** Challenge groups to come up with math problems related to wetlands to quiz other groups. When problems are answered correctly, add them to the “Math Marsh.”

**Language Arts: Writing – Range:** Have students find out the status of the wetland birds they studied. Note that the *āe'o*, *'alae 'ula*, *'alae ke'oke'o*, and *koloa* are all endangered species. Ask students to create poetry or songs about these wetland birds and what we can do to *mālama* (care for) them. For more information about these birds, see the U.S. Fish and Wildlife Service Pacific Islands - Endangered Species Web site at:

<http://www.fws.gov/pacific/pacificislands/wesa/hawanimalsindex.html#Hawaiian>

### RESOURCES

Lanius, Cynthia. ©July, 1997-2004. *Fractions' Shapes- Geometric Figures. Names of the Geometric Figures. No Matter What Shape | Fun Fractions | Drawing Fun Fractions | Designer Fractions.* Retrieved June 23, 2005, from <http://math.rice.edu/~lanius/Patterns/notes.html>

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