**Adapted for Survival?**  
*Designing a Bird Adapted to Its Habitat*

**Overview**
“Adapted for Survival” is designed to allow students to think about specific adaptations and how they pertain to the survival of the individual, and ultimately, the species. Students design a habitat and then design a bird with specific adaptations that would be best suited for their bird’s survival in its habitat. After drawing the bird and its habitat, students exchange habitats with another group and must decide and then explain if their bird could survive in the new environment.

**Estimated Time**
One class period

**Objectives**
Students will be able to:
- Describe adaptations of birds to their environment.
- Explain how the adaptive characteristics of a bird enable it to survive in its environment.
- Describe why extinction of a species could occur when the environment changes and the adaptive characteristics of the species is insufficient for its survival.

**Materials**
- 1 large piece of paper (poster size) and one small piece of paper (8 ½ X 11) for each group of 3 or 4 students
- markers/colored pencils, scissors, tape
- Copies of student worksheets

**Vocabulary**
adaptation, evolution, species, natural selection, habitat, extinction

**Science Content Standards**

**Grade 7**
- **Standard Set 3.a:** eoth genetic variation and environmental factors are causes of evolution and diversity of organisms.

**Standard Set 3.e:** extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient for its survival.

**Grades 9-12**
- **Biology/Life Sciences Standard Set 6.a:** biodiversity is the sum total of different kinds of organisms, and is affected by alterations of habitats.
- **Biology/Life Sciences Standard Set 8.a:** how natural selection determines the differential survival of groups of organisms.
- **Biology/Life Sciences Standard Set 8.b:** a great diversity of species increases the chance that at least some organisms survive large changes in the environment.

**Acknowledgment**
This activity is based on “Fashion-A-Fish” which is found in Aquatic Project Wild and published by the Western Regional Environmental Education Council.

**Additional Resources/Activities**

**Background**

Biological evolution accounts for the diversity of species developed through gradual processes over many generations. For instance, birds are the products of countless adaptations over long periods of time. These adaptations, for the most part, are features that increase birds’ likelihood of surviving in their habitat.

When a habitat changes, either slowly or catastrophically, the species with adaptations that allow them many options are the ones most likely to survive. Some species have adapted to such a narrow range of habitat conditions that they are extremely vulnerable to change. They are over-specialized and are usually more susceptible than other species to death or extinction.

“California is one of the most biologically diverse areas in the world. Within its 160,000 square miles, California harbors more unique plants and animals than any other state. The diversity of climates and landscapes, and all the barriers to migrations such as rivers, mountains, and deserts, have led over thousands of years to the evolution of a large number of isolated species and varieties of animals, many of which are found only here. For example, there are about 30,000 species of insects recorded in California, 63 freshwater fishes, 46 amphibians, 96 reptiles, 563 birds, 190 mammals, and about 8,000 plants.

“Yet it is also true that today, California’s extraordinary diversity is being lost in many important habitats throughout the state... Why does California have more endangered species than any other state? Biologists believe that the basic cause is an ever-increasing human population that is degrading the environment at an ever-accelerating rate. Many of California’s unique species live in restricted habitats, under special conditions to which they have been adapting for hundreds or thousands of years. As people change these habitats, their native inhabitants die or fail to reproduce.”


**Teacher Procedure**

1. Students should be divided into groups of three or four.
2. Each group will need two sheets of drawing paper - a smaller piece may be used for the bird, a larger piece for the habitat.
3. Each group is assigned a habitat to draw on the large sheet of butcher paper. The descriptions of each habitat (salt marsh, redwood forest, freshwater pond, grasslands, mountain, desert, riparian or river habitat, and beach) should be photocopied and distributed to the students.
4. After drawing the habitat, each group must choose one of each of four adaptations for body shape, coloration, beak, feet, and nesting strategy. It may be helpful to enlarge the adaptation sheet, photocopy on cardstock and then laminate and cut out the individual cards from which students may select. These may then be reused in the future.
5. Allow students to design and draw the bird. Students draw, color and cut out their bird separately from the habitat so that they can exchange habitats later. When all groups are finished, have each group share with the class their bird, explaining adaptations and why the bird is well-suited to the habitat.
6. After sharing this information, have the groups randomly exchange habitats with each other. Each group must then discuss among themselves and answer questions pertaining to the fate of their bird in its new habitat. Could it survive and why?
7. As an in-class assignment or for homework, each student should read the California clapper rail description and answer questions about its adaptations and habitat.
Adapted for Survival?

INTRODUCTION
Does the coloration of an animal affect its chances for survival? Do feeding mechanisms alter an organism’s chance of living? How would an organism’s reproductive strategy affect the individual? How would it affect the species? Throughout time, people have marveled at the great amount of diversity found in nature. It is adaptations that have led to this vast array of variation and which have resulted in the enormous variety among species. In this activity, you will be studying the effects that an adaptation, any feature which increases an organism’s reproductive success (fitness) in its environment, has on a bird’s success in different California habitats.

PROCEDURE
1. Read the description of the habitat your group has been assigned and draw the habitat on the large piece of paper, showing details such as plants, animals, water, soil, etc.
2. Design a bird to live in this habitat.
   a. Choose one of each type of adaptation for beak, feet, body, and nest, using the adaptations page, before designing your bird.
   b. List and describe your bird’s specific adaptations below.
      1. What does it eat and how does it get its food?
      2. How does it build its nest, reproduce, and raise its young?
      3. How does it protect itself from predators?
   c. Explain why your bird is adapted to survive in its specific habitat.
3. Using the smaller piece of paper and pencils provided, design, color, and cut out one bird showing all of the adaptations you have chosen and described. Use your imagination to add details!
4. Assign your bird a scientific name and a common name. Write both in the space below and on the back of your bird.

Scientific name:___________________________________________

Common name:___________________________________________
5. Place your bird in its habitat and secure gently with tape if necessary.
6. When everyone is done designing their bird, explain to the class how your bird is adapted for this particular environment. Describe the habitat your bird lives in and the adaptations that are most important to your bird’s survival in this habitat.
7. Trade habitats with another group, keeping the bird you designed.
8. Place your bird in the new habitat and reevaluate the probability of success for your bird.

**Analysis Questions**

1. List and justify any adaptations which will *limit the success* of your bird in its new habitat.

2. List and justify any adaptations which will *enhance the success* of your bird in its new habitat.

3. Which adaptation is most important for the survival of the individual bird? Explain your reasoning.

4. Which adaptation is most important for the survival of your bird’s species? Explain your reasoning.

5. Bonus: What role do adaptations play in Darwin’s Theory of Natural Selection?
6. The California clapper rail, *Rallus longirostrus obsoletus*, is a bird that lives only in the salt marshes surrounding San Francisco Bay. Read the one-page description about the California clapper rail.

a. How is the California clapper rail adapted to the salt marsh? Be specific.

b. What issues have affected the California clapper rail in the past and what issues are currently affecting it?

c. Is it important to protect the remaining salt marsh? Explain why or why not.
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Choose one adaptation from each category (a beak, a pair of feet, a nest, and a body).

Use these adaptations to design a bird for your habitat.

### Beaks
- long, slender beak for probing in mud or sand for food
- slim, sharp beak for catching insects
- sharp, hooked beak for tearing apart small animals
- straw-like beak for drinking nectar
- long, hooked beak for catching fish
- long, broad beak for spearing fish, crabs, or rodents
- broad, flat beak for straining plankton from water

### Feet
- long-toed feet for walking on mud or sand
- three toes in front, one in back for perching on branches
- two toes in front and two in back for climbing trees
- webbed feet for swimming
- sharp-clawed feet for grasping prey

### Nest
- small indentation on ground
- burrow in ground or plant for hot areas or to protect from predators
- in a tree or bush in forested areas

### Body
- small body and rapid wingbeats for flying and perching in trees
- large body and long neck to spear crabs and fish
- legs set back on body for swimming
- large body and large wings to soar overhead looking for prey
## Adapted for Survival?

### Habitats

Photocopy this page and cut apart the descriptions; assign one habitat to each group of students and give them the description with their worksheet.

<table>
<thead>
<tr>
<th>Habitat</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Salt Marsh</td>
<td>Salt marshes are wetlands found at the edges of bays and estuaries. The tide carries salty water in and out of the marsh. Low-growing plants, such as pickleweed and cordgrass, grow. Plankton and fish live in the water, crabs and clams burrow in the mud, and mice and insects live in the plants.</td>
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<tr>
<td>2. Redwood Forest</td>
<td>Redwood forests exist where fog creates a moist environment. Tall redwoods and sequoias form a dense canopy shading the forest floor. Ferns, moss, and fungus grow in the understory and redwood needles form a soft blanket of duff on the ground. Squirrels, slugs, and deer live in the forest.</td>
</tr>
<tr>
<td>3. Grasslands</td>
<td>In the Central Valley, low-lying flat areas are covered with grasses. Lizards and snakes bake on exposed rocks. Kit foxes and kangaroo rats roam during the night. Summers are hot and winters are cold.</td>
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<tr>
<td>4. Mountain/Alpine</td>
<td>In the high elevations of the Sierra Nevada, granite peaks are inhabited by pine trees and aspens. Snow falls through the winter and melts in the spring, running down creeks to rivers. The air is crisp and cold.</td>
</tr>
<tr>
<td>5. Desert</td>
<td>Much of Southern California consists of arid regions that are typically hot during the day and cool at night. Very little rain falls, and all of the plants and animals have to find ways to conserve water and tolerate the heat.</td>
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<tr>
<td>6. Riparian</td>
<td>Located alongside rivers in California, riparian habitat consists of willows, alder, and oak trees. A wide variety of animals seek shelter, food, and water in these shady areas. The river water flows over rocks and sandy areas inhabited by invertebrates and fish.</td>
</tr>
<tr>
<td>7. Beach / Shoreline</td>
<td>The sandy shore exists where the ocean meets the land. In the sand, invertebrates live. Dead bits of kelp, seaweed, and animals are washed up with the tides each day and left behind. Dunes of sand are formed at the highest points on the beach, and beach grasses grow.</td>
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</tbody>
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CALIFORNIA CLAPPER RAIL

*Rallus longirostris obsoletus*

The California clapper rail, one of three subspecies of clapper rail found in California, formerly nested in tidal marshes from Humboldt County to San Luis Obispo County. A short, compact bird with a tawny brown breast, flanks striped with white, a dappled back, and a patch of white under the tail, it slips quietly through the cordgrass and pickleweed marshes of San Francisco Bay, searching in the mud for a meal of clams, mussels, and crabs. These elusive birds are most often observed during flood tides when they are forced out of their marshland cover. At other times they may be detected by their distinctive “clapper” or “clatter” call from which the species derives its common name.

This bird requires dense stands of vegetation in the lower marsh, where it nests and hides from predators, as well as upper marsh areas which it uses as retreats during high tides. Over 85 percent of the tidal marsh that once provided habitat for clapper rails has been destroyed. It has been diked and filled and turned into marinas, airports, garbage dumps, housing tracts, industrial parks, and salt ponds. During the winter months nearly the entire population of California clapper rails is found in only eight marshes around San Francisco Bay. Almost everywhere, levees now separate the remaining tidal marsh from the rail’s historic high marsh retreat areas, which now underlie shoreline development. With no easy access to cover during high tides, the normally elusive clapper rails become vulnerable to predators such as northern harriers.

Clapper rails have been hunted by European settlers since the 1700s. They were so abundant at the turn of the century that hunters boasted of shooting two hundred in a day, and San Francisco restaurants hung strings of rails in their windows. But by 1987 California clapper rails were confined to San Francisco Bay — more than 90 percent of them in the south bay — and the entire population was estimated at only seven hundred birds. In 1989 the total population was estimated to be fewer than five hundred birds.

An indicator of environmental quality, the clapper rail is responding to the continued degradation of San Francisco Bay. Introduced predators have decimated rail numbers in some key marshes, sewage effluent has converted salt marsh habitat into brackish marsh, and pollutants from urban runoff and sewage discharge are finding their way into the rails’ food. With less than five hundred individuals remaining, there is little certainty that this bird will survive for another twenty years.

If the California clapper rail is to be saved, exotic predators must be controlled, bay water quality must be improved, and historic tidal marshes must be restored.

In 1988 legislation was passed in the U.S. Congress that authorized the U.S. Fish and Wildlife Service to acquire up to twenty thousand acres to expand the San Francisco Bay National Wildlife Refuge. Purchase of abandoned salt ponds will enable the Service to restore additional tidal marshes which may give the clapper rail a chance at survival.

*California’s Wild Heritage: Threatened and Endangered Animals in the Golden State,* by Peter Steinhart, California Dept. of Fish and Game, 1990.