Unit: Evolution

Objective: To help students understand adaptations and why organisms in different environments have different characteristics to help them survive.

Materials:
-Adapted for Survival Procedures and Questions worksheet (one per group or one per student)
-Adapted for Survival Habitat card worksheet (one habitat per group so you may need to make two copies of this worksheet if you have more than 7 lab groups)
-Adapted for Survival Beaks, Feet, Nest and Body worksheet (one per group)
-California Clapper Rail article and questions (one per lab group or one per student)
-One blank piece of white paper per lab group
-Colored pencils
-Scissors
-Scotch tape

Teacher Prep Work:
1. Make the necessary photocopies for the students - I photocopied the habitat descriptions on card stock so they can be used over again (cut them apart and put on lab tables) and I photocopied the beak/feet/nest/body worksheet onto card stock. (~20 min)

Procedures:
1. Tell students that they will have a habitat description on their lab table. They need to read the description and draw and color a detailed picture of the habitat on white paper. (~10 minutes)
2. Choose one beak, one set of feet, one nest, and one body of a bird that could live in the habitat. Discuss with your group and color and cut out the parts you decide on. Tape to habitat. Answer questions on worksheet. (~15 min)
3. Give a scientific and common name to your bird.
4. Do if there is time: have groups share out descriptions of their habitats and their bird adaptations that allow the bird to survive in the habitat.
5. Trade habitats with another group but keep the bird you designed. Answer the questions about whether your bird will survive in the new habitat. (~10 min)
6. Read California Clapper Rail article and answer questions. (~10 min) This is a nice worksheet to give a real world, local example of a bird and its adaptations to live in its habitat. I like to tie in environmental issues whenever possible and this article does this well.
7. Return the habitat drawing to the group you switched with. Tape your bird down to your own habitat drawing.
8. As class is ending, students can walk around the lab tables to see what habitats and birds the other groups have created.

First & Last Names:

Date: Per: Table #:

Adapted for Survival?

Student Pages

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 Answer in complete sentences.

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. What role do adaptations play in Darwin's Theory of Natural Selection?

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.

1. Salt Marsh
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.

2. Redwood Forest
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.

3. Grasslands
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.

4. Mountain/Alpine
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.

5. Desert
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.

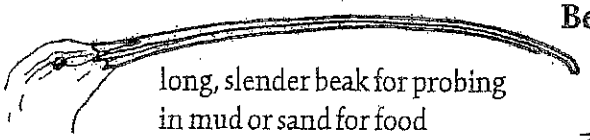
6. Riparian
Located alongside rivers in California, riparian habitat consists of willows, alder, and oak trees. A wide variety of animals seek shelter, food, and water in these shady areas. The river water flows over rocks and sandy areas inhabited by invertebrates and fish.

7. Beach / Shoreline
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.

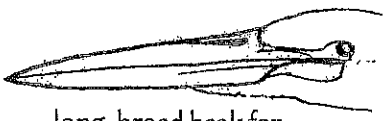
Adapted for Survival?

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

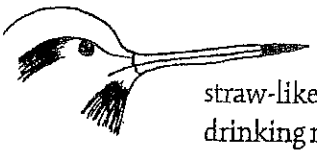


long, broad beak for spearing fish, crabs, or rodents

slim, sharp beak for catching insects

sharp, hooked beak for tearing apart small animals

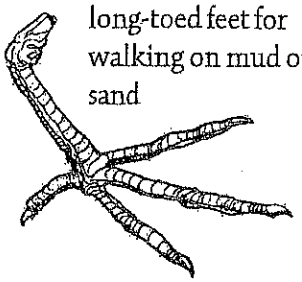
broad, flat beak for straining plankton from water



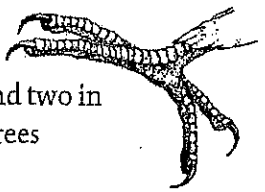
straw-like beak for drinking nectar

long, hooked beak for catching fish

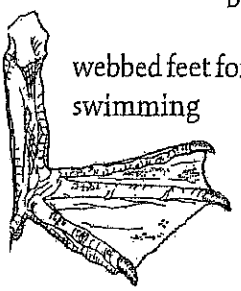
Feet



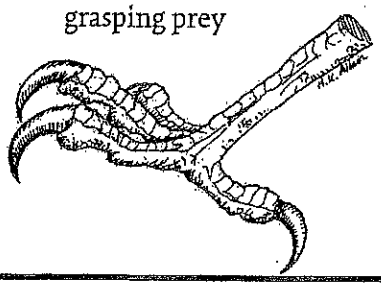
long-toed feet for walking on mud or sand



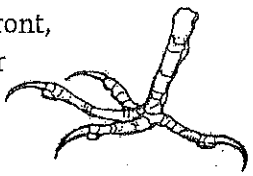
two toes in front and two in back for climbing trees



webbed feet for swimming

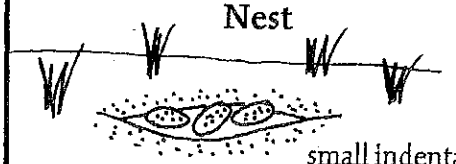


sharp-clawed feet for grasping prey

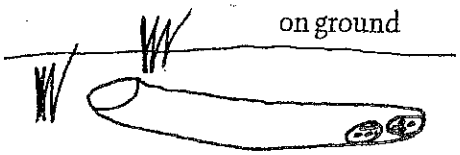


three toes in front, one in back for perching on branches

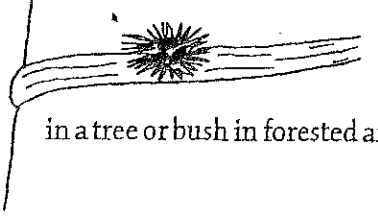
Nest



small indentation on ground

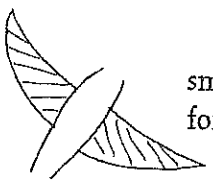


burrow in ground or plant for hot areas or to protect from predators

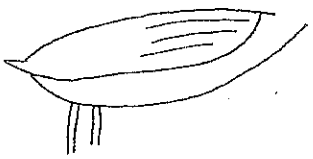


in a tree or bush in forested areas

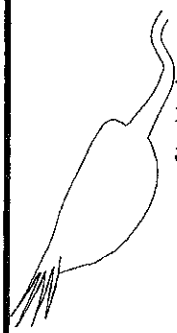
Body



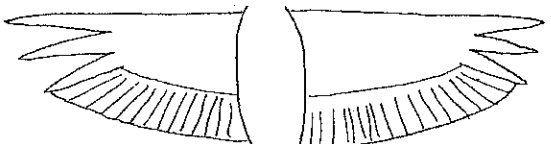
small body and rapid wingbeats for flying and perching in trees



legs set back on body for swimming

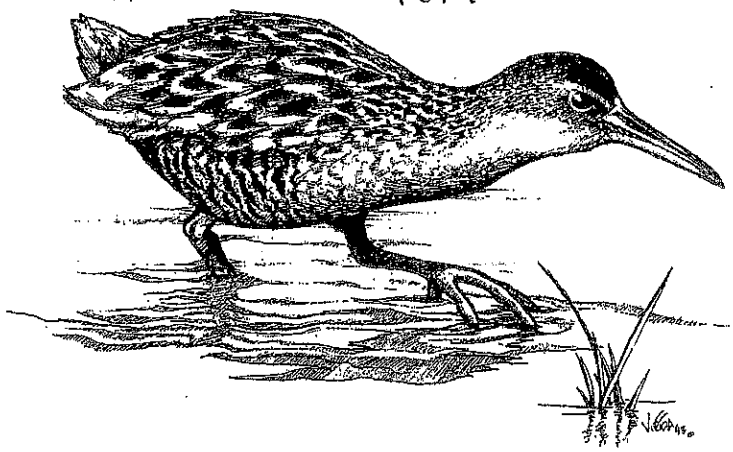


large body and long neck to spear crabs and fish



large body and large wings to soar overhead looking for prey

First and Last Name:
Date: Per:



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.

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. Answer in complete sentences.

   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.

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

Salt Marsh

Tablet # 8 Isabel Huang Jan Hawaia Miles Bowman