

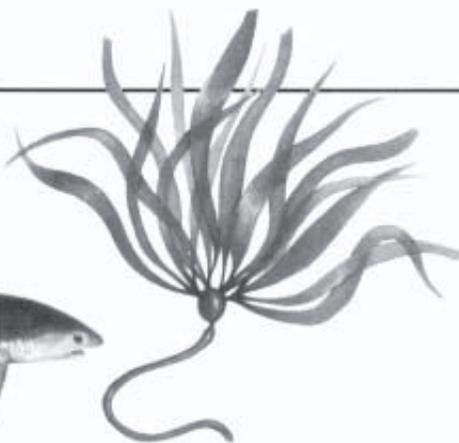
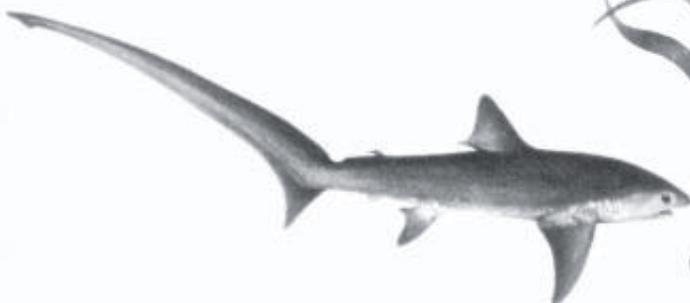
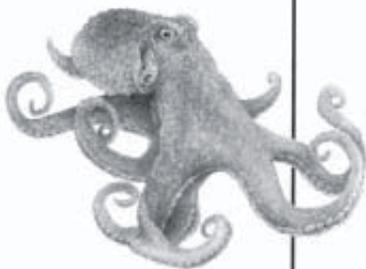
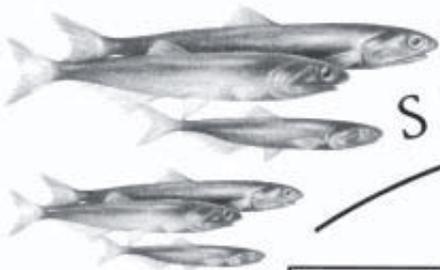
SEARCHING

SEA

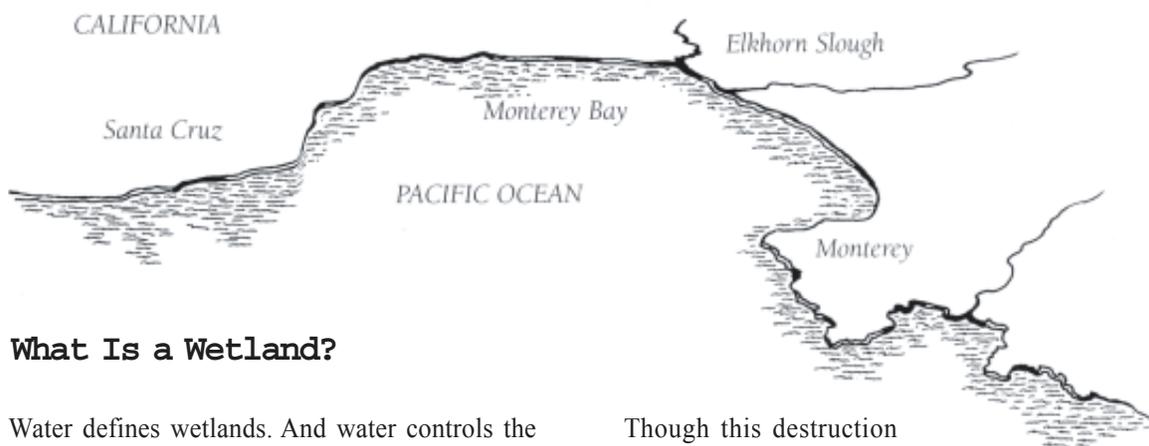
HABITATS

The Wetlands

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THE WETLANDS FIELD NOTES



What Is a Wetland?

Water defines wetlands. And water controls the kinds of plants and animals that live there. The water may be salty or fresh, and a wetland may be always wet or sometimes dry. Wetlands, unlike rivers and lakes, are usually less than six feet (two meters) deep.

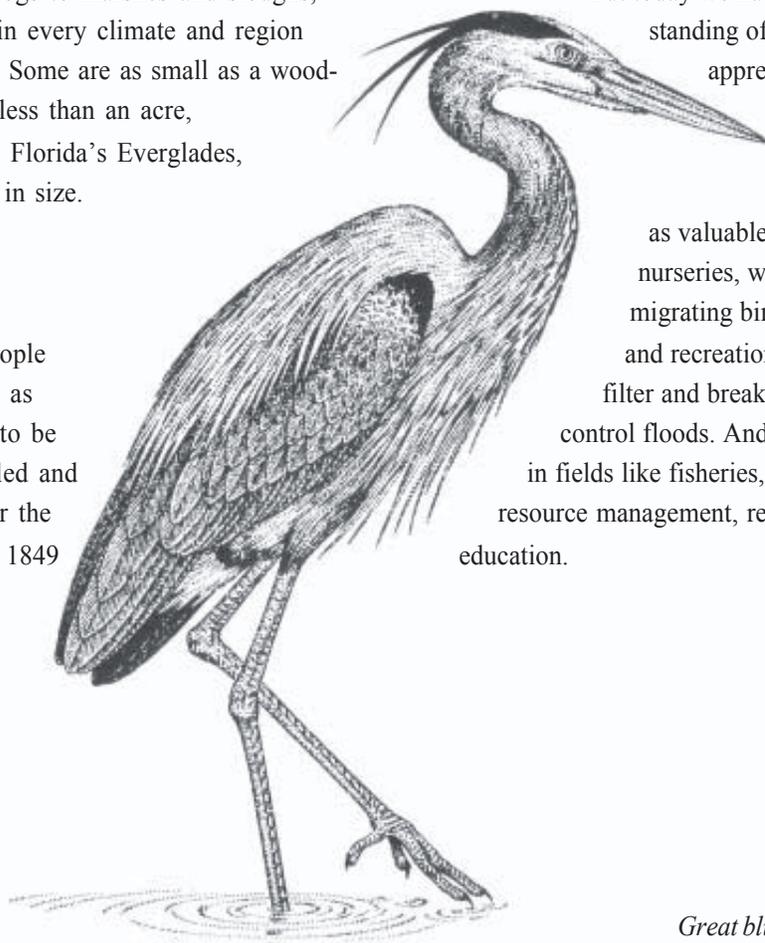
From swamps and bogs to marshes and sloughs, wetlands are found in every climate and region of the United States. Some are as small as a woodland pond covering less than an acre, others are as vast as Florida's Everglades, over a million acres in size.

A new look

In the past, most people considered wetlands as wastelands—places to be drained, plowed, filled and developed. And after the Swamp Land Act of 1849 made it legal to “reclaim” wetlands, millions of acres were destroyed.

Though this destruction has slowed, the country's remaining wetlands are still threatened by a growing human population. The need for more homes and more food means continued pressure to drain and destroy this habitat.

But today we have a better understanding of, and a new appreciation for wetlands. We now see them in their natural state as valuable wildlife habitat, fish nurseries, wintering grounds for migrating birds, water reservoirs and recreation areas. Wetlands filter and break down pollutants and control floods. And they provide jobs in fields like fisheries, wildlife and resource management, research and education.



Great blue heron

At the Edge of Monterey Bay

At the middle of the curve of Monterey Bay sits Elkhorn Slough (say “slew”) — one of the largest remaining coastal wetlands in California.

Elkhorn Slough is considered a slough because it’s a narrow, winding waterway edged with muddy and marshy ground. But Elkhorn Slough is also a seasonal estuary—a protected place where fresh water meets and mixes with sea water. After winter rains, fresh water runs off the surrounding land and mixes with the slough’s salty water.

A diversity of life

Coastal wetlands support more life than most other ecosystems—and are more productive than most good farmlands. More than 80 species of fishes and 250 species of birds live in Elkhorn Slough during some part of their lives.

At Elkhorn Slough

One of the keys to this slough’s great productivity is the abundance of tiny particles of decaying plants and animals, called detritus, floating in the water. Animals like fat innkeeper worms, bent-nosed clams and skeleton shrimp thrive on this rich fertilizer, supporting a food web of thousands of different kinds of animals. Some of the detritus comes from within the slough, primarily from

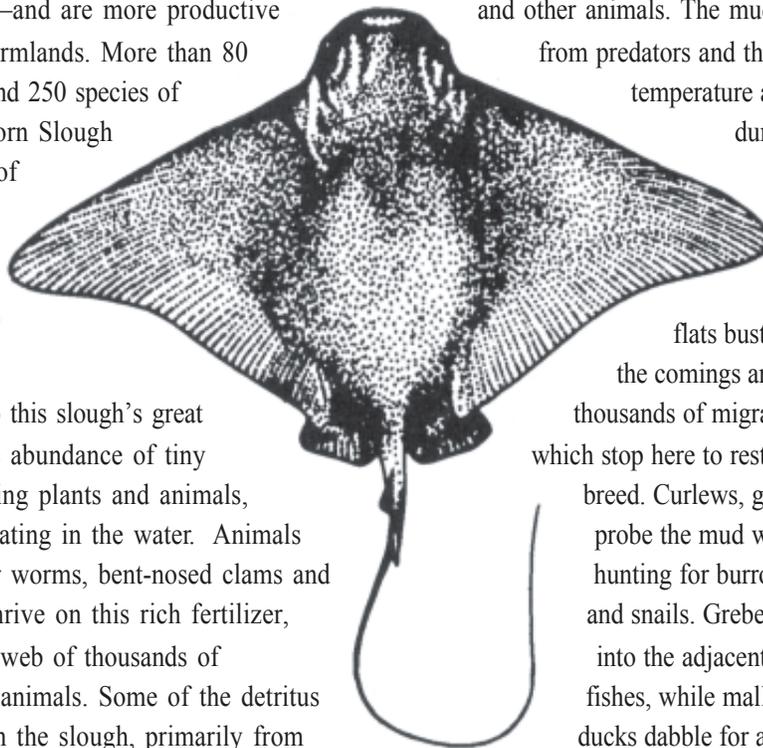
the marsh plants, and some of its brought in from Monterey Bay with the tide.

Fishes come in from the ocean, too. Bat rays glide along just above the mud; their winglike fins stir up sediment to unearth clams and other burrowers. Leopard sharks, flatfishes, anchovies and sardines enter to feed on small fishes or plankton.

The mud flats

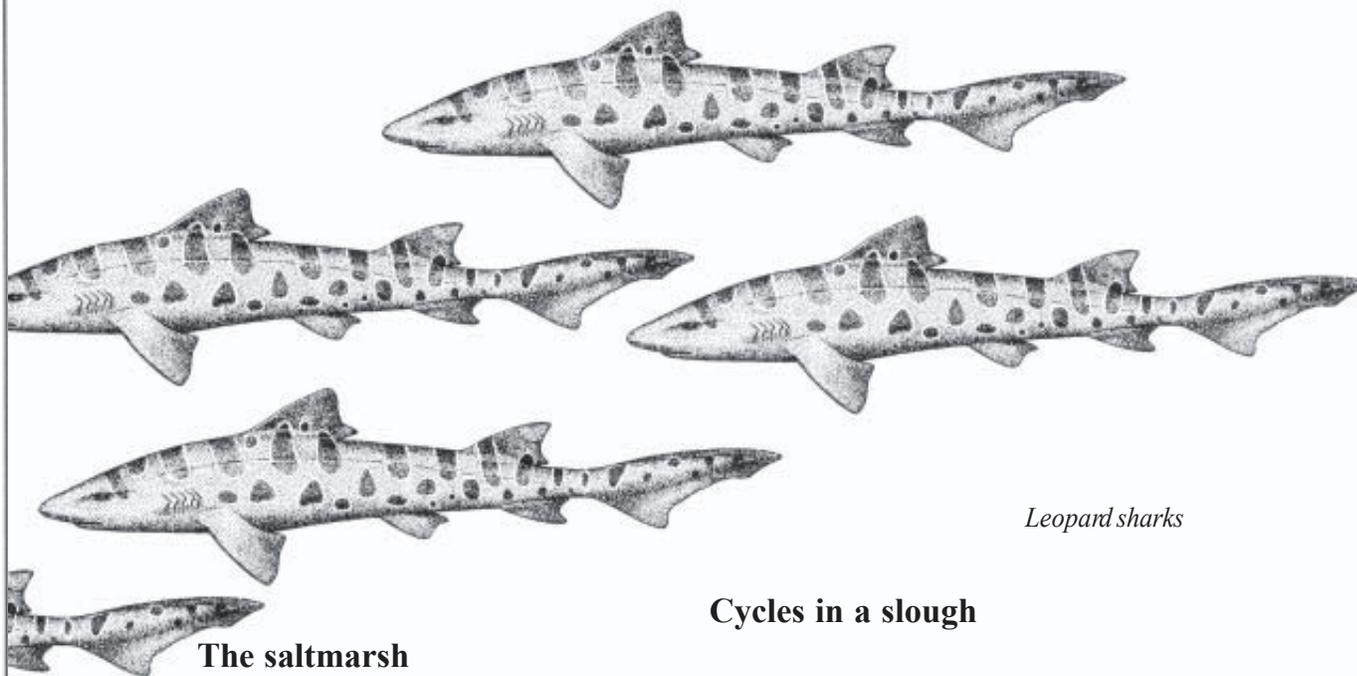
When the tide recedes, it exposes rich, dark mud.

Seemingly lifeless at first glance, each cubic foot (.03 cubic meters) of mud may be crowded with thousands of crabs, shrimps, worms, snails, clams and other animals. The mud protects them from predators and the changes in both temperature and water conditions during daily tidal changes.



Bat ray

In spring and fall, the mud flats bustle with the comings and goings of thousands of migrating birds which stop here to rest, feed and breed. Curlews, godwits and willets probe the mud with their bills, hunting for burrowing crabs, worms and snails. Grebes and pelicans dive into the adjacent channel for small fishes, while mallards and other ducks dabble for algae.



Leopard sharks

The saltmarsh

For a few days each month, when the moon is either in its full or new phase, the high tides top the mud flats, flooding the adjacent ground. This land is the saltmarsh: a habitat covered with low-growing, salt-tolerant plants.

While most plants would wither and die in these wet, salty conditions, pickleweed concentrates salt in the tips of its stems, then discards it when the tips drop off in the fall. Other plants like salt grass have special glands that secrete tiny cube-shaped crystals of salt.

The uplands

Further from the water, beyond the long stretches of saltmarsh, lie the uplands. Coast live oaks, coyote bush, sage and grasses grow on these drier hillsides, and spring carpets the hills with a colorful display of wildflowers. Hawks and golden eagles scan the uplands in search of rodents to eat.

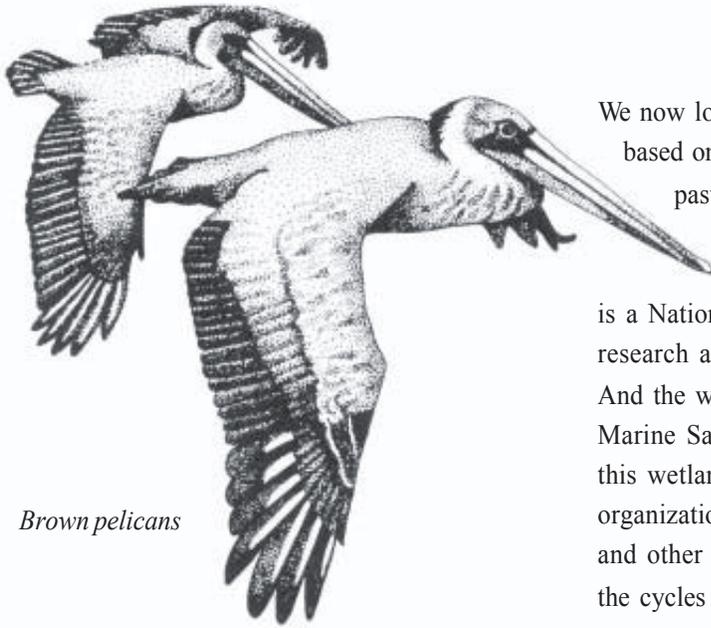
Cycles in a slough

The cycles in a slough are many. The daily tides rise and fall, night becomes day and the seasons change. There are cycles of reproduction, migration, food webs, energy, water and nutrients. Each cycle affects the others in an ever-shifting balance of life and change. Together, along with the plants and animals, they create the complex ecosystem of the slough.

Changes over time

People, too, are part of a slough's ecosystem. At Elkhorn Slough for instance, Ohlone Indians began making their home there more than 4,000 years ago. Since then, our effect on Elkhorn Slough has progressed with the technological advances of humankind. In the 1700s, the Spanish grazed their cattle on the slough's native grasses. In the mid-1800s, Americans began logging and farming the uplands, causing erosion and introducing pesticides and non-native species: problems that continue to affect the slough today.

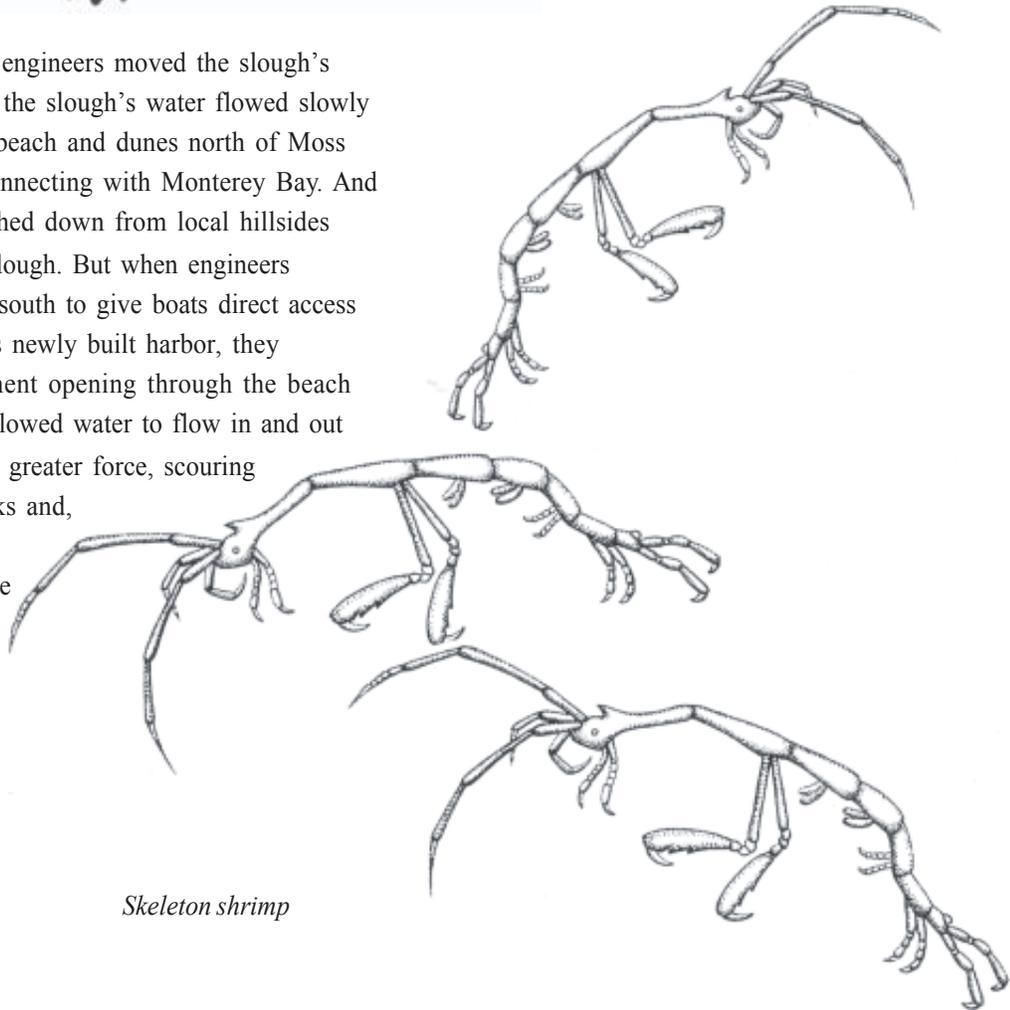
THE WETLANDS FIELD NOTES



Brown pelicans

We now look at sloughs with a new perspective based on the lessons we've learned from the past. But their future depends on the decisions we make as voters and citizens. Today, part of Elkhorn Slough is a National Estuarine Research Reserve where research and education programs are conducted. And the waters of the Monterey Bay National Marine Sanctuary extend up the slough, increasing this wetland's protection. Together, these and other organizations hope to ensure the survival of this and other coastal environments—and to see that the cycles of life in them continue.

In the mid-1900s, engineers moved the slough's mouth. Originally, the slough's water flowed slowly behind the sandy beach and dunes north of Moss Landing before connecting with Monterey Bay. And sediment that washed down from local hillsides slowly filled the slough. But when engineers moved the mouth south to give boats direct access to Moss Landing's newly built harbor, they punched a permanent opening through the beach and dunes. This allowed water to flow in and out of the slough with greater force, scouring the channel's banks and, unfortunately, further eroding the saltmarsh and mud flat communities.



Skeleton shrimp

Songs about the Slough

Sing songs about the slough (pronounced “slew”). . . and make up your own verses!

“We’re Going to the Slough”

Sung to the tune of “*The Farmer in the Delf*”

We’re going to the slough,
We’re going to the slough,
The slough’s a type of habitat,
We’re going to the slough.

We’re passing pickleweed,
We’re passing pickleweed,
Salty mud is where it lives,
We’re passing pickleweed.

We’re walking through the mud,
We’re walking through the mud,

Keep your feet from getting stuck,

We’re walking through the mud.

We’re swimming in the water,

We’re swimming in the water,

The water’s cold and salty here,

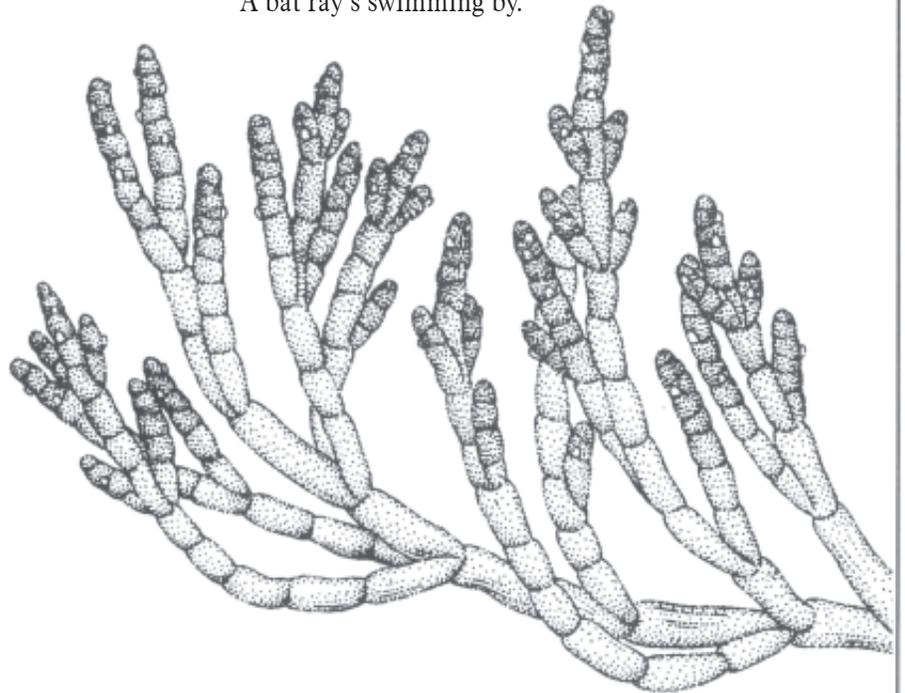
We’re swimming in the water.

A bat ray’s swimming by,

A bat ray’s swimming by,

Watch the bat ray slurp a clam,

A bat ray’s swimming by.



“The Parts of the Slough”

Sung to the tune of “The Wheels on the Bus”

The mud in the slough goes squish, squish, squish,

Squish, squish, squish,

Squish, squish, squish,

The mud in the slough goes squish, squish, squish,

All day long.

The water in the slough is salty and cold,

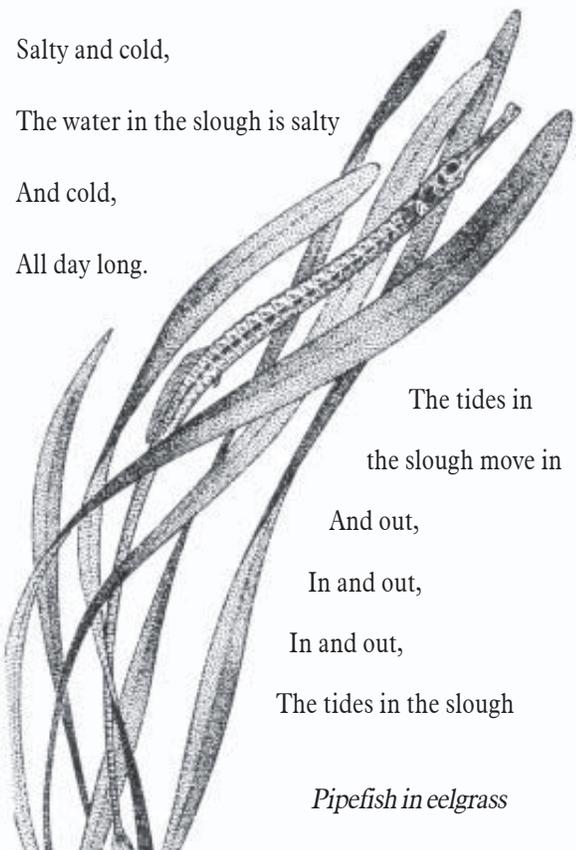
Salty and cold,

Salty and cold,

The water in the slough is salty

And cold,

All day long.



The tides in
the slough move in
And out,
In and out,
In and out,
The tides in the slough

Pipefish in eelgrass

move in and out,

All day long.

The land near the slough goes from wet to dry,

Wet to dry,

Wet to dry,

The land near the slough goes from wet to dry,

All day long.

The animals in the slough they burrow and dig,

Burrow and dig,

Burrow and dig,

The animals in the slough they burrow and dig,

All day long.

The plants in the slough can be tiny or large,

Tiny or large,

Tiny or large,

The plants in the slough can be tiny or large,

All day long.

Look Who's in a Slough



MATERIALS

- One copy each of pages 52 and 53. Enlarge images on a copier, if you'd like.
- Crayons
- Scissors
- Paste
- Pencils

Color the habitat scene, leaving the empty squares blank. The squares represent places where plants and animals can live in a slough. How many different habitats can you find at the slough? (Look for mud, water and land.) Cut up the small pictures into individual picture cards and sort them into groups. Why did you sort them the way you did? Color the picture cards, then fold each one in half along the dotted line. (The drawing will be hidden).

Pick one picture square at a time and decide whether or not it belongs in a

slough. If it does belong, paste the picture to the empty square that represents where it can be found in a slough. If you find things that don't belong, write the heading. "These don't belong in a slough" on the back of your habitat scene. Then paste the pictures of things that don't belong under that heading.

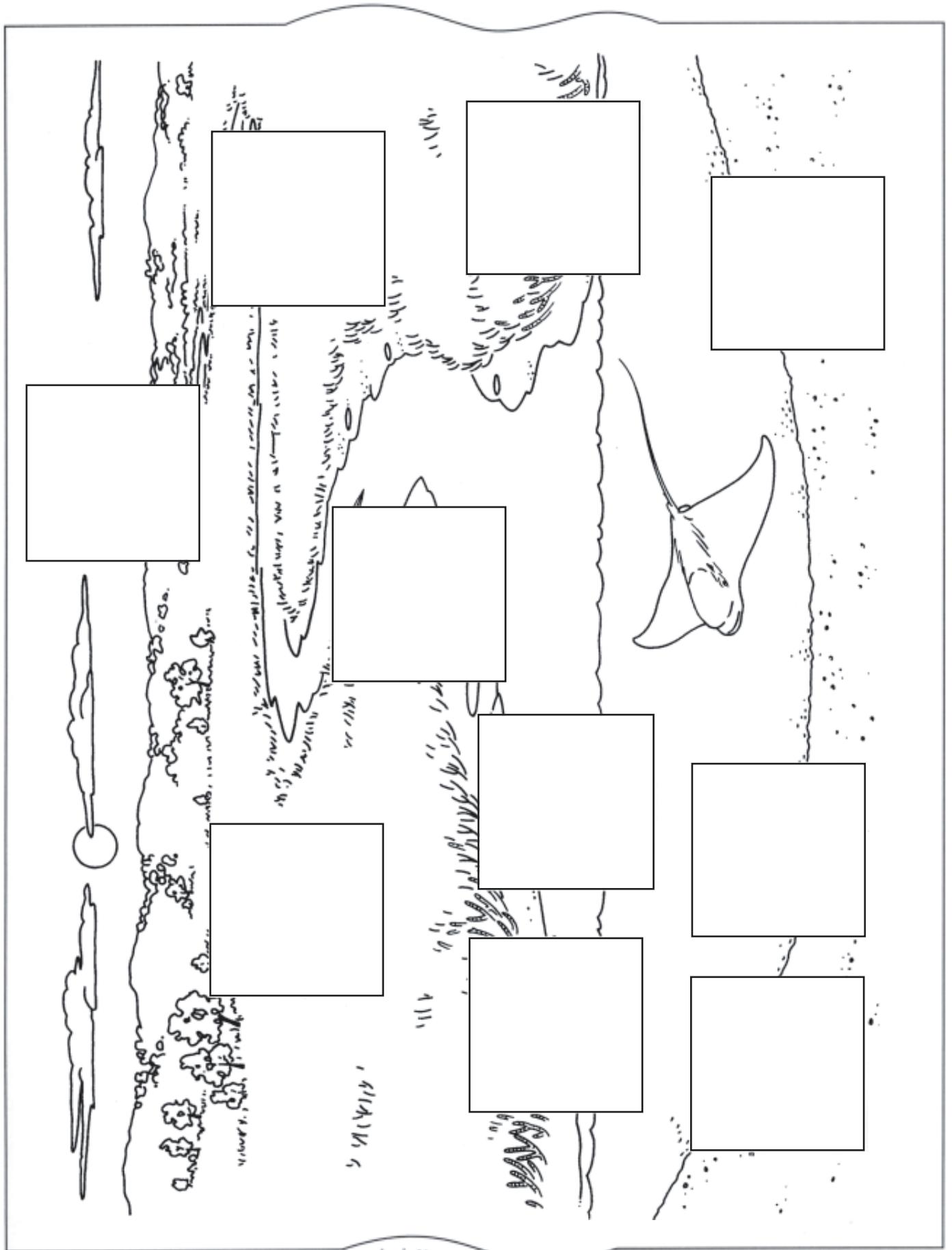
Which pictures did you put in your "These don't belong in a slough" pile? Do those things ever get into sloughs? How do they get there? Why don't they belong there? What happens to a slough's plants and animals when these things get into the slough? What would you do if you saw any of these things in a slough? Have you ever seen garbage in your backyard or school yard? What would you do about it?

Make a pledge. Some examples to get started are, "I will pick up trash when I see it and throw it away," or "I will recycle my trash whenever I can." Write your pledge on a piece of paper and put it in a place where you'll see it.



THE WETLANDS
SEARCHING FOR MORE

	<p>Lined shore crab</p>		<p>Plankton</p>
	<p>Dog</p>		<p>Fat innkeeper worm</p>
	<p>Pickleweed</p>		<p>People</p>
	<p>Great blue heron</p>		<p>Bent-nosed clam</p>
	<p>Garbage</p>		<p>Boat</p>
	<p>Moon snail</p>		<p>Brown pelican</p>



A Web of Life



MATERIALS

- Three copies of the front and back sides of the Wetlands Field Guide (pages 57-60)
 - Scissors
 - Masking tape
- Large ball of yarn or string
- Two blank pieces of paper, each cut in half to make four pieces total

An activity to do at school or at a party! You'll need at least 10 children.

Cut the Wetland Field Guide into individual cards. You'll need one card for all but four children. On the blank sheets of paper, label one as sun, one as mud, one as water and one as air.

To begin, hand out one of the Wetlands Field

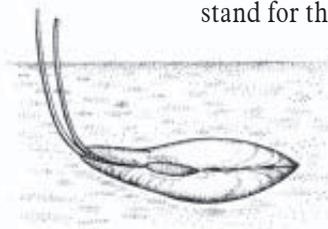
Guide cards to all but four of the children (If you're modifying this for a small class or party, be sure to use the plankton, bent-nosed clam, fat innkeeper worm, pickleweed, bat ray and great blue heron cards.) Hand out the sun, mud, water and cards to the remaining four children.

Have children with identical cards get together into groups (for example, all the pickleweeds in one group, the moon snails in another). Have them read their cards and determine what their plants or animals eat and where they live. Have the sun, mud, water and air get together in one group to determine how they're necessary to the survival of

slough plants and animals. (The sun provides energy which plants use to make food; mud provides a place for plants and animals to live; water provides transport; and air provides oxygen.) Have children tape the cards to their chests.

Come back together as a group. Ask children to define "interaction" and give some examples of different ways plants and animals interact with each other and with their habitat (for example, the relationship between an animal and the animal it eats, or the interactions between an animal and the temperature, currents and other characteristics of its home).

Outside, arrange the children in one large circle by groups so all the pickleweeds stand together, all the moon snails stand together and so on. The sun, mud, water and air should be interspersed among the other children in the circle. (Children can sit or stand for this.)



Bent-nosed clam

Have each group briefly report or act out (but not read) to the rest of the circle who they are, what they eat and where they live. Ask children if they think all of these living and non-living things could be connected to each other through their interactions.

Hand the ball of yarn to one child from one of the groups and ask that group to decide who or what their plant or animal interacts with. Then have him or her toss or roll the ball of yarn to one person in that group and explain how they interact with one another. For example, a bat ray might throw the

THE WETLANDS

SEARCHING FOR MORE

yarn to a clam (what it eats) who might throw the yarn to the mud (where it lives).

Continue this until each child has gotten the yarn at least once. Ask children what they can tell you about the web. Point out (if they haven't already!) that everything in the slough is interconnected, then ask them if anything stands out as being more important than the others.

Read the following scenarios to the children, one at a time, and follow the directions in parentheses at the end of each one.

1. "People dig for clams and fat innkeeper worms to use as bait when fishing." (Have clams first, then fat innkeeper worms, gently tug on the yarn. Ask children to raise their hands when they feel the tugging and to tug on the yarn in return.)

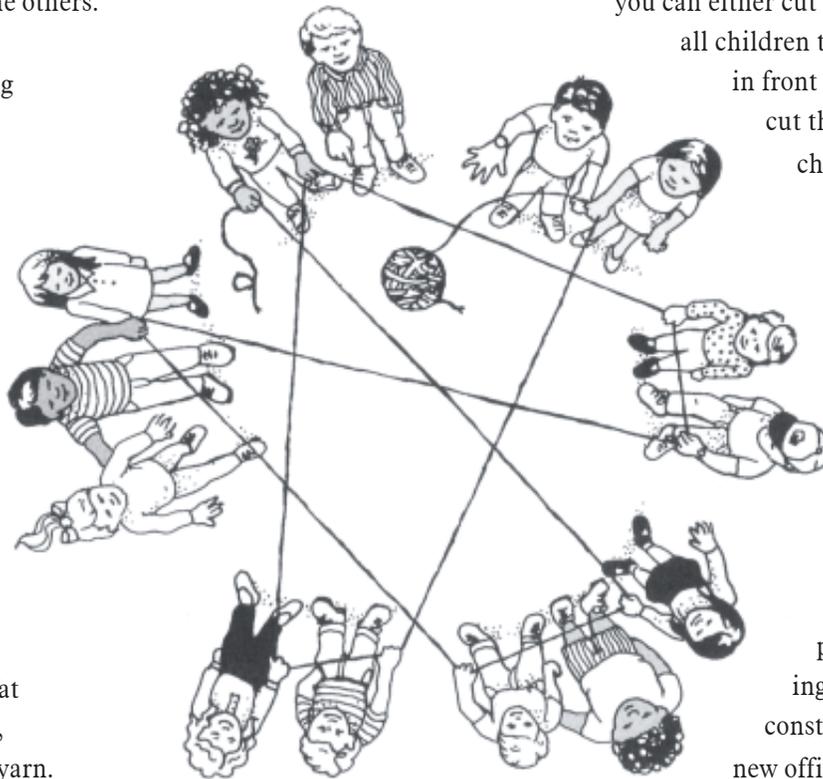
2. "Gourmet food industry discovers pickleweed and starts harvesting it to make slough cookies." (Have pickleweeds tug on yarn and ask children to raise hands and tug back.)

3. "Eucalyptus trees are cut down because they're not native to the slough. This destroys the great blue heron nesting sites." (Have great blue herons tug on yarn and ask children to raise hands and tug back.)

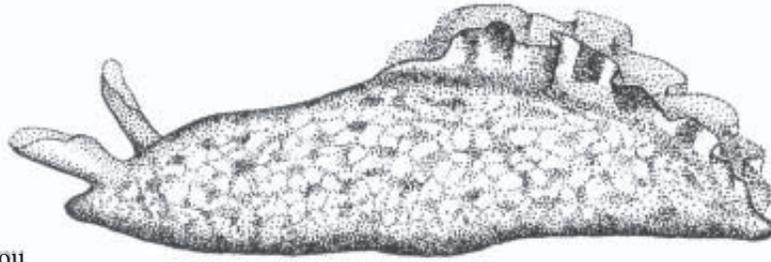
4. "An office building is built on top of the mud." (Have all children gently pull on the yarn. Then you can either cut the yarn or ask all children to drop the yarn in front of them. If you cut the yarn, have children put the yarn down on the ground in front of them as they feel it go limp.)

5. "Local citizens write letters and attend public hearings to stop construction of the new office building on the mud flat." (Ask children to pick up yarn, then tie it back together if cut.)

What happened to the slough?



Animal Riddles



Sea hare

Here are a few for you
To try, then make up your own.

I don't have a shell and I crawl across the mud
Looking for seaweed to eat. (sea hare)

I crawl in the mud and drill holes in the shells of
my food. (moon snail)

I use my big fins that look like wings to swim over
the mud. (bat ray)

I burrow in the mud and build a net to trap my
food. (fat innkeeper worm)

Get Involved

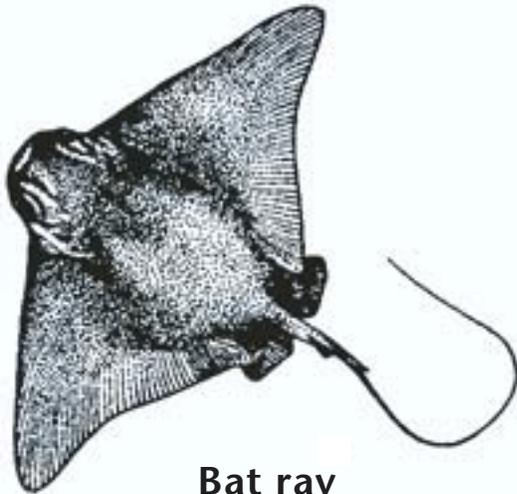
List some of the things your class or family can do to help protect wetlands and other threatened habitats in your area. Some ideas are: a family volunteers to help replant native plants, a student volunteers to assist a researcher who's studying shorebirds, a class raises money for a conservation project to restore a local habitat and two students visit a farm or industry and prepare a report on what these operations are doing to be good environmental neighbors.



A Wetlands Celebration

Plan an annual Habitat Protection Day or Habitat Protection Week for your community or school. Design ways to share why the habitat is important and how others can become involved in protecting and, if needed, restoring it. You might even want to set up field trips to your special habitat. School celebrations could be in conjunction with National Estuaries Day events happening locally as part of the annual Coastweeks celebration.

Critter Cards - Wetlands



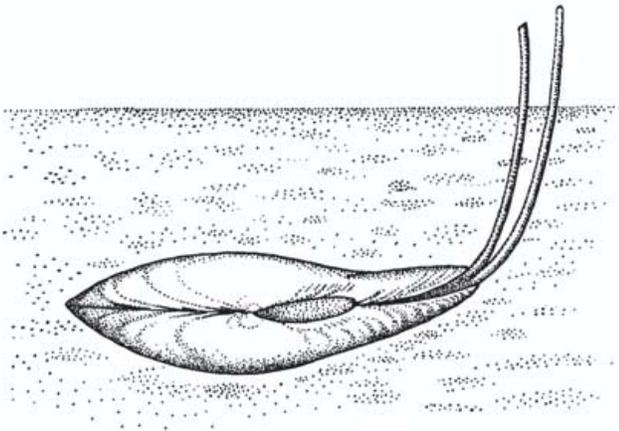
Bat ray

Bat ray

Myliobatis californica [size: to 6 ft. wide (1.8 m)]

Bat rays prey on clams, shrimp, worms and other invertebrates that live in the mud. Flapping their wings to clear away mud, rays suck up their prey, crushing the shells with their strong jaws and hard, flat teeth.

In summer, bat rays enter sloughs and bays where they give birth to live young. It's a trait they share with several other members of the shark family.



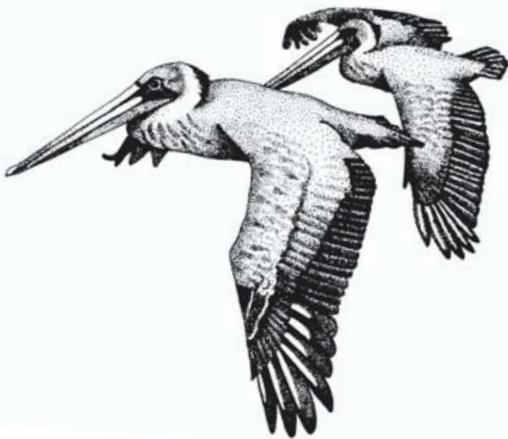
Bent-nosed clam

Bent-nosed clam

Macoma nasuta [size: to 2.5 in. (6 cm)]

Using its muscular foot, this clam digs about six inches down into the mud. It rocks back and forth as it digs, like a coin sinking in water. When it finally settles, it lies horizontally, not vertically like most clams.

To eat and breathe, it sticks a tube up to the mud's surface. Like a vacuum cleaner, the clam sucks down tiny particles, mostly the remains of plants and animals, along with sand and grit. Then it sorts the food from the muck.



Brown pelican

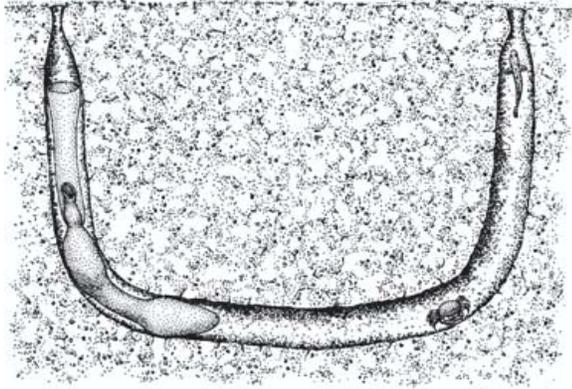
Brown pelican

Pelecanus occidentalis [size: to 7 ft. wingspan (2 m)]

Thousands of pelicans visit Elkhorn Slough in summer and fall. In late fall, they migrate south to Mexico and South America where they build saucer-shaped nests on the ground or in trees and raise two to three young.

In the 1960s, heavy use of the pesticide DDT nearly killed all the brown pelicans. Today, DDT is banned in the United States. But its use in Mexico and other countries along with habitat loss within the pelican's range are still threats.

Critter Cards - Wetlands



Fat innkeeper worm

Fat innkeeper worm

Urechis caupo [size: to 20 in. (51 cm)]

An innkeeper worm digs a U-shaped tunnel in the mud. At one end, it attaches a mucous net that it secretes from special glands. Slowly pulsing its body, the innkeeper pumps water through its tunnel. As water flows through, the net traps tiny plankton floating in the water.

When the net is full, the innkeeper eats both it and the trapped food. Worms, crabs and even goby fish share the tunnel, eating anything the innkeeper misses.



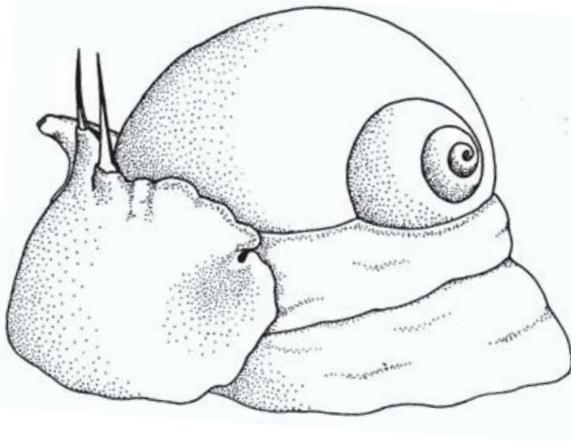
Great blue heron

Great blue heron

Ardea herodias [size: to 6 ft. wingspan (1.8 m)]

Great blue herons live year-round at the slough. They depend on the slough to eat, rest and raise their young. Look for them standing still in shallow water, quietly waiting to snatch and eat small fishes that swim by.

In early spring, great blue herons build nests in the tops of trees. Made of twigs and leaves, each nest shelters three to five bluish-green eggs. Both the male and female incubate the eggs which take about two months to hatch.



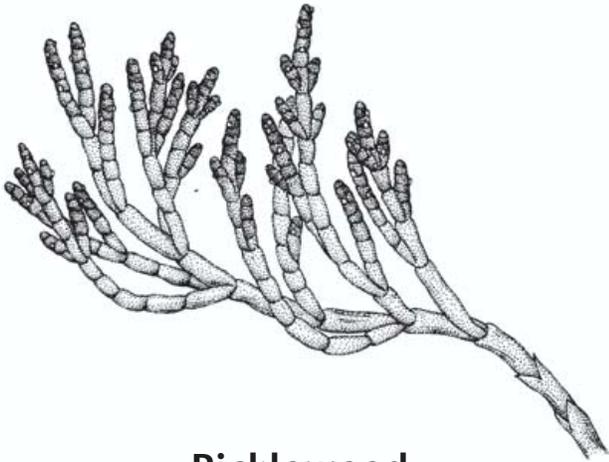
Moon snail

Moon snail

Polinices lewisii [size: to 5 in. (13 cm)]

The moon snail plows slowly through the sand, hunting for clams. Finding one, the snail surrounds the clam with its huge foot. It drills a hole in the shell, rasping with its filelike tongue and softening the shell with a special liquid. When the hole is finished, the snail eats the clam's soft insides.

Critter Cards - Wetlands



Pickleweed

Pickleweed

Salicornia virginica [size: to 25 in. (63 cm)]

This plant can withstand salty conditions that would cause other plants to wither and die. Pickleweed draws the slough's saltwater into its stems and stores the extra salt in the tips of the stems. In fall, the stems turn color, becoming an orange or rosy red. Then they wither and drop off, taking the stored salt with them.



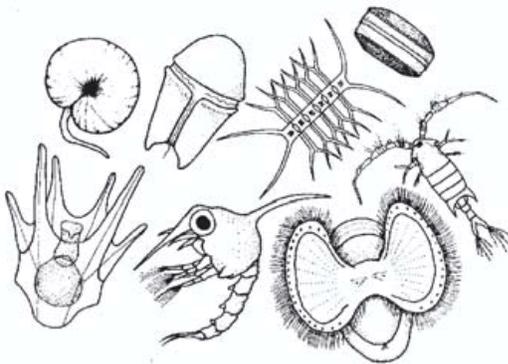
Pipefish with eelgrass

Pipefish with eelgrass

Syngnathus leptorhynchus with *Zostera marina*
[size: pipefish to 13 in. (33 cm); eelgrass to 3 ft. (91 cm)]

With its long and thin green body, a pipefish blends in well with the eelgrass blades it lives in. It even sways back and forth with the currents like eelgrass does.

Eelgrass, unlike most flowering plants, lives with its roots in mud under the water. Its matted roots trap sediments, helping to keep the mud in place and providing a stable home for many animals.



Plankton

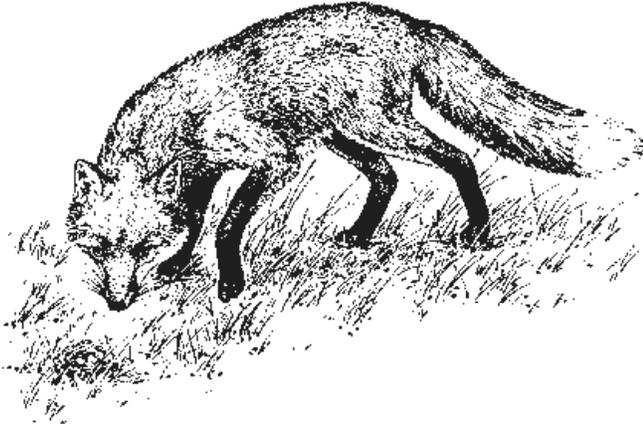
(Plant plankton, top row from left: two dinoflagellates, chain diatom, diatom. Animal plankton, bottom row: sea urchin larva, crab larva, snail larva, copepod.)

Plankton

Plankton are plants and animals that drift on ocean currents instead of swimming. Most are tiny; these pictures are many times larger than the actual organisms.

Plant plankton form the first link in many of the ocean's food chains. Animal plankton eat these tiny plants. Filter-feeders like clams and sand crabs eat both kinds of plankton.

Critter Cards - Wetlands



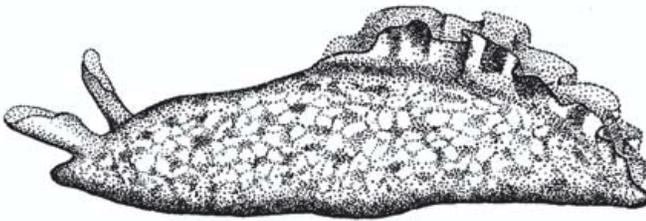
Red fox

Red fox

Vulpes fulva [size: to 3.5 ft. (106 cm)]

A red fox stalks its prey at night, feeding on ground-nesting birds, their eggs and small animals. During the day it returns to its home in the uplands, a den dug down in the ground.

Many people are concerned about red foxes at the slough. Unlike native gray foxes, red foxes were brought to the slough by people. Without natural predators, the red fox's population grows unchecked. And as red fox numbers grow, populations of its prey decline.



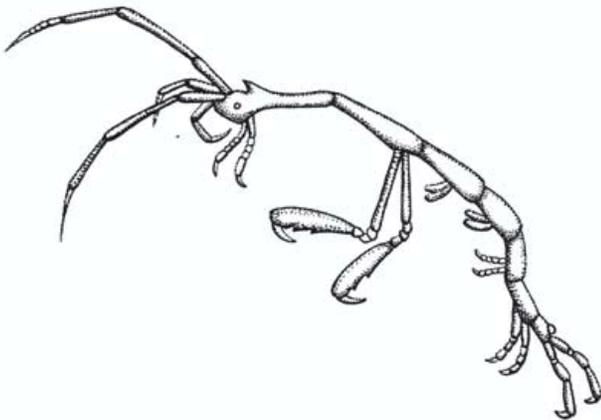
Sea hare

Sea hare

Aplysia californica [size: to 16 in. (41 cm)]

A sea hare glides along the muddy bottom, searching for algae to eat. With its filelike tongue, called a radula, it scrapes up its food, eating nearly 10 percent of its body weight a day.

An adult sea hare is both a male and a female, but it must mate with another sea hare. After mating, it lays strings of greenish eggs that look like spaghetti. Each string contains up to a million eggs.



Skeleton shrimp

Skeleton shrimp

Caprella californica [size: to 1.5 in. (4 cm)]

You have to look closely to find skeleton shrimp. Their small, clear, sticklike bodies blend in well with the eelgrass where they live. They cling to the plants with three pairs of legs, and use their clawlike "arms" for grabbing food, fending off predators and cleaning themselves.

A skeleton shrimp eats whatever it can. It feeds on smaller plants and animals and scavenges for other bits of food.