

*Padilla Bay National
Estuarine Research Reserve
Breazeale Interpretive Center*

**THE
ESTUARY
GUIDE**

LEVEL 1

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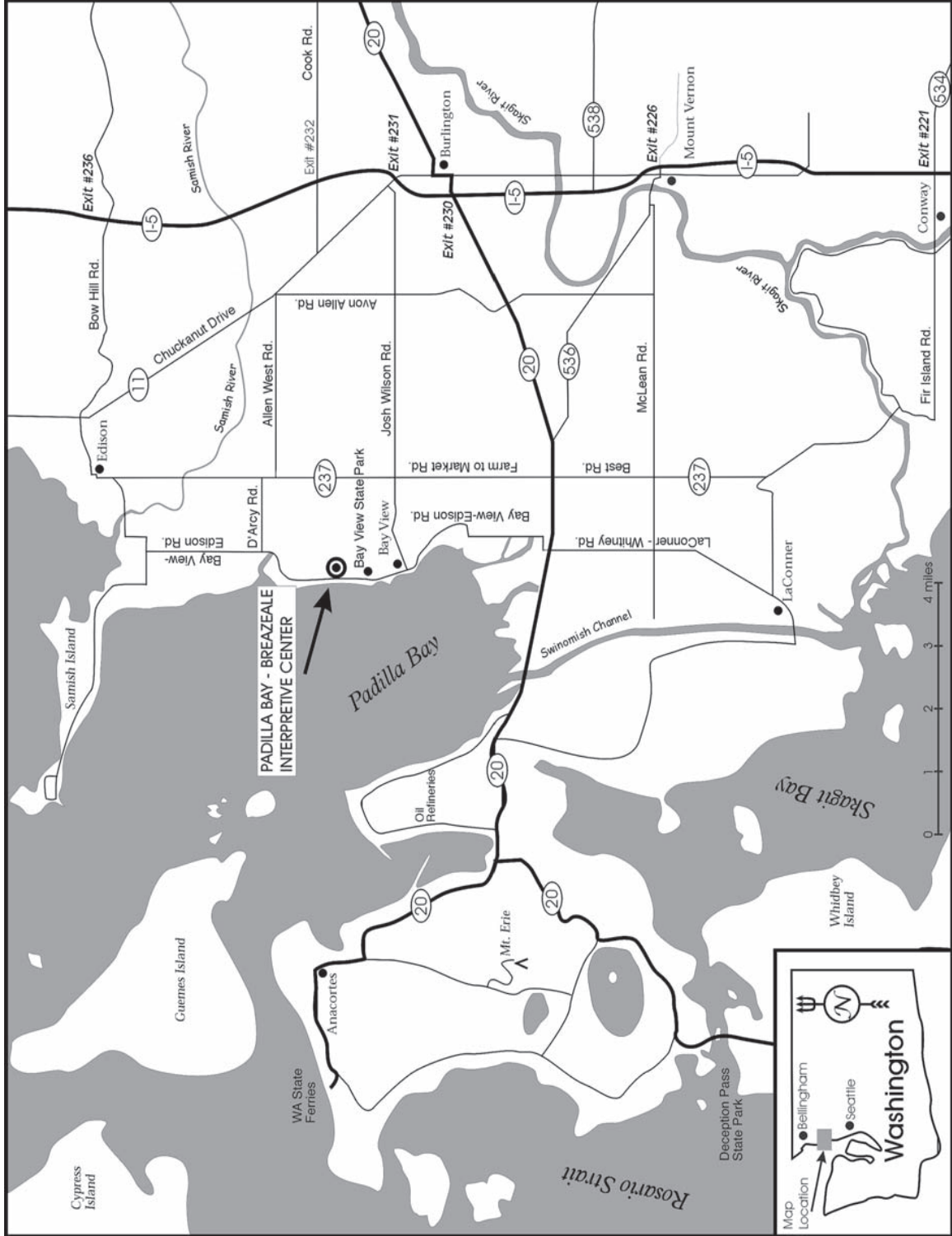


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Introduction

This guide is designed for use by teachers of primary grades to complement a visit to the Padilla Bay National Estuarine Research Reserve. It is also a useful resource to anyone teaching about watersheds, estuaries, shorelands, and coastal resources.

It is divided into four sections:

- Pre-trip information and activities
- On Site materials
- Post-trip ideas
- Resources

A variety of activities is included, designed to weave together many subjects and many ways of learning. Our hope is that some will fit comfortably into your class work and with your unique style of teaching.

There is a wealth of beauty, humor and truths stranger-than-fiction out there waiting to be understood. May these beginning activities lead to a closer bonding between people and the natural world.



Padilla Bay has been designated as a National Estuarine Research Reserve, managed by the Washington State Department of Ecology in cooperation with the National Oceanic and Atmospheric Administration (NOAA). One of 25 reserves around the country, Padilla Bay is set up as a natural field laboratory for research and education, with the goal of enhancing public awareness of the value of estuaries and improving coastal resource management.



Teacher Checklist

Pre-trip:

- Read through this curriculum packet.
- Arrange for adequate adult supervision. (We suggest one adult for every 5-8 children.)
- Prepare adults by giving them the Parent Page on pages 32-33. Be sure drivers have the map on page iv.
- Make legible name tags for all.
- If you will be visiting the beach, emphasize the importance of warm outdoor clothing: warm jackets, rain gear, hats, and gloves during October - May. Snug boots or old shoes that tie are best for low tide dates.
- Consider using one or more of the pre-trip activities on pages 7-27. Prepared students benefit most from our program.
- If you will be visiting the beach at Bay View State Park on your own, please read through "At the Beach" on pages 34-36.

On Site:

- Are your students wearing name tags?
- Please arrive at your scheduled time or call to let us know of a change.
- Enjoy!

Post-trip:

- Continue the estuary studies back in your classroom with some of the many activities listed on pages 39-78 of this curriculum.
- If you have suggestions for any improvements or changes we could make to our program, please write or call (360)428-1558.
- Our programs are supported by State and Federal funds as well as a nonprofit foundation. We encourage groups to join or make a donation to:

The Padilla Bay Foundation
PO Box 1305
Mount Vernon, WA 98273



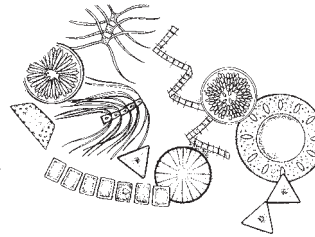
A Bit About Estuaries ...

The Skagit River begins in the North Cascades. It tumbles down mountain sides, spills over waterfalls, runs past towns and under bridges, winds through the fertile Skagit Valley and eventually slows down as it nears its estuary, the Skagit Delta. An estuary: the place where a river meets the sea.

Estuaries are remarkable places, rich with treasures hidden to the casual observer. Life is concentrated here. The amount of plant material produced in an estuary far exceeds that of even our best-tended wheat fields. In turn, plants provide food and shelter for a myriad of animals. The bay is a veritable garden.

Plants

The complex marine food web begins with phytoplankton, the tiny, free-floating plants that thrive in the shallow, sunlit, nutrient-rich water. Phytoplankton belong to a group of plants called algae. Large algae is commonly called seaweed.



Another producer is eelgrass, a flowering marine plant which carpets Padilla Bay. It offers food and shelter to the many animals that live on and among its blades. Eelgrass is valuable both as habitat while it is living, and as a food once it has died and decayed.



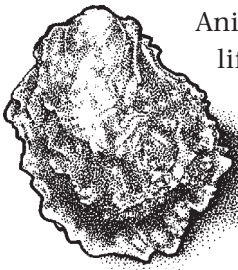
A third major group of plants consists of the salt marsh plants that form the transition zone between land and water. These specialized plants add nutrients to the bay, filter out toxins from land runoff, and soak up excess rainwater like a sponge.



A Bit About Estuaries ...

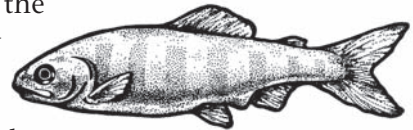
Animals

The abundant plant life in an estuary attracts incredible numbers of animals, for it provides ample food and shelter. Estuaries can be a home, a nursery or a rest stop for migrating animals.



Animals such as oysters, clams, worms, crabs, and snails begin their life as zooplankton and settle down as they mature. These invertebrates provide food for larger animals such as birds and fish.

Salmon need to spend time in an estuary on their journey to the sea. The bay provides food, protective shelter, and a gentle transition stage from the fresh water to the salt. Juvenile Dungeness crab, herring, and flounder are some of the many animals found in large numbers in the shallow waters of the estuary.



Padilla Bay is located along a major flyway and hosts thousands of migrating birds, including shorebirds, ducks, brant geese, and raptors such as eagles and falcons. Some choose to winter here, while others continue southward.

“Estuary” comes from the Latin word *aestus*, meaning *tides*. Twice a day the tides fill and empty the bay. Seasonal cycles and daily fluctuations of tides, salinity and temperature create a unique environment that can be incredibly stressful to its inhabitants. Species that have adapted to the stresses tend to be numerous, attesting to the high productivity and natural wealth in an estuary.





A Bit About Estuaries ...

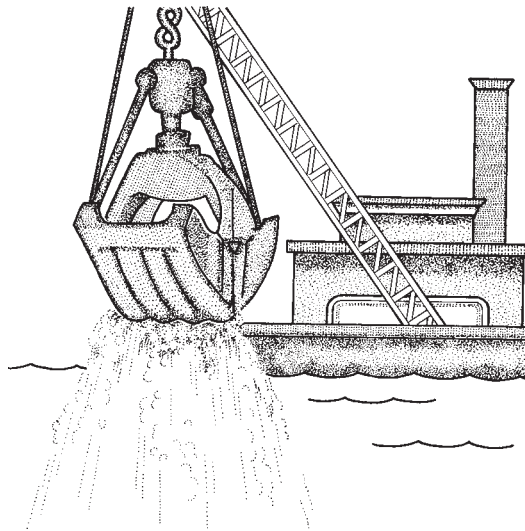
People

People are much like birds. We, too, “flock” to estuaries for the natural resources, edible as well as aesthetic, and for the ease of transportation by land, water and air. The scenic backdrop for recreational activities and the peace and beauty at the water’s edge lure us. More than half of the U.S. population resides near an estuary. Most of the people in Washington state live on the coast, near an estuary (Puget Sound)— and these numbers are steadily increasing.

Growing appreciation is a mixed blessing. Estuaries have been used and much abused in the past. Seen as barren and muddy wastelands, they have been targeted sites for dredging, diking, and dumping of wastes. Development is often accompanied by habitat loss, polluted runoff, increased erosion, and other water quality problems.

There are many things individuals can do to change this trend. Learning more about estuaries is a good first step, followed by a close examination of our own decisions and behaviors that affect estuaries.

We are glad you are here to learn with us.





Pre-trip

Introducing Your Class to Estuaries	10
Where Is My Home?	11
Estuary Birds	15
Vocabulary List	21
Word Games	22
Salt Water–Fresh Water	26



by Tessa



Introducing Your Class to Estuaries

- **Lead a discussion.** When introducing your class to estuaries, begin with the familiar. Ask about their experiences that may connect with estuaries.

Do you live near a river or beach?

Have you ever visited an estuary?*

What have you seen or done there?

What did it look like?

What plants or animals did you see there?

Do you ever go boating?

Do you catch fish?

Was the water fresh or salty? (Don't discount fresh water experiences.)

If you live near a river or stream, find out where you would end up if you floated down river in a boat.

- **Read a story.** Many good ones are listed on page 83.
- **Sing a song.** Check pp. 73-79.

* Most of the groups that come to Padilla Bay live right by an estuary, though they may not realize it. Puget Sound is one very large estuary. That means that everyone near Puget Sound is near an estuary! Let your students know that an estuary is not necessarily some muddy, marshy, far away place. It may be right next door!



Where Is My Home?

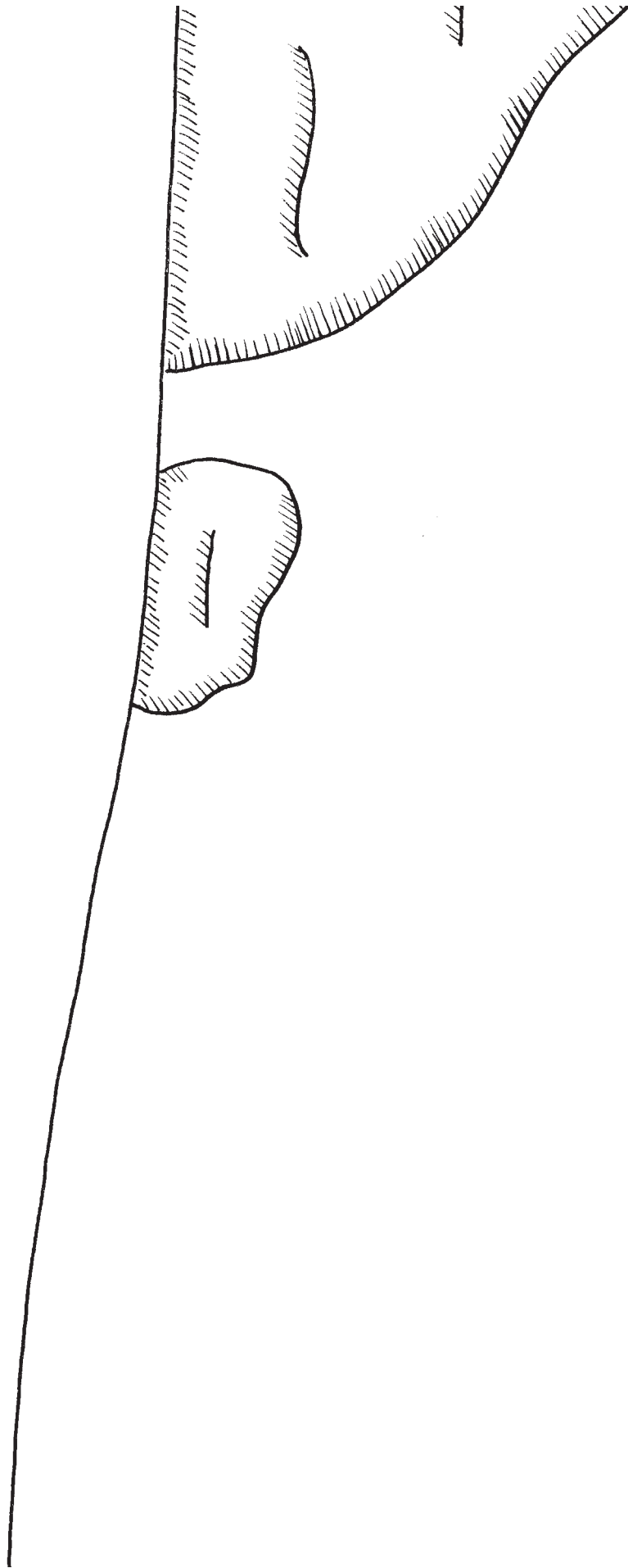
In this activity, students cut out estuary plants and animals and glue them onto the correct habitat.

Concepts: A *habitat* is a place where a plant or animal lives. Different plants and animals live in different habitats. Estuaries have many different habitats. This activity shows the rock, mud, and water habitats.

Discuss habitats with your students. Begin with familiar habitats such as a forest, pond, or backyard. What plants and animals live there? Why do they think different plants and animals live in different habitats? Imagine how silly a plant or animal would be in the wrong habitat.

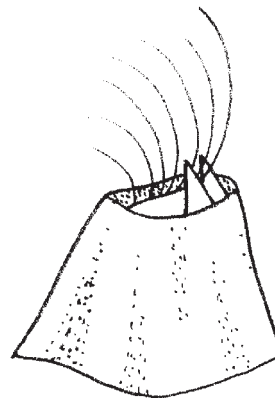
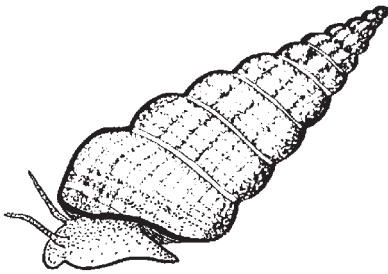
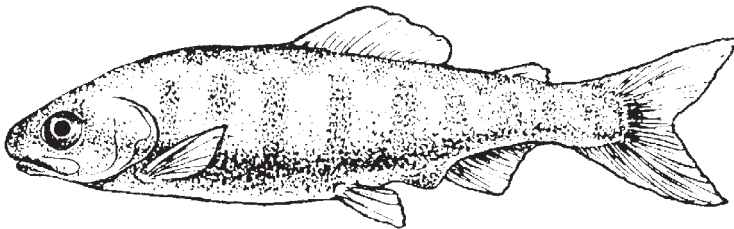
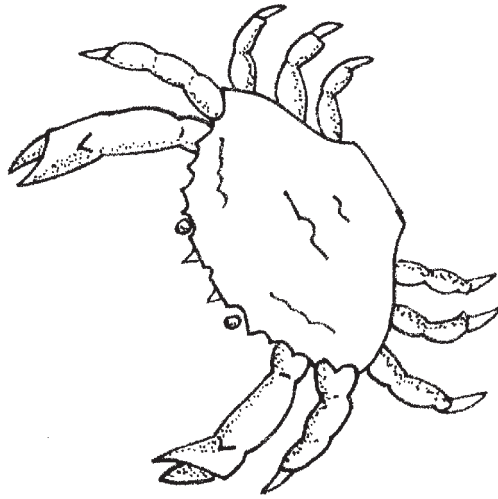
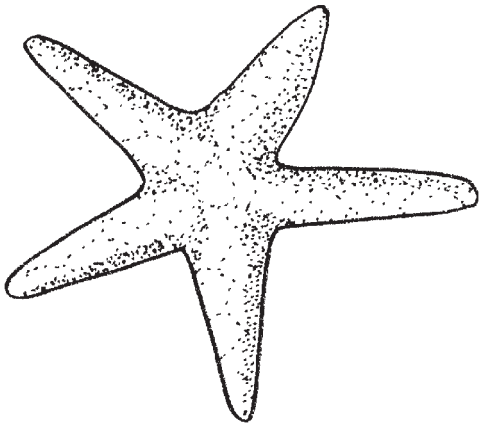
Talk about animals at the beach. What lives in the water? What lives on or under rocks? Could a barnacle live at a beach where there were no rocks? Make a list of possible estuary habitats (eelgrass, mud, cobble, rocks).

Color and cut out the estuary animals and glue them in the right habitat. There are two sets of animals included here. Choose the one appropriate for your students. Students can use the habitat background on the next page or make their own on a large sheet of paper.



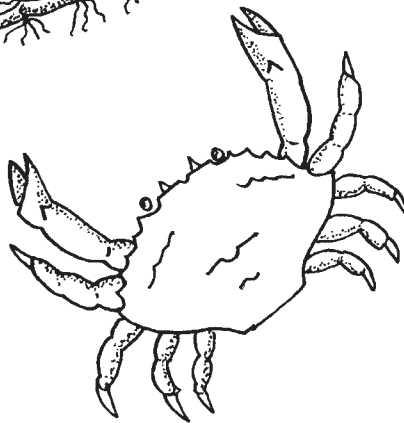
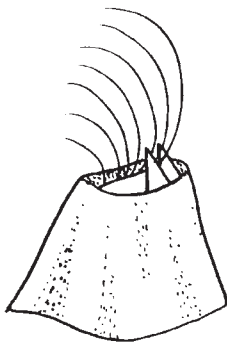
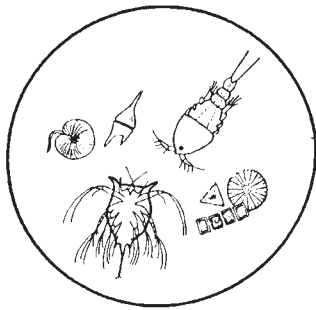
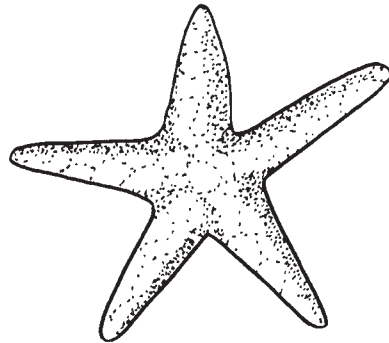
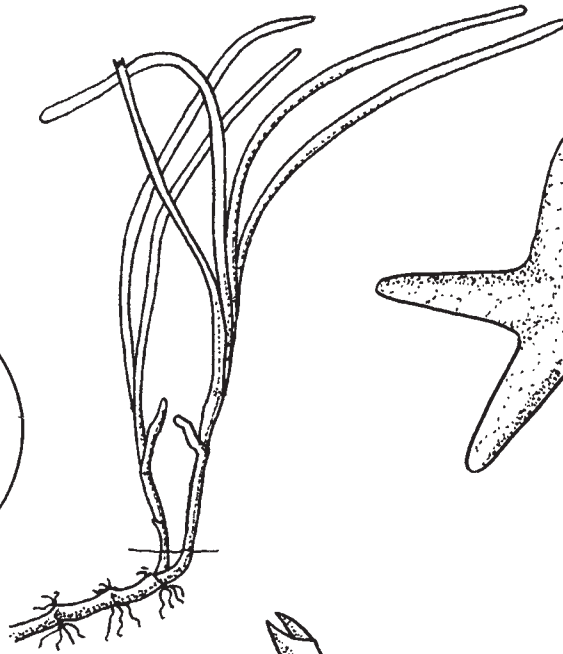
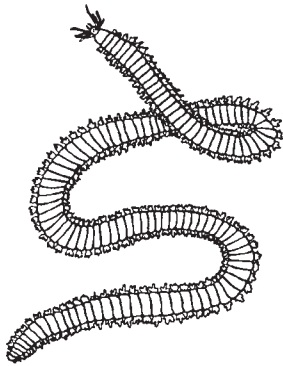
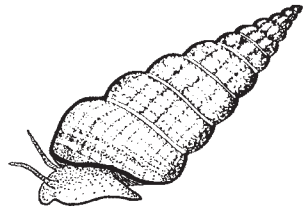
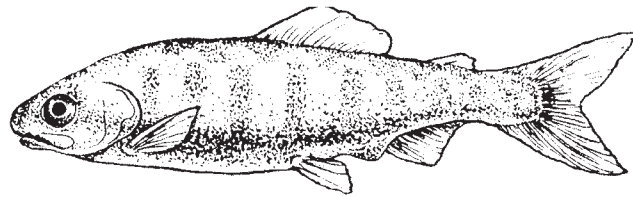


Where Is My Home?





Where Is My Home?





Estuary Birds

In this activity, students become familiar with different kinds of birds that can be found in estuaries like Padilla Bay -- birds they are likely to see on their field trip. They color the Estuary Birds page and may add more birds (and themselves), if they like.

Many birds use estuaries for protection and food. Each is very specialized with adaptations for its particular environment and food preference. Birds' beaks, feet, body shape, etc., tell us about how they live.

Tape or pin the four bird drawings in front of the class. Talk about the differences. Guess where you might see them and what they might eat. Talk about specific adaptations such as long legs, sharp talons, webbed feet, long beaks, and curved beaks. Why would these adaptations be useful? Can they name the birds? Have students color the *Estuary Birds* page and add other birds they think they may see. The following information may be useful in your discussion.

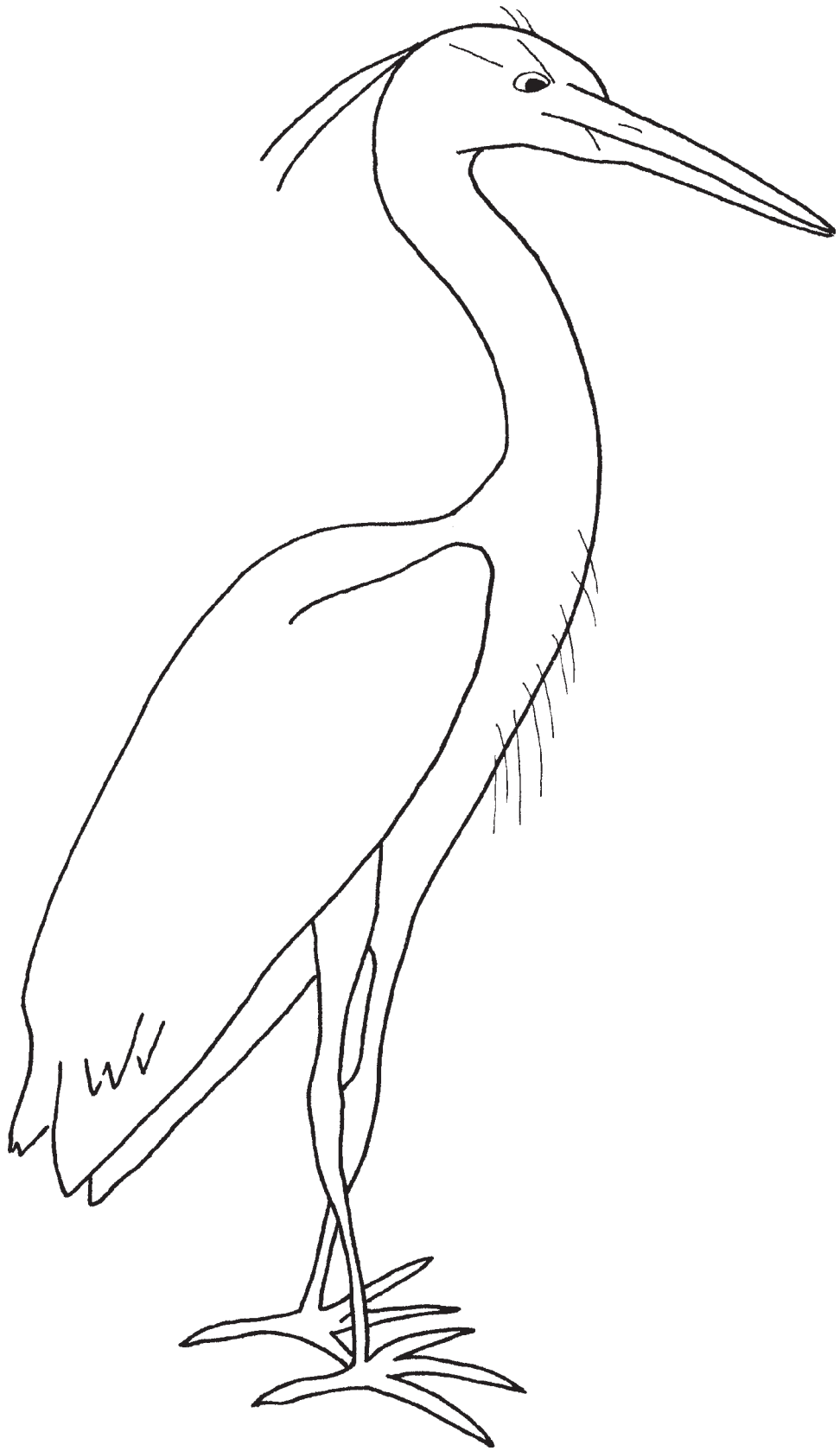
Eagles are one of the largest birds in North America. They are often seen perched in tree tops or soaring with wings outspread. They eat most types of fish as well as ducks, rabbits, turtles, and other small animals. They also eat carrion. Adults get their characteristic white head and tail at 4-5 years of age. Immature birds appear dark.

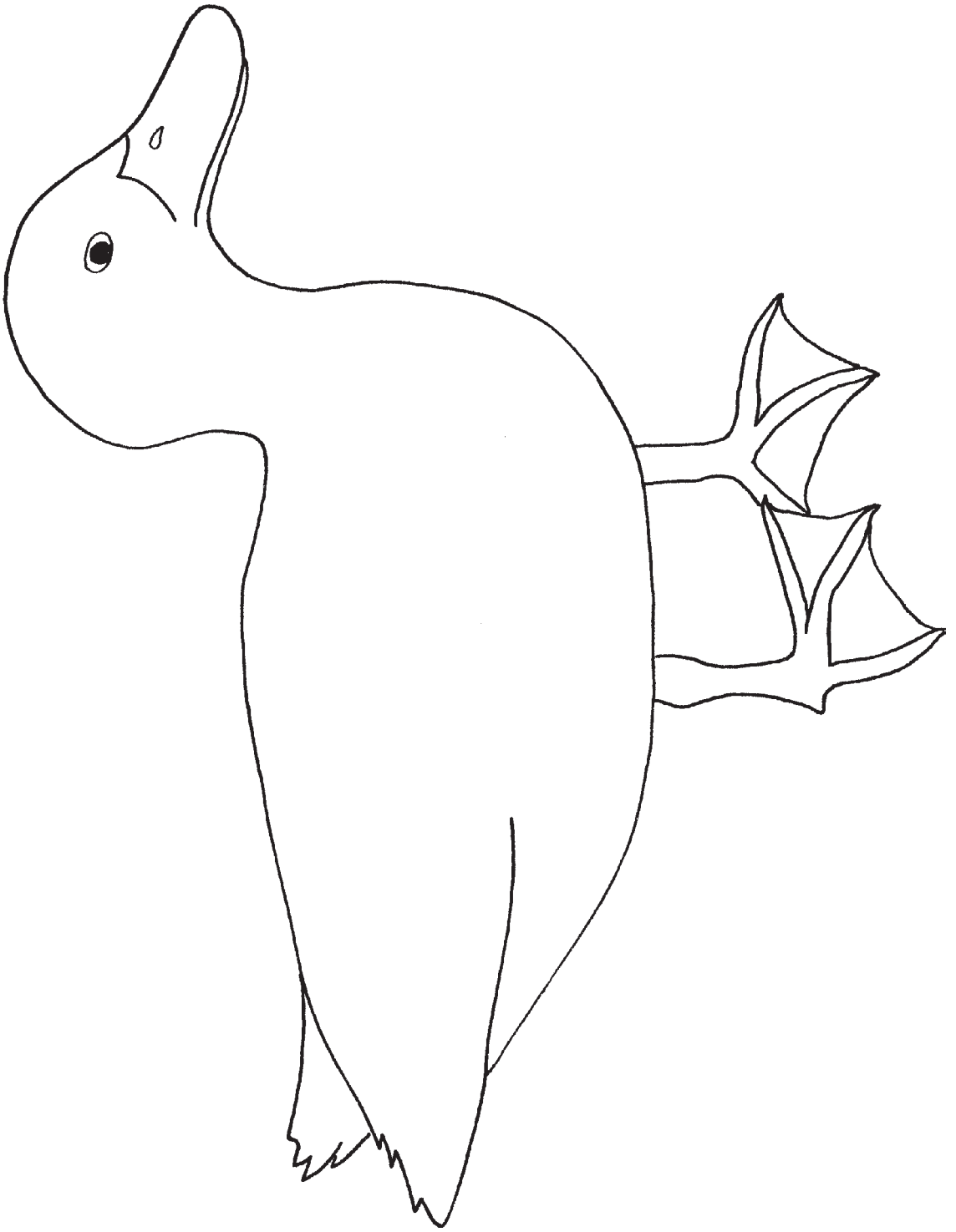
Great Blue Herons stand 3-4 feet tall. They fly with a slow wing beat and legs stretched out behind them. When flying and often while standing, they fold their long neck up into an "S" shape. They can stand almost motionless in the water when hunting for a meal of fish or crab.

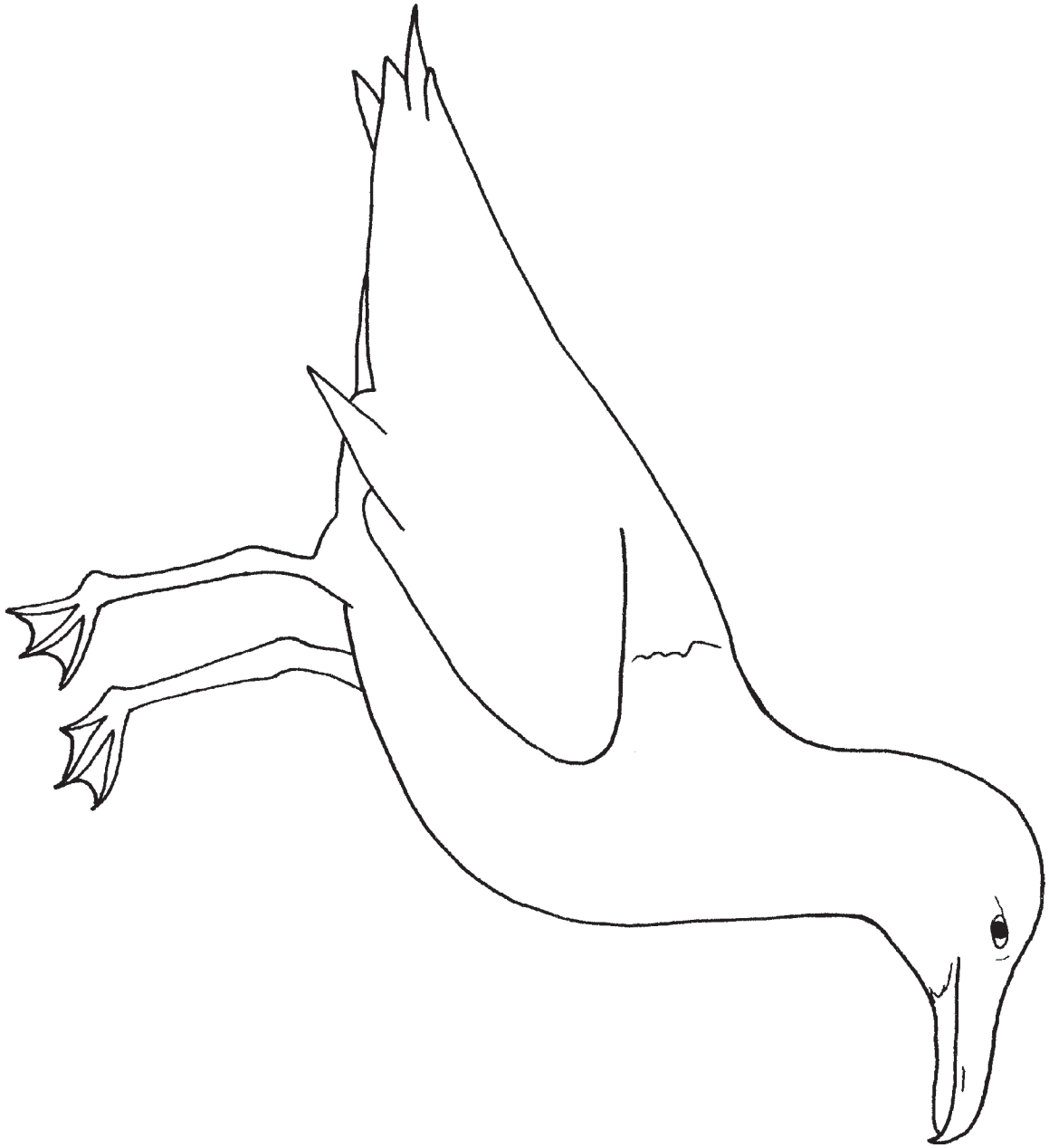
Ducks are here by the thousands from October through April. Places like Padilla Bay are their wintering grounds. Their rapid wing beats can often be heard when they fly overhead. There are many different kinds of ducks. Some eat plant matter, some eat fishes and some dive for clams and crabs on the estuary floor.

Gulls are well known to most of us. These striking grey and white birds frequent shores, the open ocean, inland waters and garbage dumps! Though they often scavenge dead things or garbage, you may observe a gull cracking open a clam shell by dropping it onto a rock below. Young gulls look dirty grey.



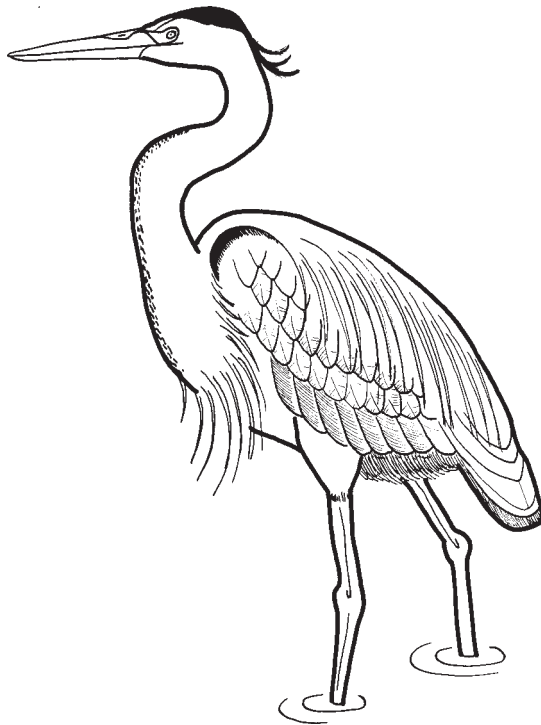
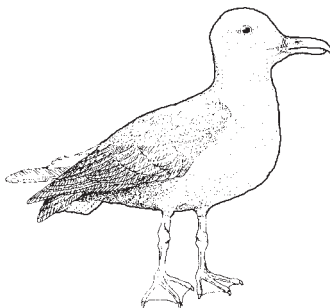








Estuary Birds





Vocabulary

estuary: a place where fresh water mixes with salty sea water. All of Puget Sound is an estuary.

fresh water: water without salt in it, like in rivers and lakes.

salt water: water with salt dissolved in it, like ocean water.

habitat: the place where a plant or animal lives.

tides: the rise and fall of ocean water twice a day.

plankton: plants or animals floating in the water -- usually microscopic.

phytoplankton: microscopic plants floating in the water.

zooplankton: (ZOE-plank-ton) microscopic animals floating in the water.

microscopic: too small to see without a microscope.

detritus: (dee-TRY-tis) rotting bits of plants and animals.

filter feeder: an animal, such as a clam or oyster, that strains food from the water.

food chain: a sequence or "chain" of living things in a community, based on what eats what: for example, gull eats clam and clam eats plankton .

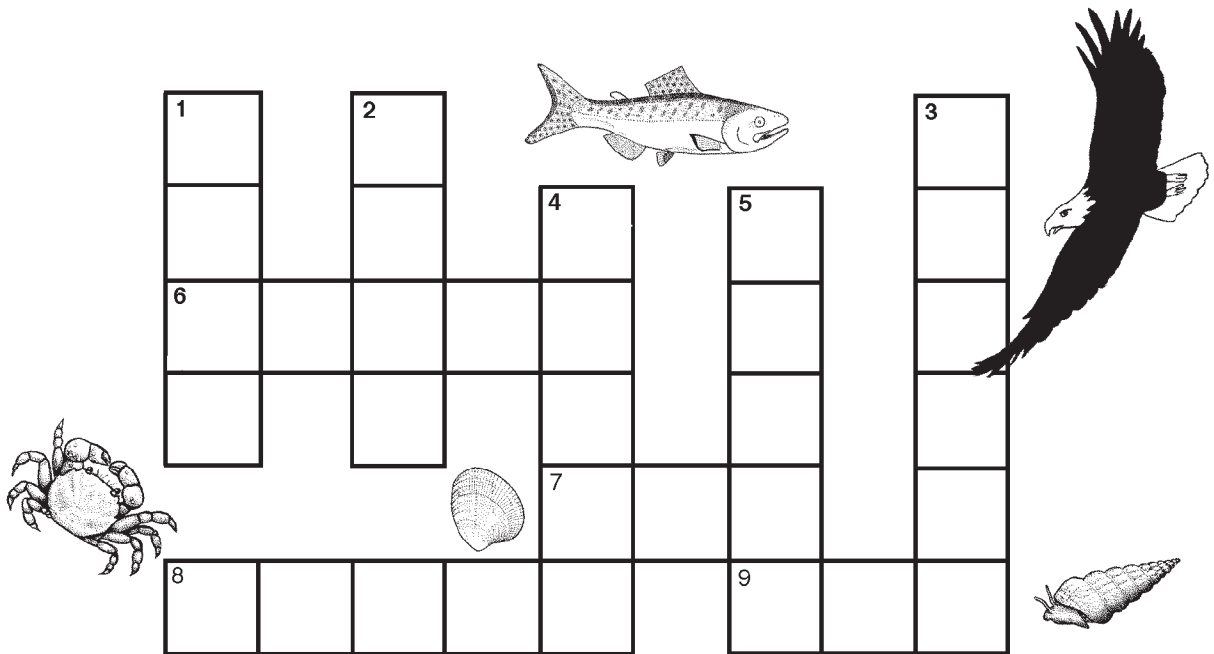
food web: overlapping and connecting food chains.

watershed: the area of land that drains into a body of water like a river or bay.

migration: seasonal movement of an animal from one place to another.



Who Am I?



Across

- I move VERY s-l-o-w-l-y.
- I am home for clams and worms.
- We go up and down in the bay twice every day.
- I shine and give energy to all the plants.

Down

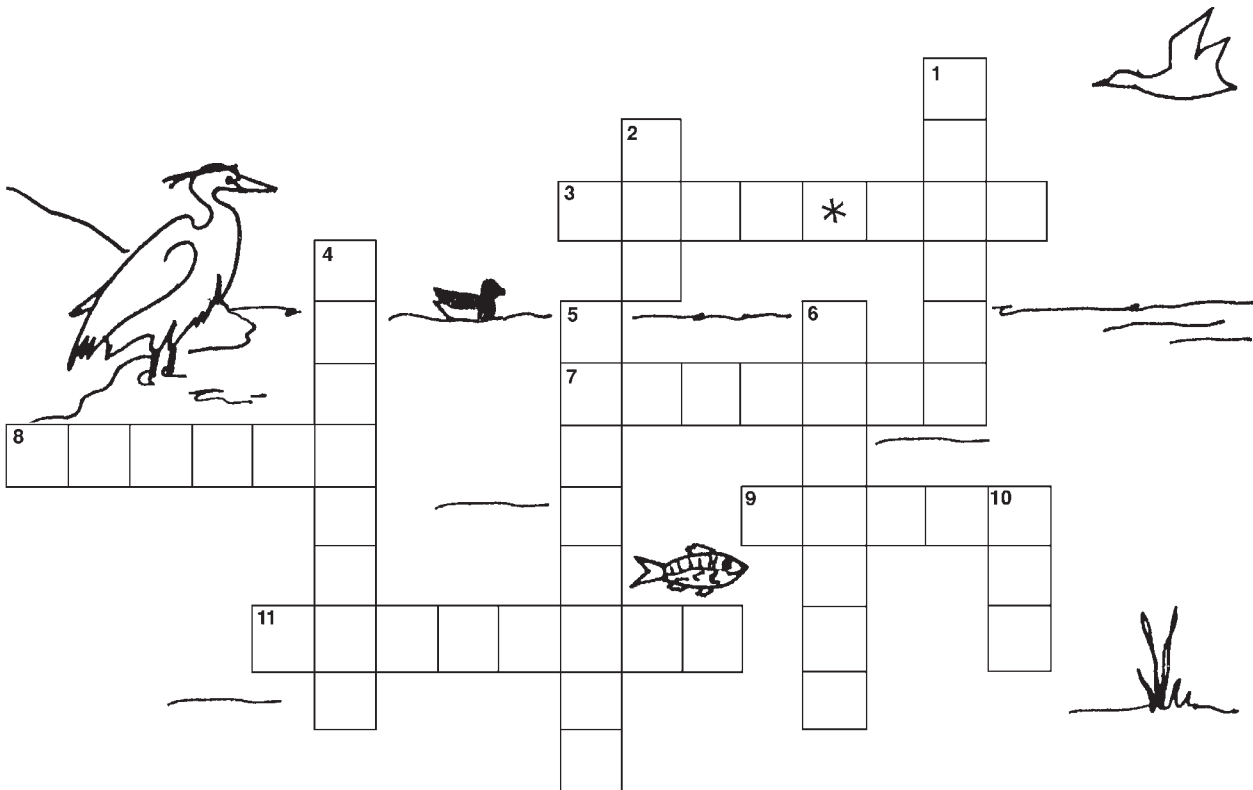
- I have fins, scales, and gills.
- I have 2 big claws and many legs.
- I swim down the river to the estuary when I am a baby.
- We have 2 shells and live under the mud.
- We fly to the bay to look for food.

Words to Use

salmon
birds
clams
crab
fish
mud
snail
sun
tides



Crossword



Across

- Many food chains connect to make a ____ ____.
- The place where a river meets the sea
- This animal goes from salt water to fresh to lay eggs.
- The rise and fall of ocean water twice a day
- Floating plants and animals

Down

- Plants get this from the sun.
- Floating animals are called ____-plankton.
- An animal that attaches to rocks and eats plankton
- Rotting bits of plants and animals
- The place where an animal lives
- The salt water in an estuary flows in from the ____.

Words to Use

plankton
 sea
 barnacle
 estuary
 habitat
 food web
 zoo
 tides
 detritus
 salmon
 energy



Word Search

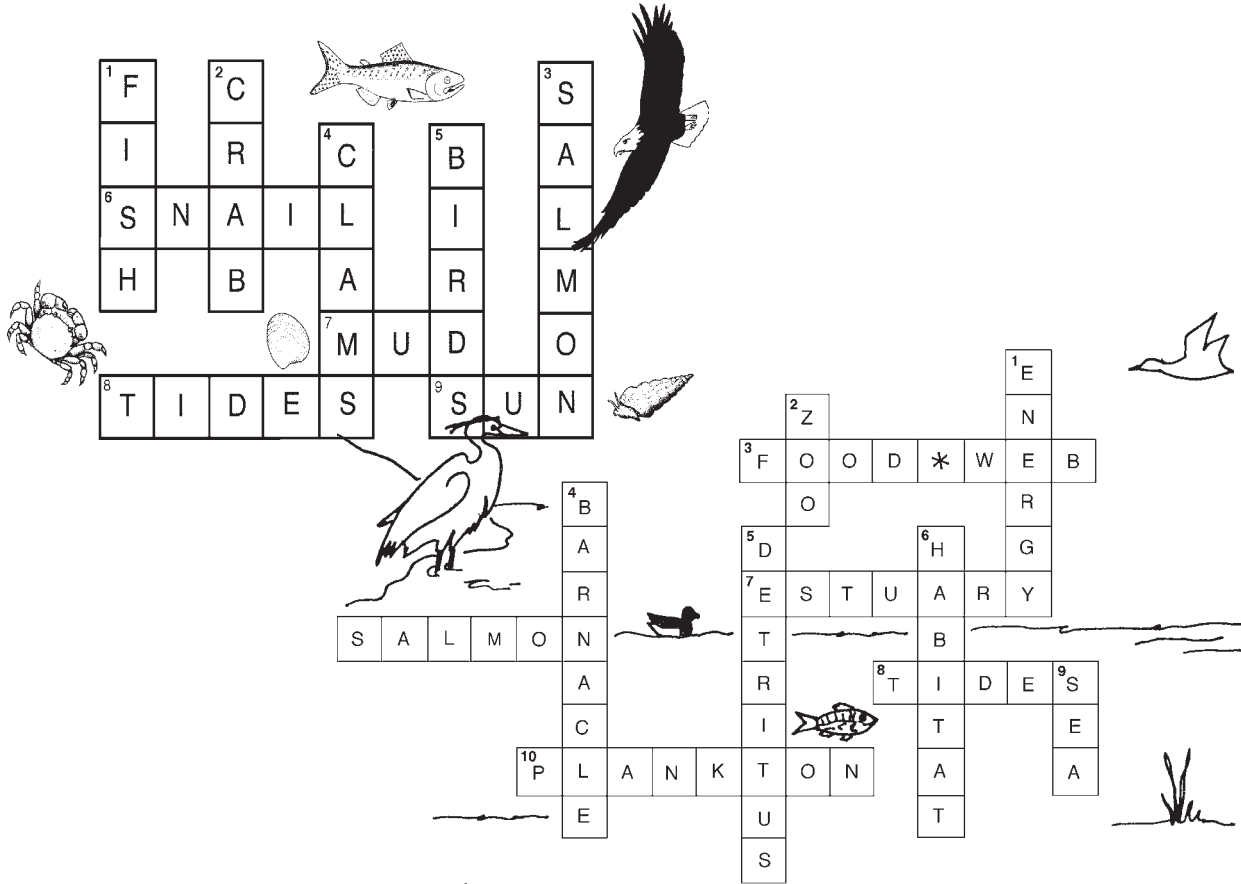
M L F E S T Z B X E C T E A P
I Y T O E R U E S I M B I L H
G T S E O N K C P E N E R G Y
R S R S T D I O S T A W I R T
A E R T S U C H A G P D Q U O
T R G U K S X H F I R O T S P
I S W A O C B T A Y U O N K L
O O T R S C F T Z I L F X V A
N A C Y Z O O P L A N K T O N
I I C T R Y T S P E E A P T K
M I C R S E E R E C T E P Z T
H A B I T D E T R I T U S X O
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T Z U T O P L A N K T O N W P
H I T R W M H E L G J B Y I X

Find each word and match it with the correct definition.

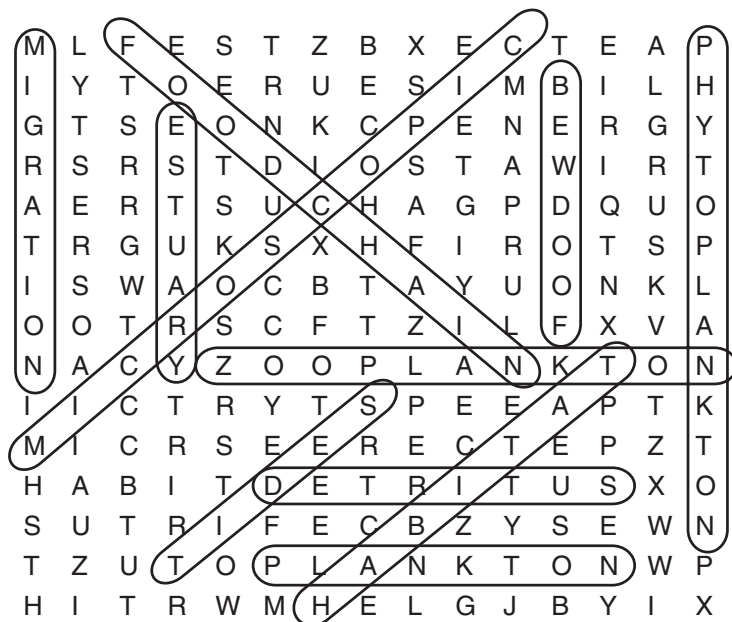
- | | |
|-----------------------|--|
| ___ 1. plankton | A. A place where fresh water mixes with salt water |
| ___ 2. food chain | B. Rotting bits of plants and animals |
| ___ 3. habitat | C. What eats what in a community |
| ___ 4. estuary | D. When a group of animals moves from one place to another |
| ___ 5. microscopic | E. Plants and animals that float freely in the water |
| ___ 6. tides | F. Overlapping and connecting food chains |
| ___ 7. zooplankton | G. The place where a plant or animal lives |
| ___ 8. migration | H. Something too small to see without a microscope |
| ___ 9. food web | I. The rise and fall of ocean water twice a day |
| ___ 10. phytoplankton | J. Animals floating in the water |
| ___ 11. detritus | K. Plants floating in the water |



Key



- E 1. plankton
- C 2. food chain
- G 3. habitat
- A 4. estuary
- H 5. microscopic
- I 6. tides
- J 7. zooplankton
- D 8. migration
- F 9. food web
- K 11. phytoplankton
- B 12. detritus





Salt Water - Fresh Water

Students observe the difference between salt and fresh water and discuss how plants and animals live in one or the other.

Talk about salt water and fresh water. Fresh water is water without salt in it, not necessarily *clean* water.

Let your students observe tap water. They can look at it, smell it, taste it. Then let them make salt water by adding 1 teaspoon of salt to 1 cup of fresh water (the approximate amount in ocean water). If the salt is dissolved, the two should look and smell the same.

Place a small amount of salt water (maybe collected from a nearby beach) in a shallow dish. Let the water evaporate and observe the salt crystals left behind. Even though we can't see dissolved salt, we know it's there!

Make two lists on the board: one of plants and animals that your students think might live in fresh water and one of plants and animals that might live in salt water. Can they think of any that live in both? Most plants and animals are specially adapted to live in either salt water or fresh water, seldom both.

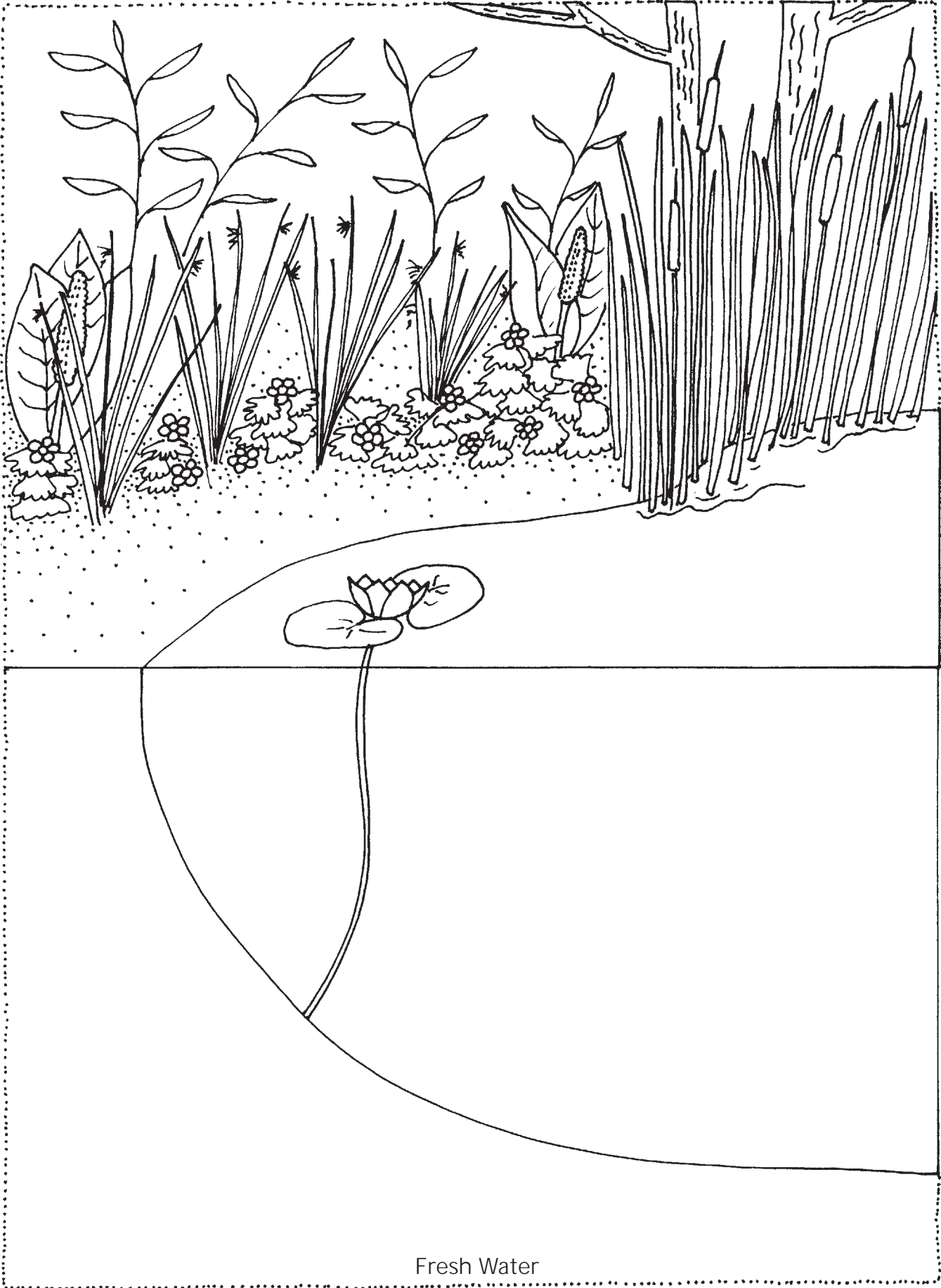
Copy the two wetland habitat pictures and let your students draw and color in animals in their appropriate home. Here's a list to get them started:

Freshwater wetland

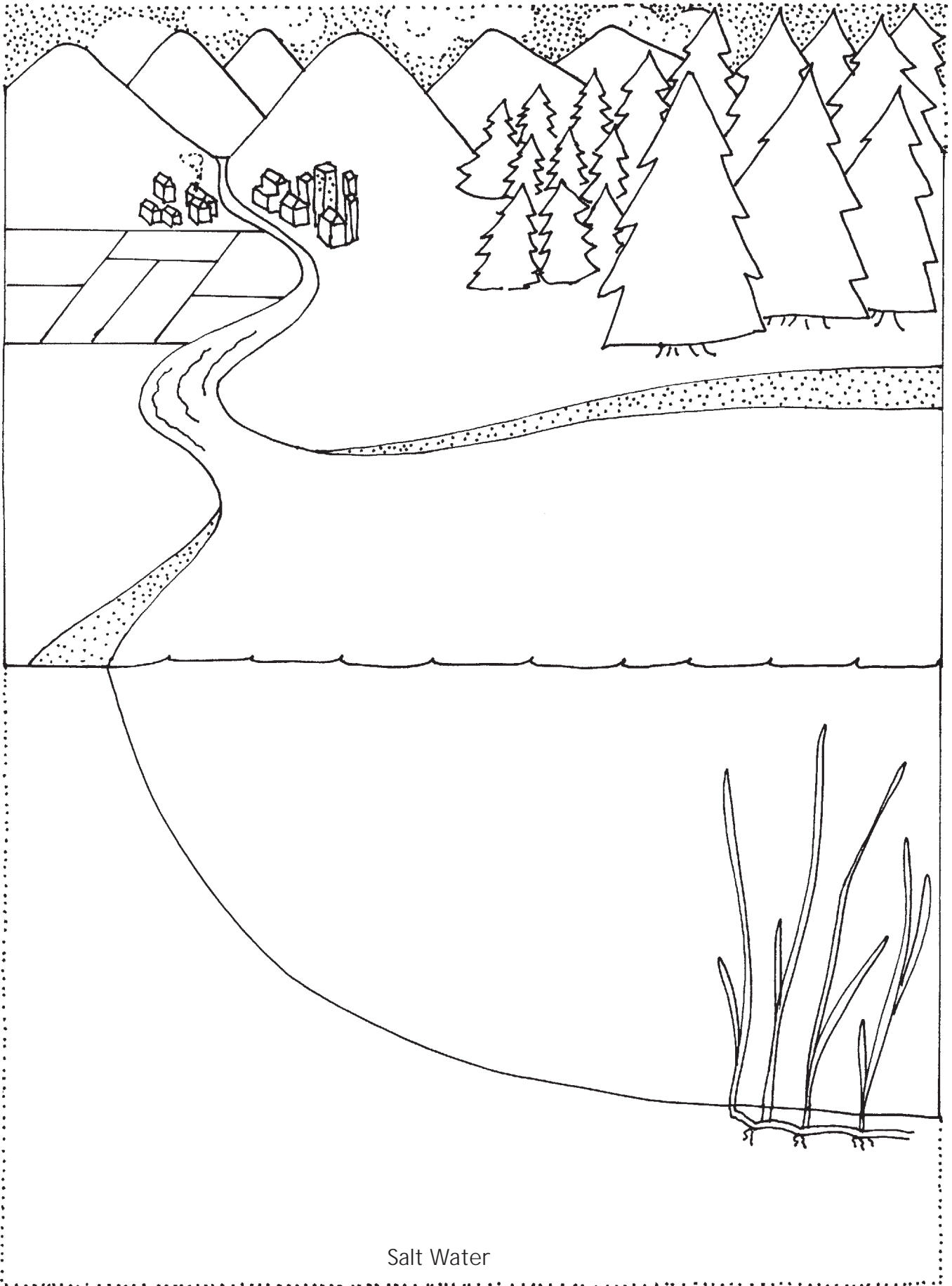
cattails
duckweed
frog (and tadpoles)
skunk cabbage
water lily
fish
salamander
turtle
snake
dragonfly
crayfish
snail
great blue heron
salmon eggs

Saltwater wetland (estuary)

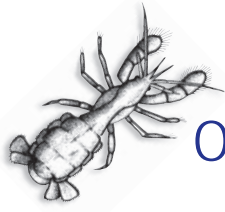
algae
eelgrass
saltgrass
crab
snail
worm
clam
shrimp
fish
seastar
hermit crab
great blue heron
salmon smolt



Fresh Water

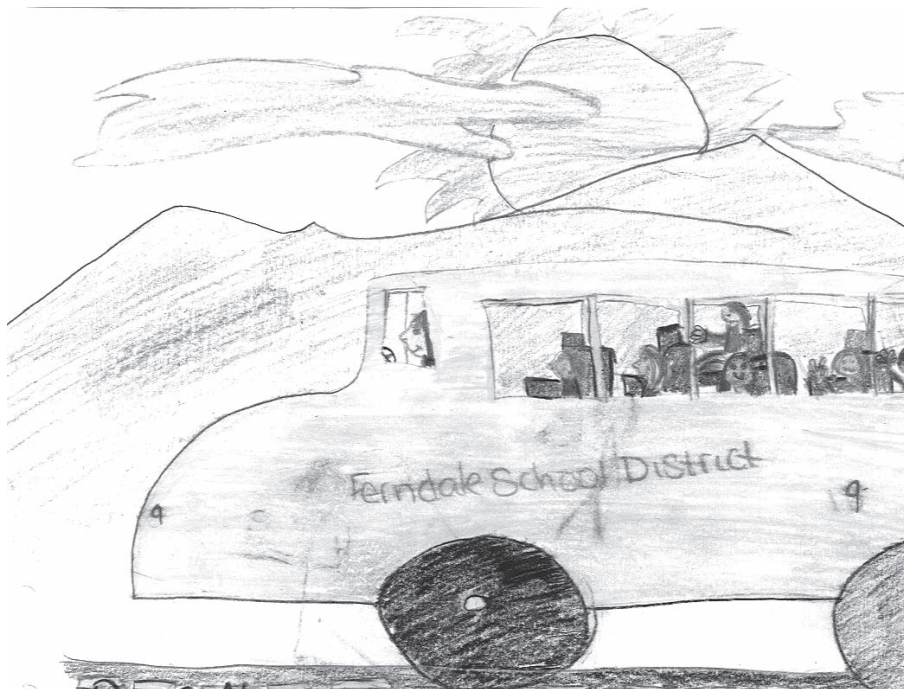


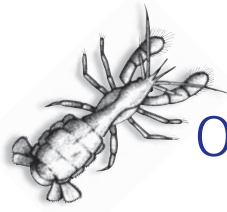
Salt Water



On Site

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Scavenger Hunts.....	36



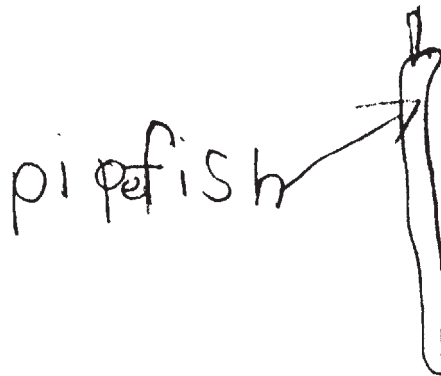


On Site

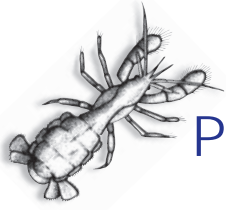
We will welcome your class at the Interpretive Center entrance. A presentation in the theater will introduce the world of the estuary through stories, creative dramatics and film. Your group will then tour the interpretive exhibits. The main exhibit room presents the Padilla Bay estuary through interactive displays, maps, larger-than-life illustrations, models, and more. The Hands On Room offers games, puzzles, books, puppets, and estuary treasures for touching. The Aquarium Room contains saltwater aquaria with live animals and plants from the Bay.

Many teachers choose to follow up the Padilla Bay visit with a trip to the beach at Bay View State Park. On pages 34-38, we have included some suggestions and resources that may be useful to you.

Please be sure to share the appropriate Parents' Pages with adult volunteers. They will be in charge of their group during the exhibit tour. We believe that students benefit more from this field trip when leaders have guidelines and suggestions for focusing the group's attention.



by Brandi Carlson



Parent Page

Thank you for joining us today. This program could not happen without you. We especially need your help when the children are touring the interpretive exhibits.

You will be in charge of a group of students. Please keep them together and focused. If your group needs help staying focused, ask questions like those below. The more you get involved, the more your group will follow suit.

Aquarium Room

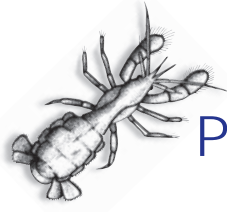
1. Many fish are CAMOUFLAGED. Look for a fish that resembles eelgrass (pipefish) and one that looks like the sand (flounder).
2. Other animals HIDE. Are any squeezed between rocks or buried under the sand?
3. How many animals can you find that have hard SHELLS on the outside of their bodies? How does this help them survive?
4. Name 3 differences between you and a fish.
5. What is your favorite animal in the aquaria and why?

Main Exhibit Room

1. Remind students to handle the exhibits gently.
2. Help your group read the exhibit panels to understand how the interactive elements work.
3. Look for the big yellow question marks and try to answer each question before checking the answer.

Hands-On Room

Though this room needs less direction, please supervise behavior and remind children to be gentle with the exhibits.



Parent Page

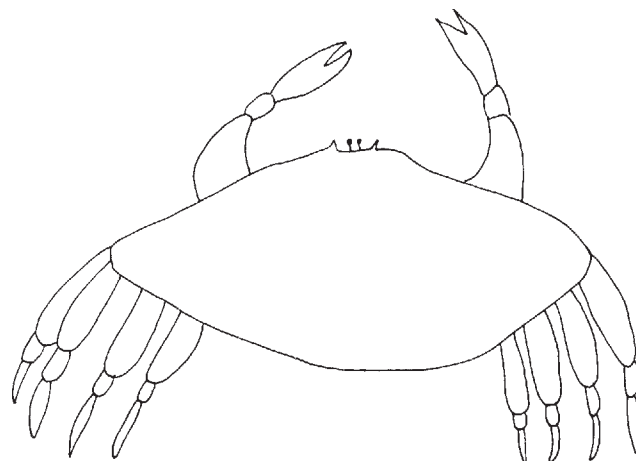
Exploring the Beach

You say you don't know the name of that crab? What in the world is that slimy green thing? You're not a marine biologist? Don't worry! Knowing everything at the beach is not what this trip is about. It's about sharing your enthusiasm, watching the excitement and curiosity of children, and exploring with them.

When your group brings something to you and asks, "What is this?" the name is not important. In fact, giving the name may just turn off attention. Rather than answering children's questions, you'll find it much more interesting to return a question. "Where did you find it? What do you think those feathery things are? Do you think it's alive? Which is the front? Does it have a head? Shall we give it a name?" Open-ended, stimulating questions involve the children and encourage discovery.

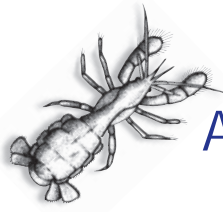
Ouch! Ouch! Be the voice of the plants and animals when students, in their eagerness, get careless. Try to impart an ethic of care and responsibility. Be sure that students return everything they find at the beach. Help by picking up any garbage you may find. Your example is very important!

Please help us keep the State Park facilities clean by checking restrooms and picnic shelter for litter.



Crab
(Yum)

by
Stephanie



At the Beach

Be prepared! Warm clothing (hats and gloves), rain gear, snug boots or old shoes that tie, a change of clothing, and a hearty lunch will help ensure that your class enjoys the day in spite of cool or rainy weather. Check the school's lost and found for items you could borrow for the day.

Study the map of Bay View State Park and, if possible, visit the site ahead of time. Notice rest rooms, telephone, and faucets for cleanup.



We find the following equipment useful when exploring the mud flat (one set for 5-8 people):

shovel (if tide is lower than +4')

tray (plastic dissecting trays or styrofoam meat trays—please don't leave these behind!)

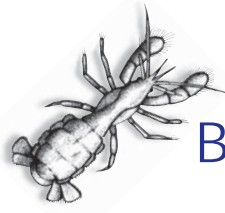
clear plastic jar or cup for keeping animals in water

plastic spoons for picking up small creatures—or use a clam shell

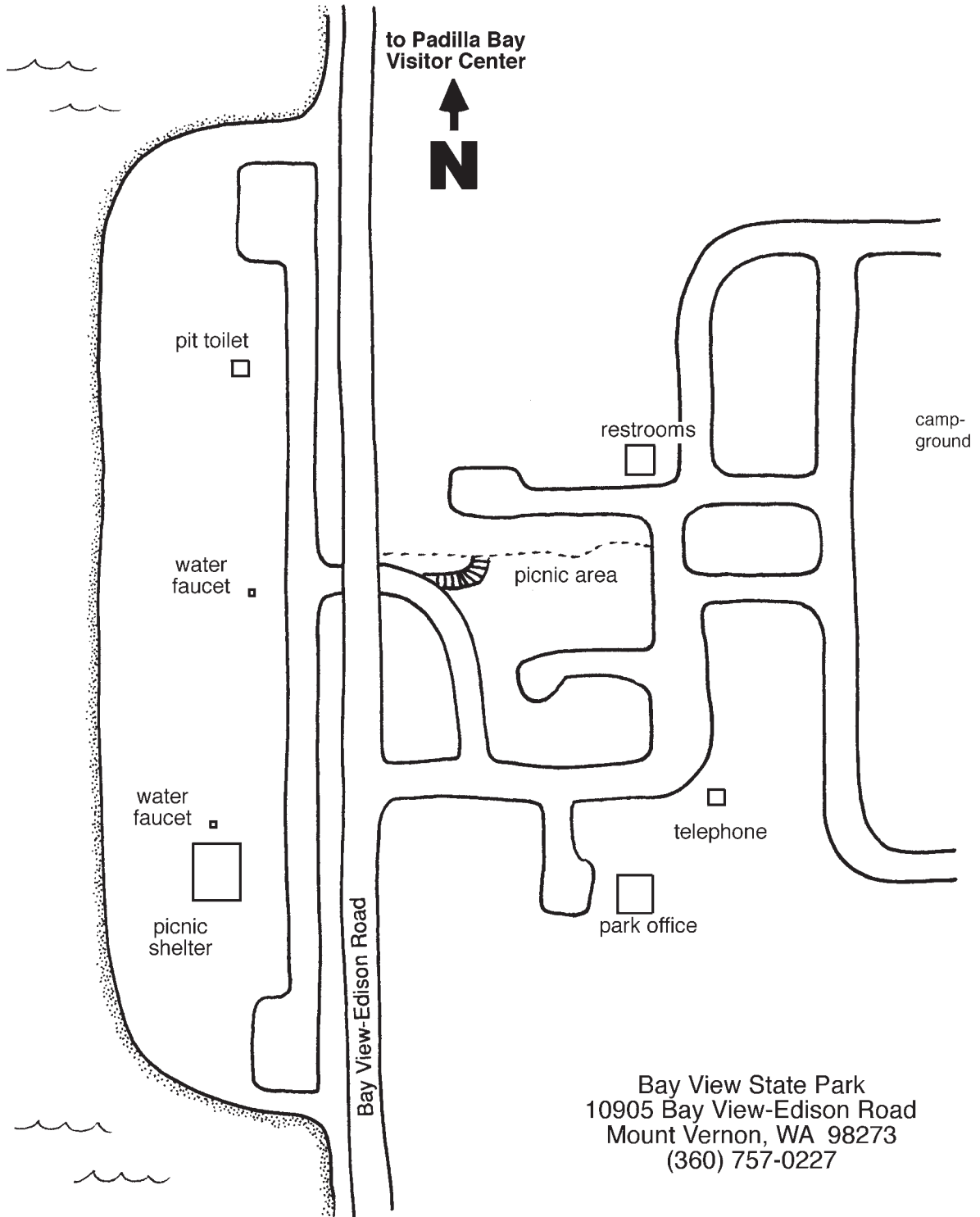
hose and/or dishpans for clean up

Though not absolutely necessary, we have found that giving the children equipment helps them observe organisms closely and carefully, and sets an atmosphere of study rather than play.

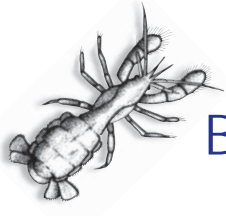
We have provided several Scavenger Hunts to help children focus their attention on observation. Choose one that fits your goals for the field trip, or create your own. Be sure to set physical boundaries for the exploration, and emphasize that *all creatures and shells must be returned to the beach.*



Bay View State Park



Bay View State Park
10905 Bay View-Edison Road
Mount Vernon, WA 98273
(360) 757-0227



Beach Etiquette

Rules

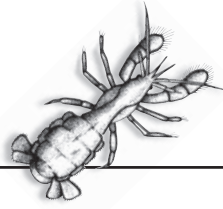
Estuaries are valuable habitats—homes for many organisms. Please discuss with your class the ways to be careful with this important resource.

A technique we use here at the Padilla Bay Interpretive Center is called the **Magic Bag**. Children reach into a bag for objects that remind us of ways to be careful and respectful. A rock with a barnacle shell attached reminds us to return rocks to their original position. A toy shovel reminds us to fill in holes. A limpet shell sparks a discussion on adaptations to avoid drying out and reminds us to leave limpets safely attached to their rocks. We also include a hat (dress properly), a boot (walk only where the mud is firm), and litter (please pick up garbage if you find any). You may want to add different items for your rules.

Cleanup

High tide cleanup is as simple as wiping off loose sand and perhaps changing wet shoes. Low tide in Padilla Bay is another story. Setting clear expectations is important. Each teacher has his or her own "tolerance level" for how much mess is allowed. Be sure your students know what you expect. You should expect muddy shoes—not necessarily muddy or wet clothing. Students should *explore* the mud, not *play* in it.

Several dishpans of water and a hose help reduce congestion at the faucet. Please wash up at the faucet at the beach, not in the campground rest rooms. Check for litter before you leave. Your help in keeping the picnic area and rest rooms clean will insure that we continue to have access to this fine facility and the State Park staff will appreciate your efforts.

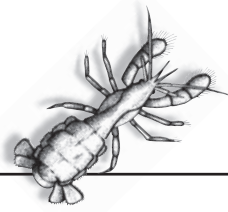


Padilla Bay's Scavenger Hunt



- A clam shell the size of your thumb & another as big as your elbow
- A bird feather
- Something mushy
- Something smooth
- A piece of wood that looks like an animal
- A crab shell with hair on it
- A crab shell with freckles
- Something pink or purple
- Something shiny
- A piece of garbage

Please return all critters to their homes when you're done.



Padilla Bay's Scavenger Hunt



Clam shells: with ridges without ridges

4 different kinds of birds: 1 _____

2 _____

3 _____

4 _____

2 kinds of eelgrass:

2 kinds of algae:

An animal track

Something that changes _____

Something slimy _____

2 kinds of crabs:

3 unique smells:

2 different mud dwellers:

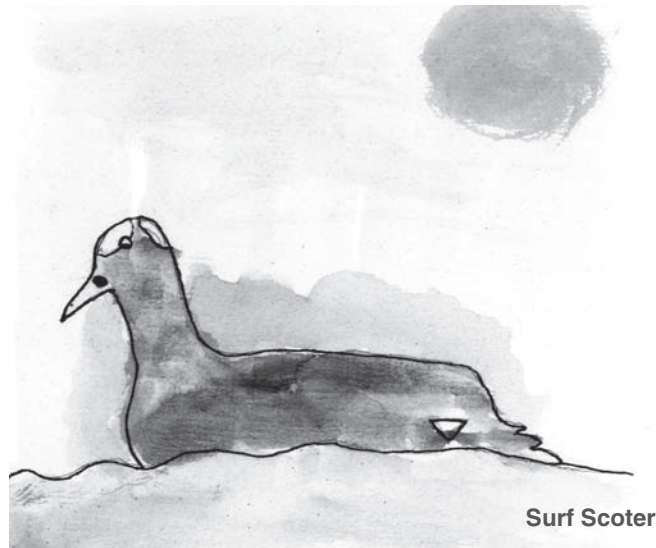
Signs of human influence: garbage

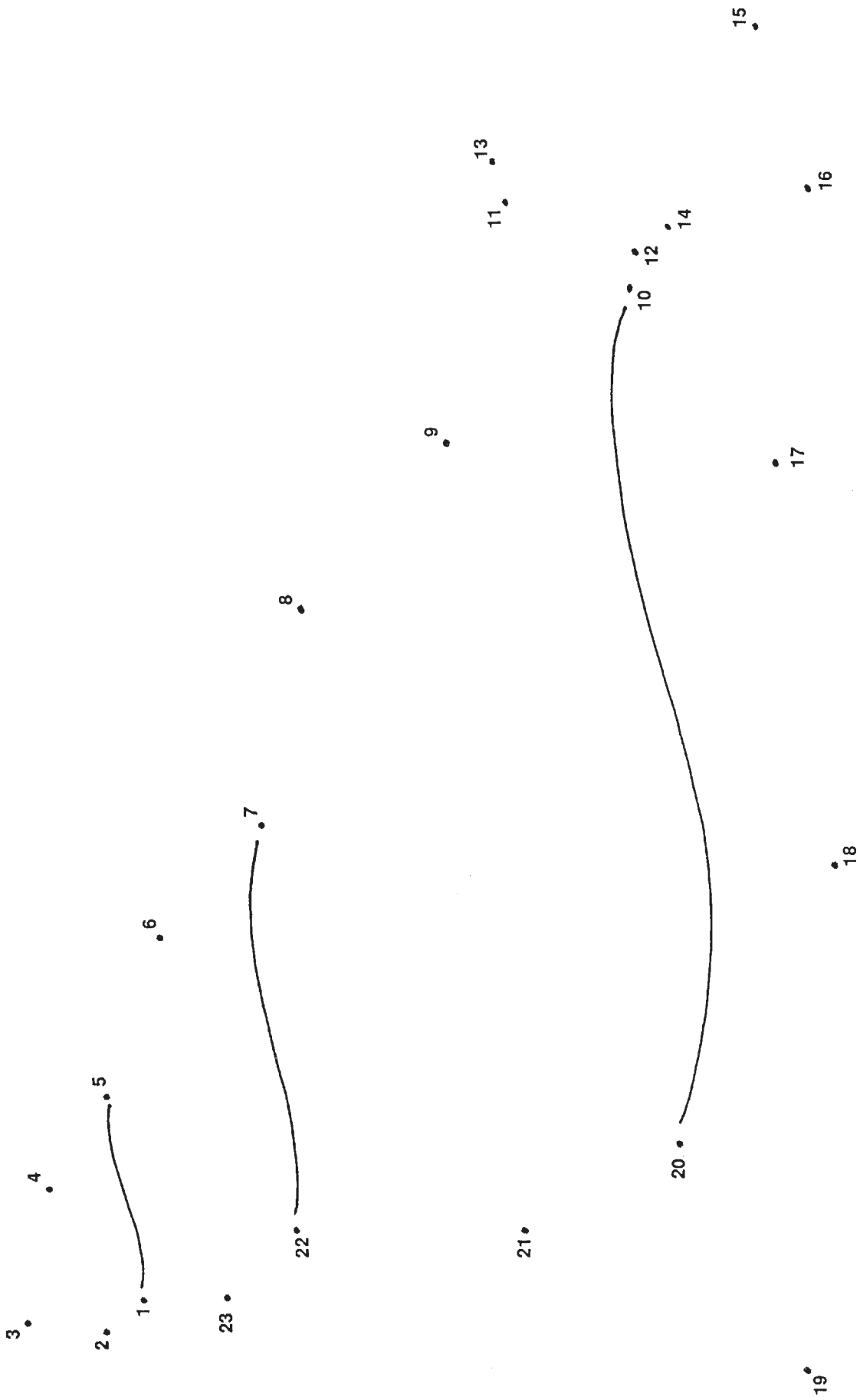
Please return all critters to their homes when you're done, replace rocks, and fill in holes.



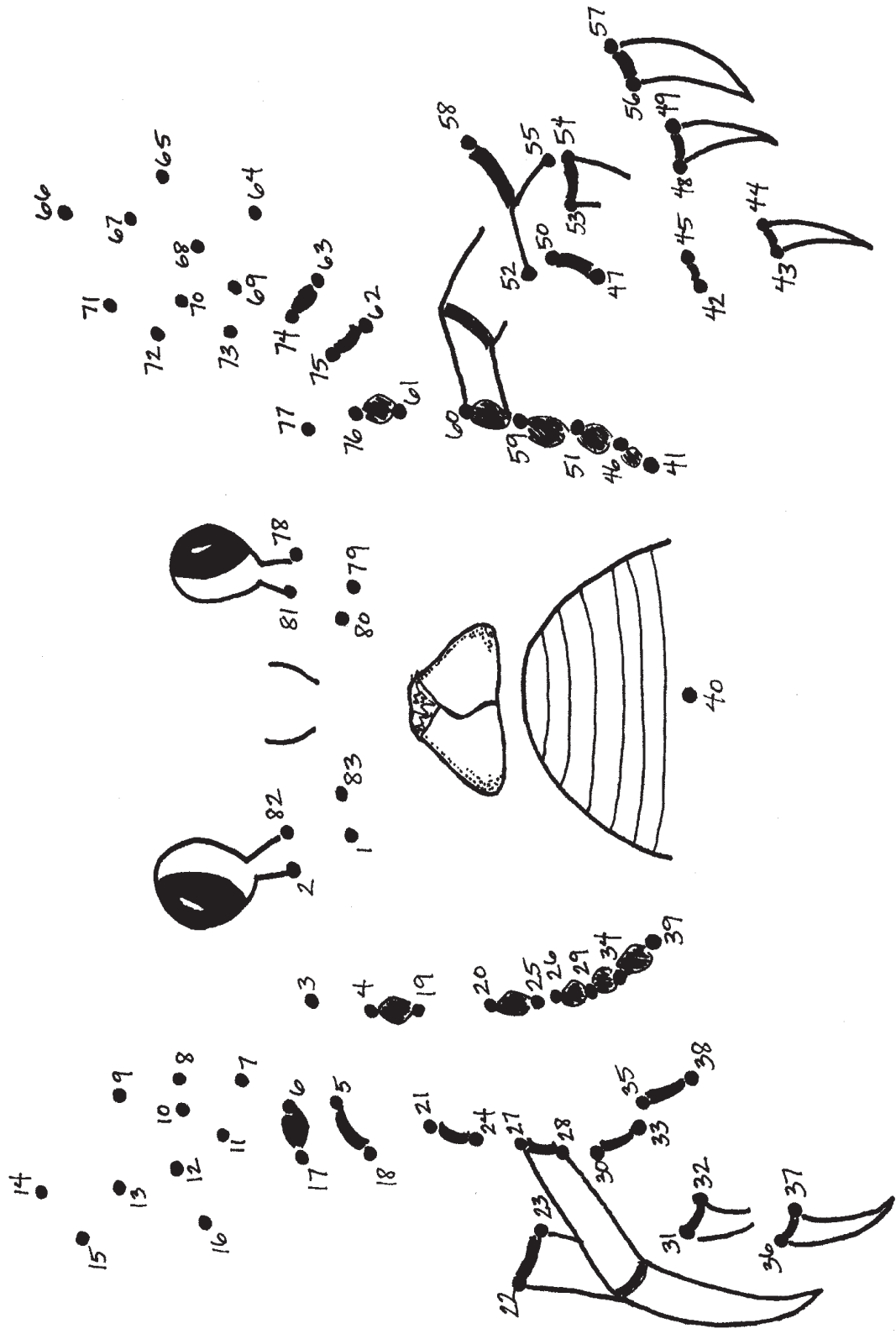
Post-trip

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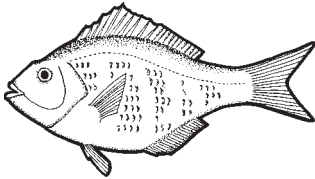
Connect the numbers to see who is creeping on the mudflats!



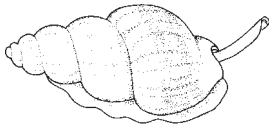
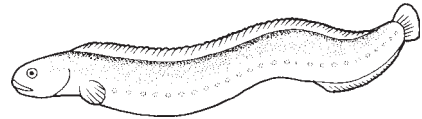
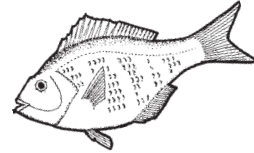
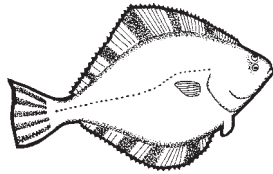
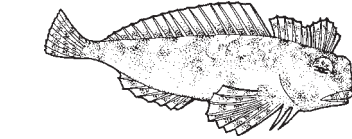
Here is something that lives in Padilla Bay. It is small enough to fit in the palm of your hand. Look for it under rocks.



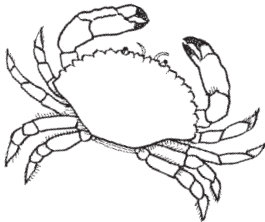
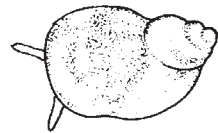
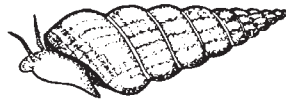
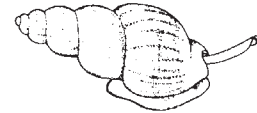
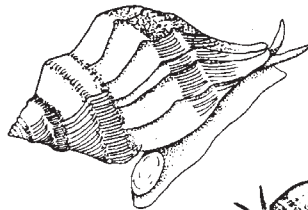
Match the Critters



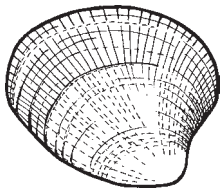
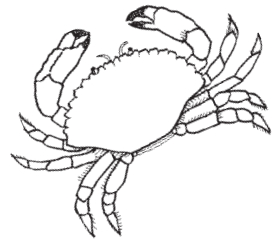
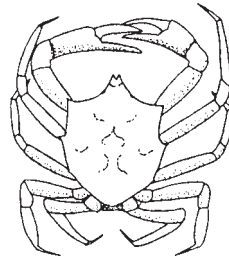
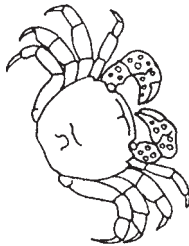
fish



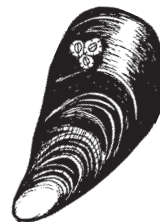
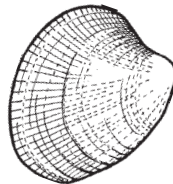
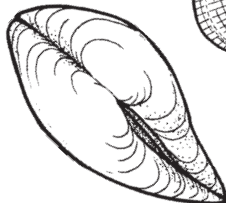
snail



crab

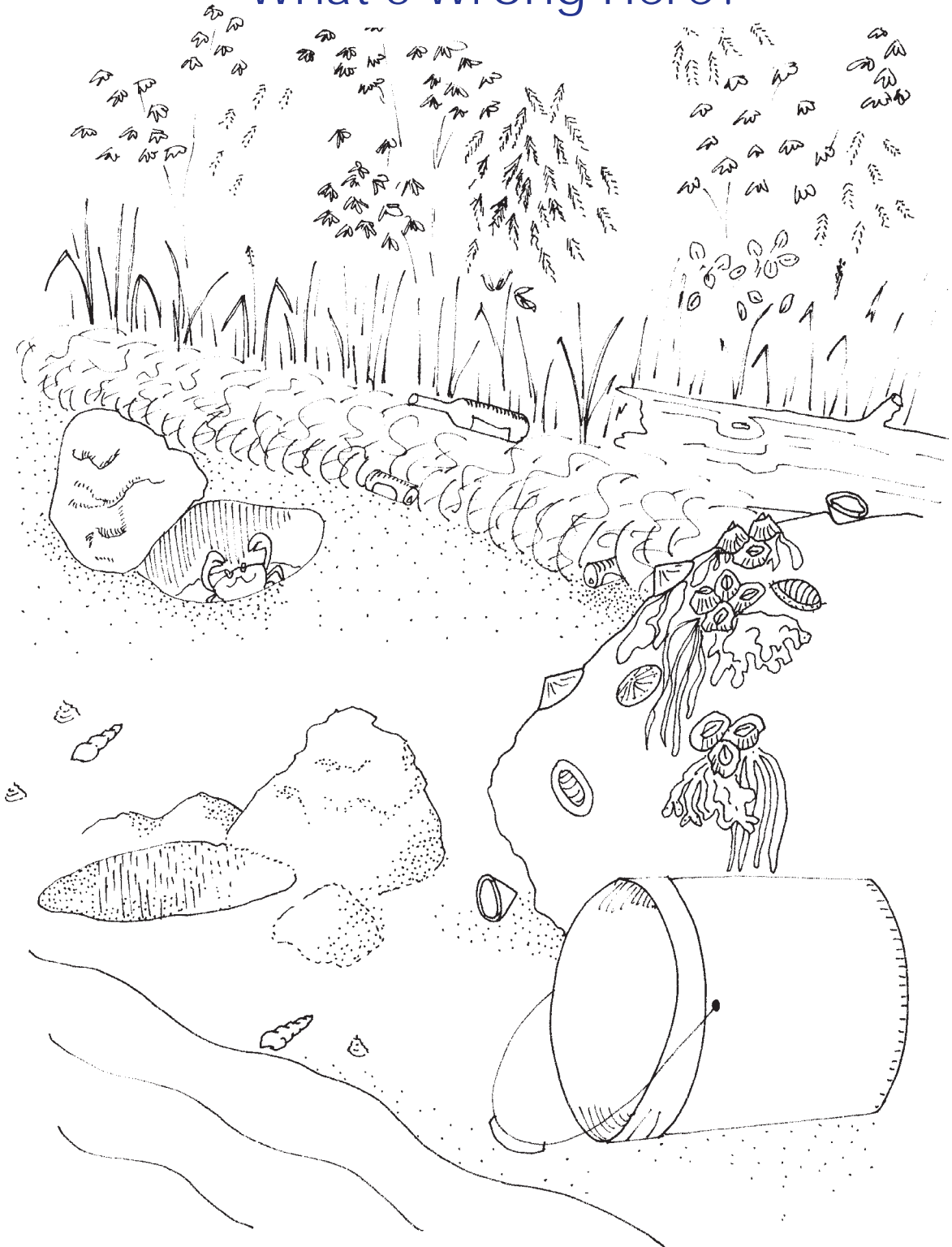


clam





What's Wrong Here?

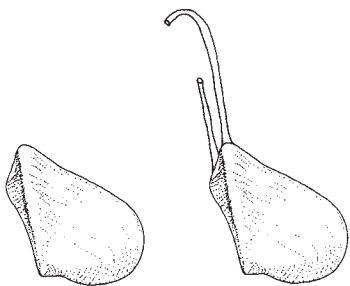
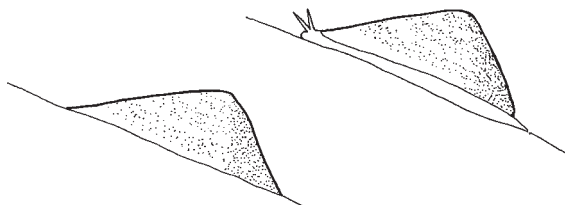
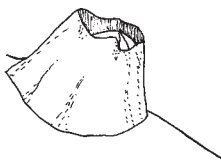
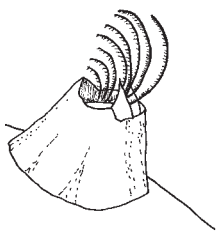


People have been to this beach. Circle the mistakes they made.

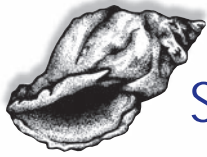


High Tide-Low Tide

Which is at high tide? Which is at low tide?



How can you tell?



Salmon Life Cycle

Students learn about the life cycle of Pacific salmon and how salmon depend on estuary habitats.

Salmon depend on estuaries and nearshore habitats during their migration between fresh and salt water. While different species and populations use the estuary for different lengths of time, the following is a typical salmon life history.

Eggs are laid in freshwater gravel beds, often in streams.

Alevin are newly hatched salmon. They live in the gravel, using the food stored in their yolk sacs.

Fry are small salmon living in the freshwater stream, feeding on insects and other invertebrates.

Smolt have changed their shape and color, and have gone through physiological changes necessary for life in salt water. They often spend time in salt marshes and bays, taking advantage of abundant food (small invertebrates) and protection from predators.

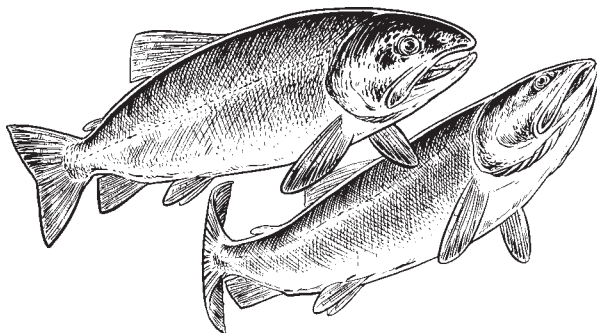
Adults live in deeper ocean water, feeding on fish such as herring, sand lance, and rockfish, as well as on zooplankton.

Spawning adults migrate back to their home stream to reproduce. Their bodies change shape and color, and they stop eating once they enter fresh water.

Share this information with your students, referring to the life cycle pictures on the next page.

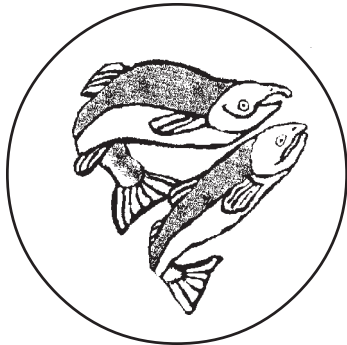
Have your students cut out the pictures on page 49 and arrange them in the correct order.

** There are many salmon resources available to teachers, including posters, videos, books, kits and curricula. Call the Padilla Bay Interpretive Center for more information. (360) 428-1558*

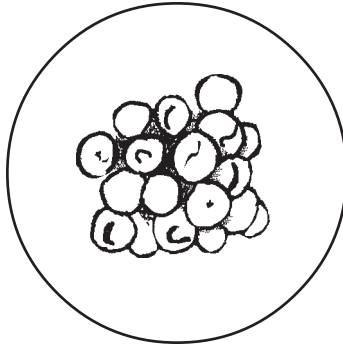




Salmon Life Cycle



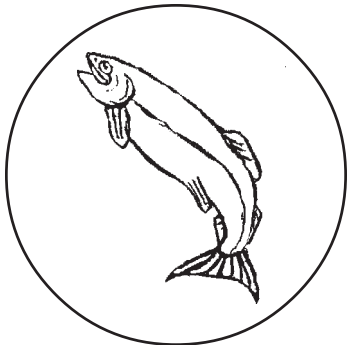
spawning adult



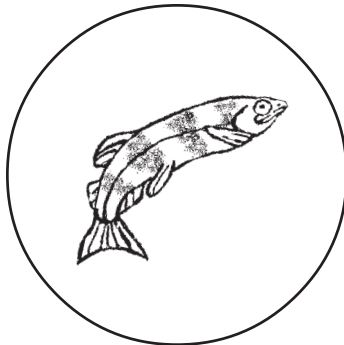
eggs



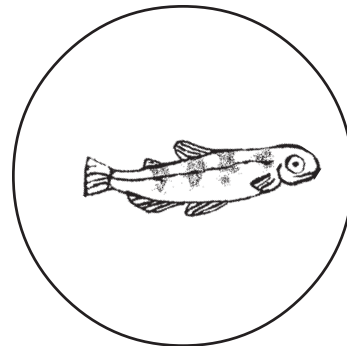
alevin



adult



smolt

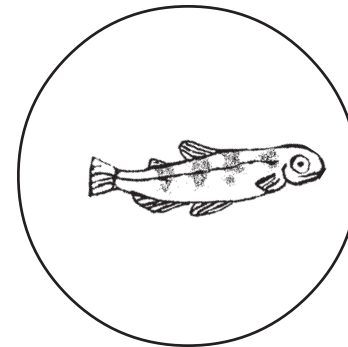
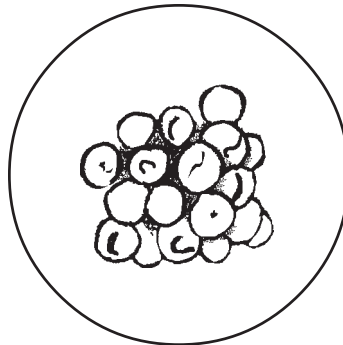
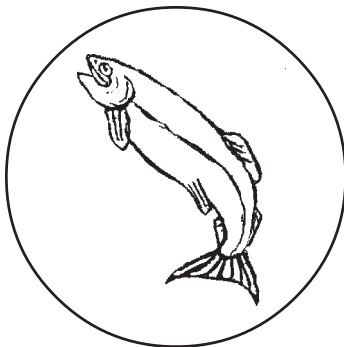
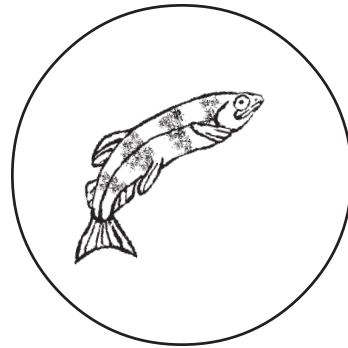
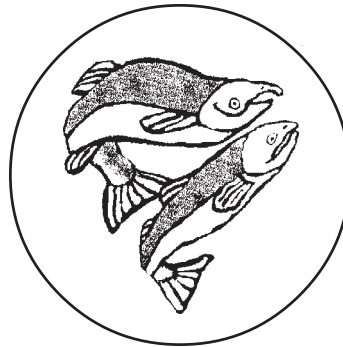


fry



Salmon Life Cycle

Cut out the salmon and paste them in a circle showing the salmon life cycle. Label them with the words below.



eggs

alevin

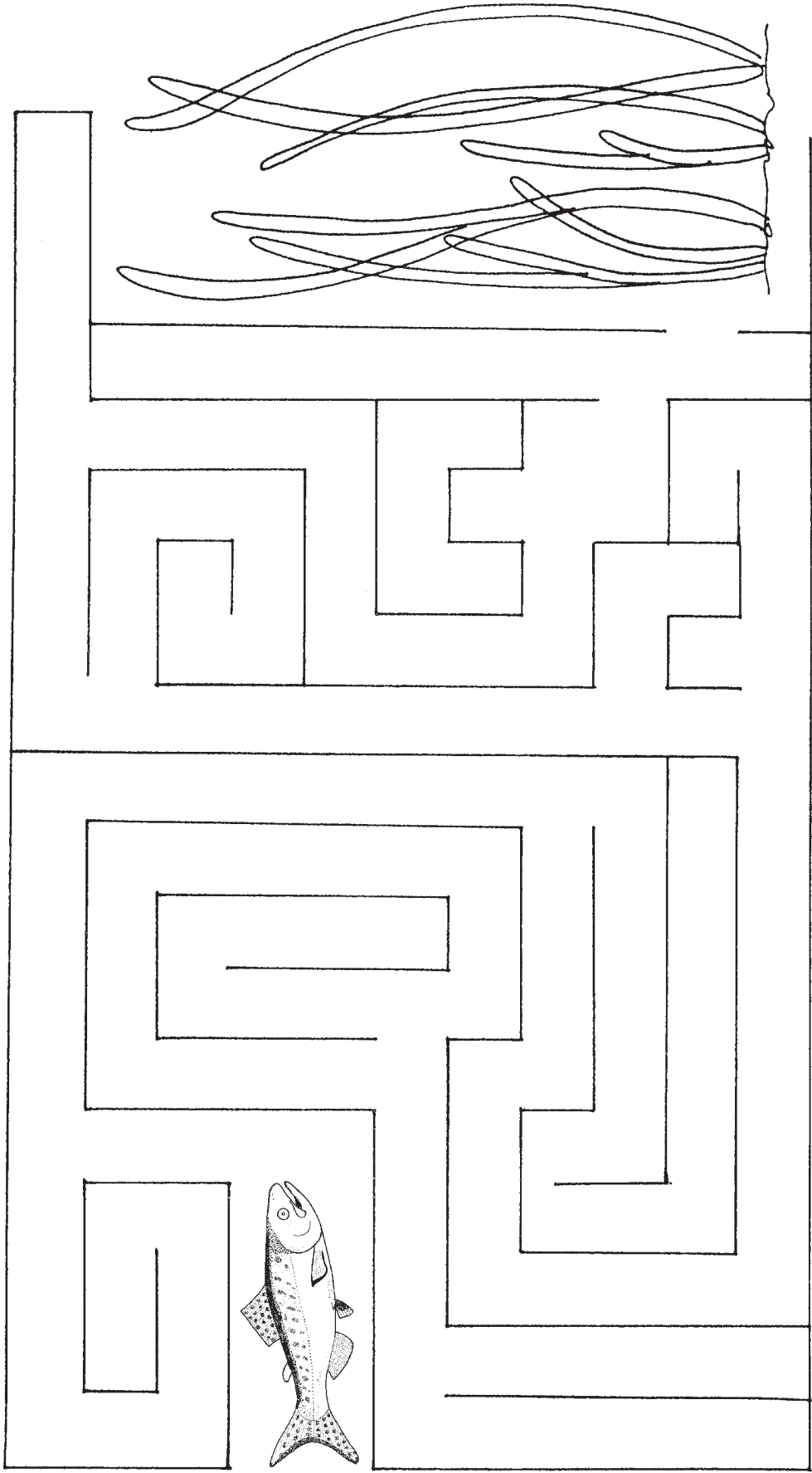
fry

smolt

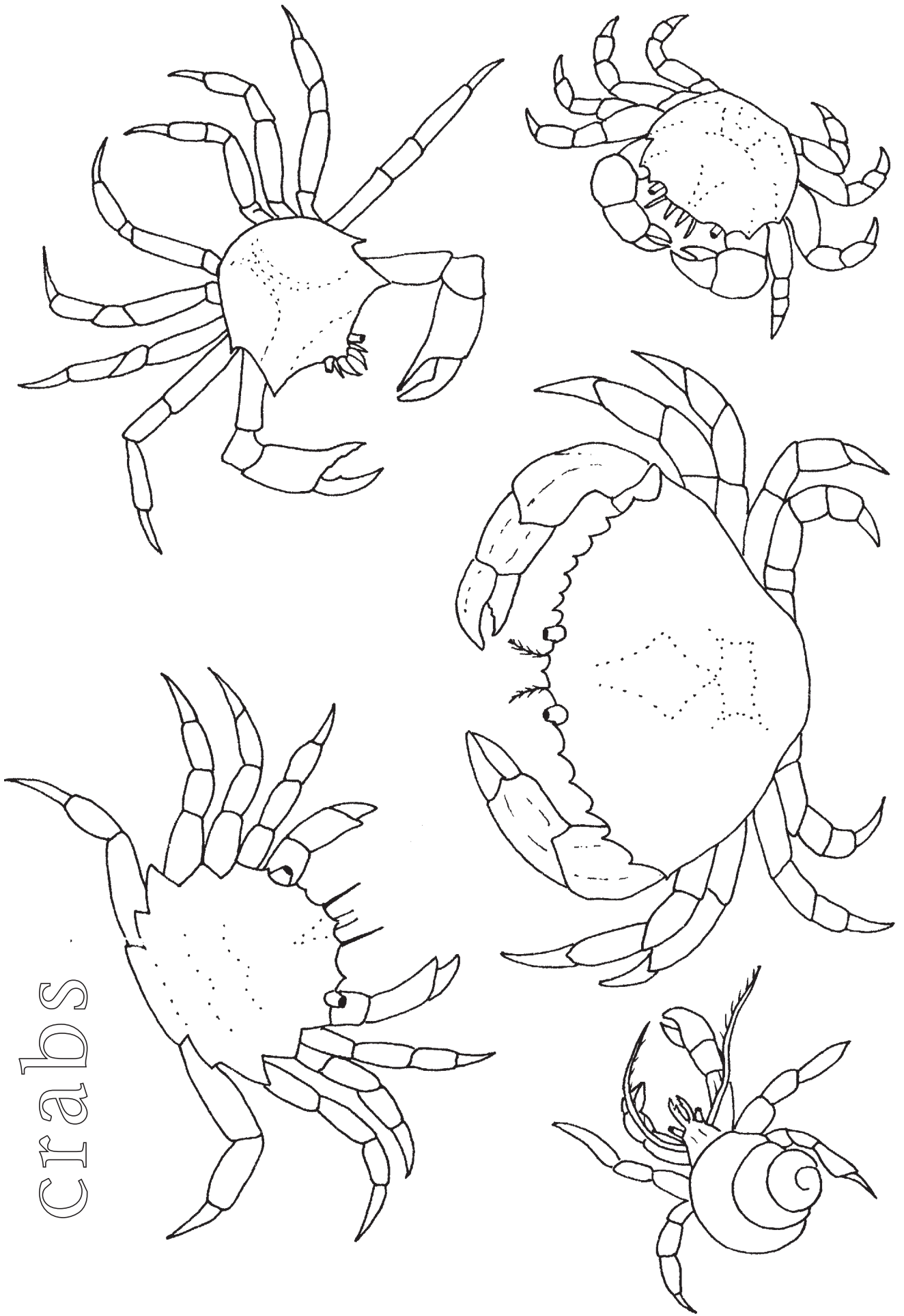
adult

spawning adults

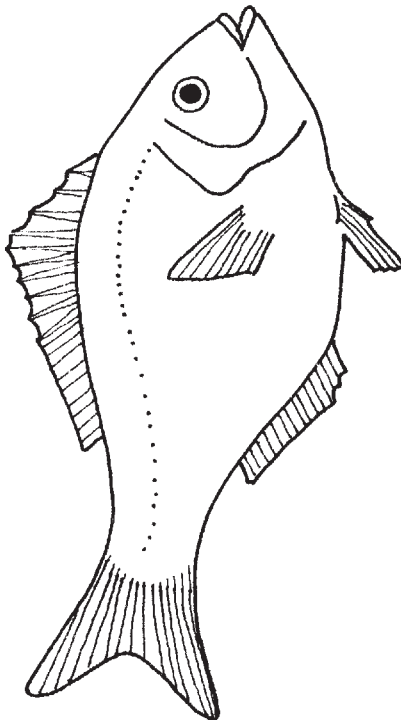
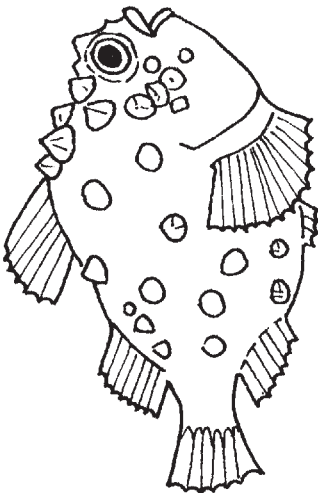
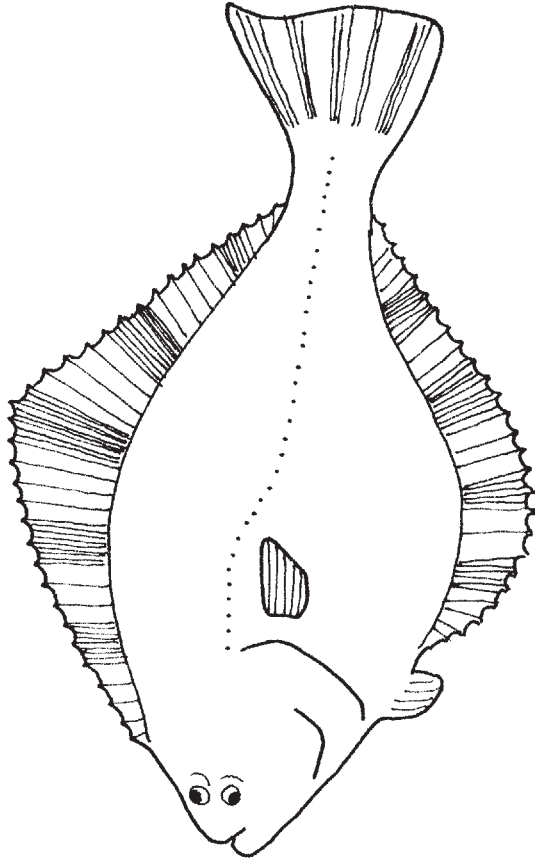
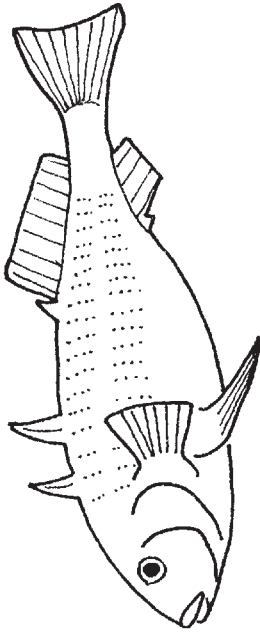
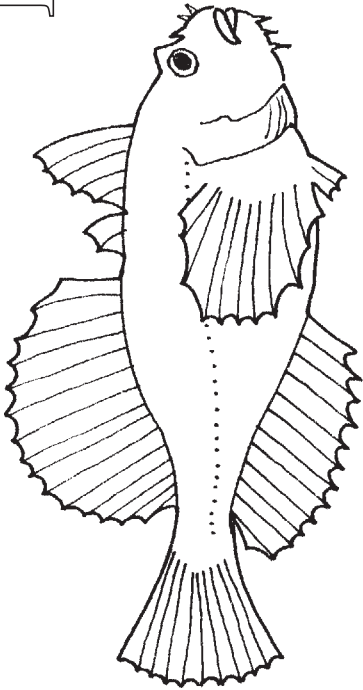
Help this salmon find shelter in the tall eelgrass.



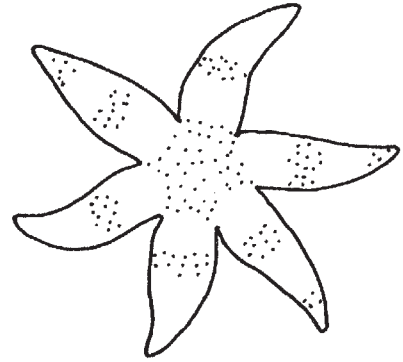
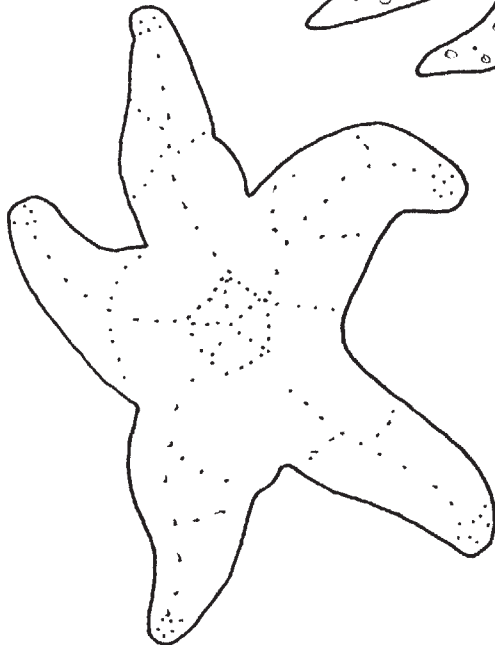
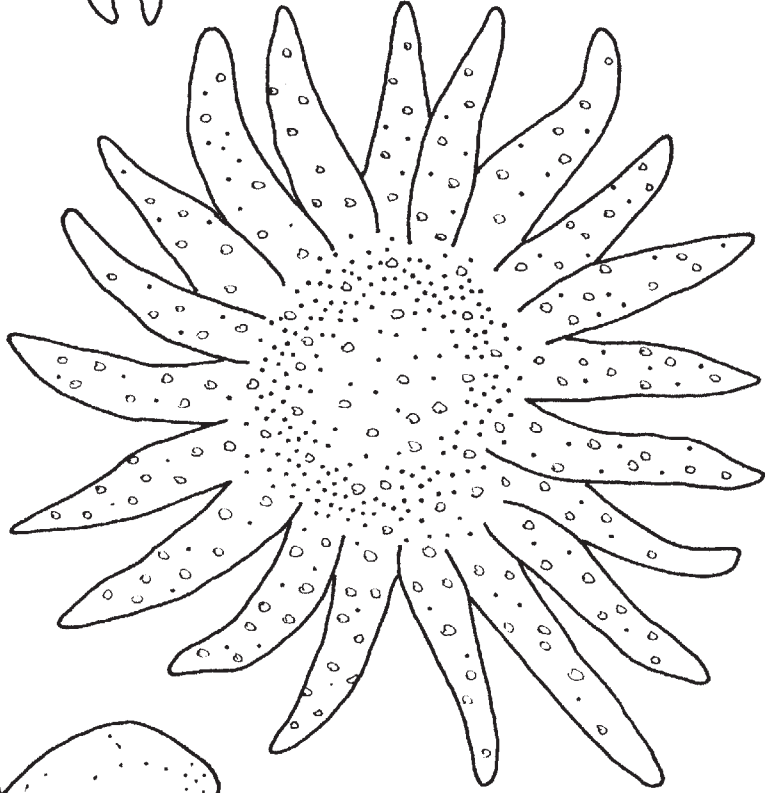
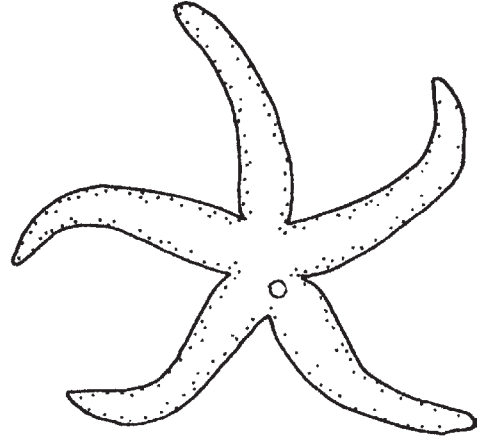
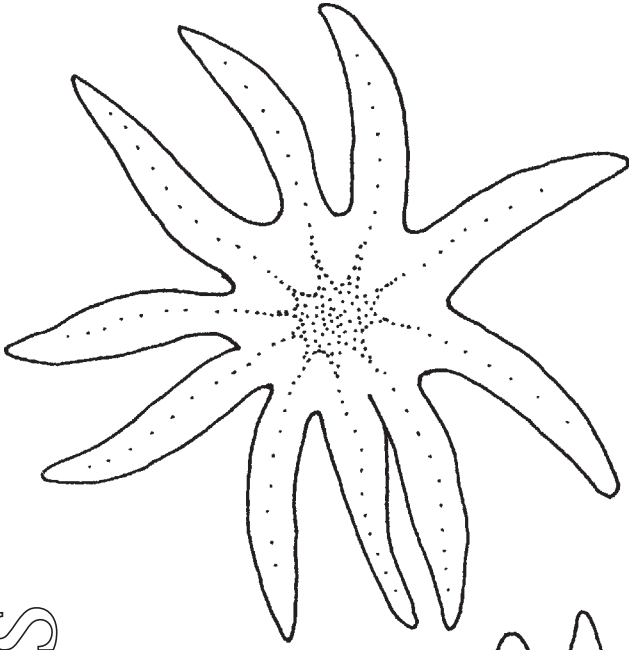
crabs

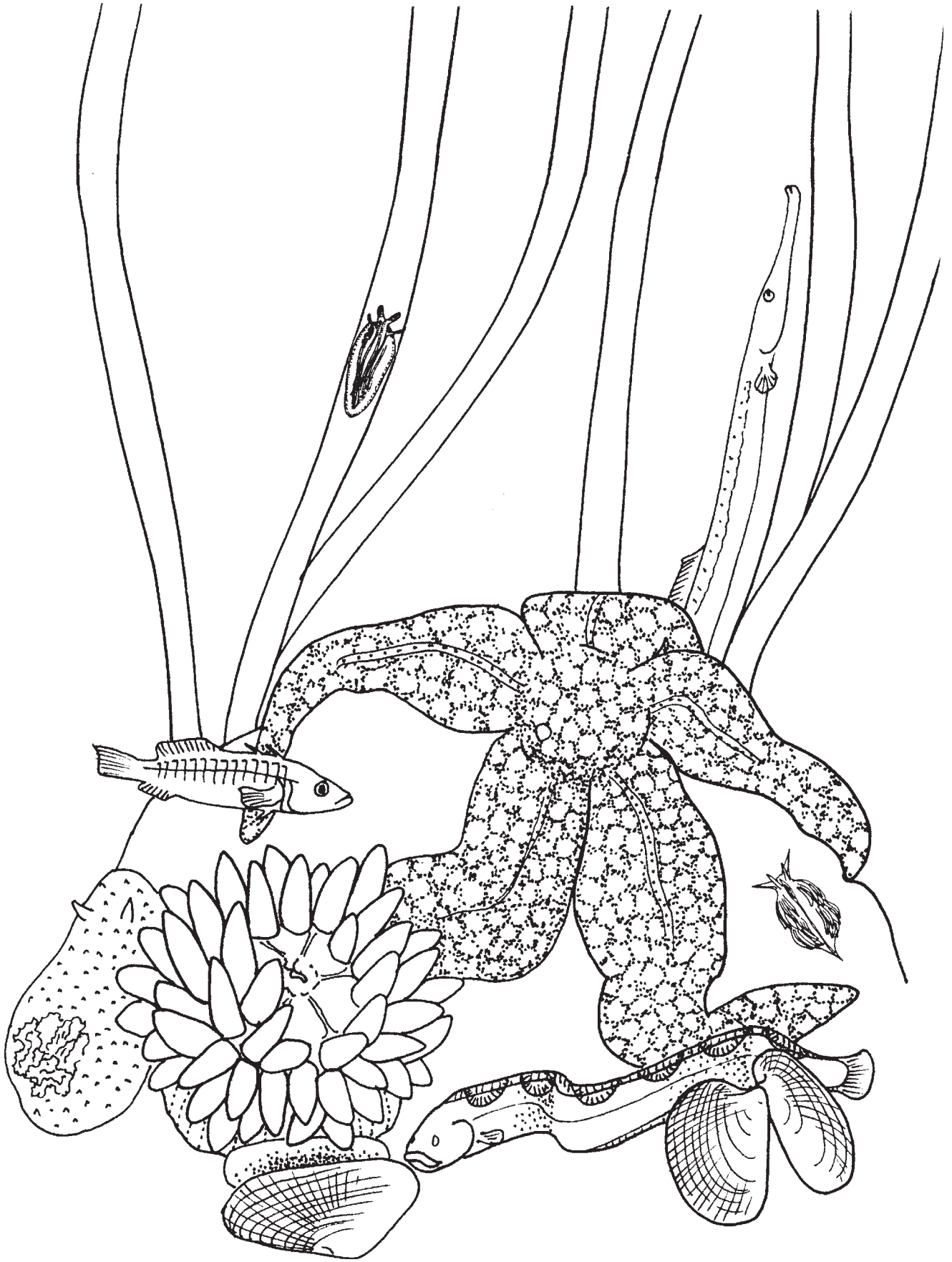


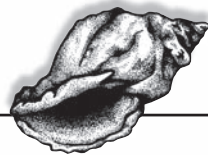
fish



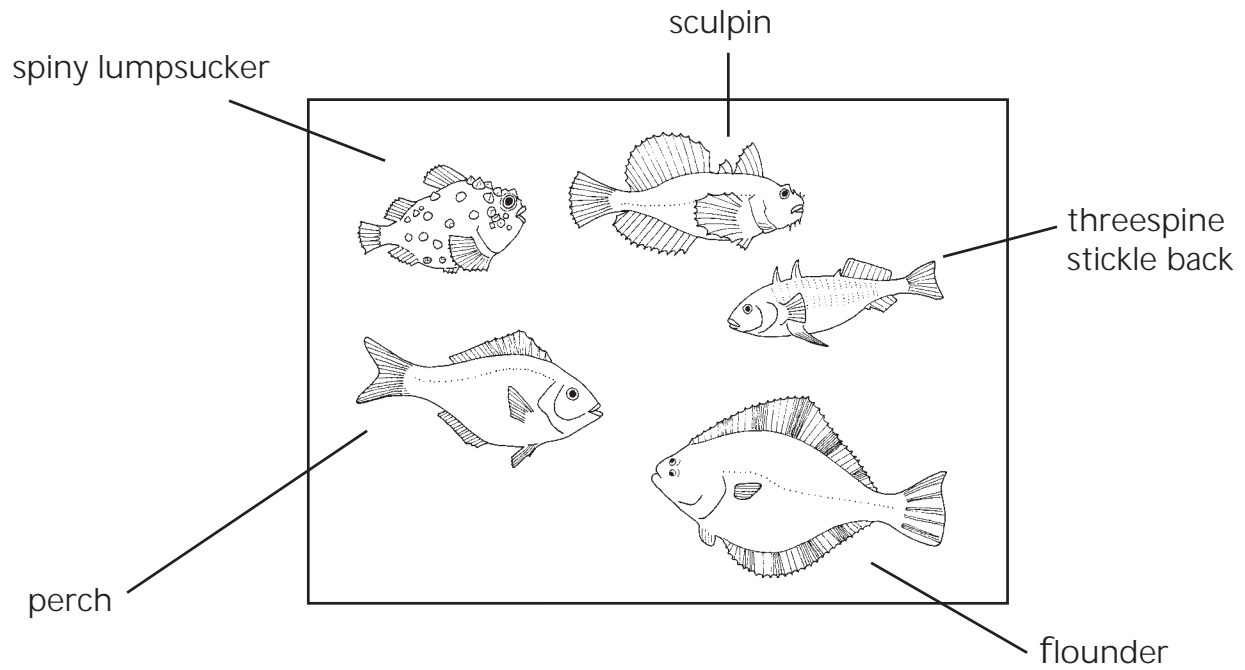
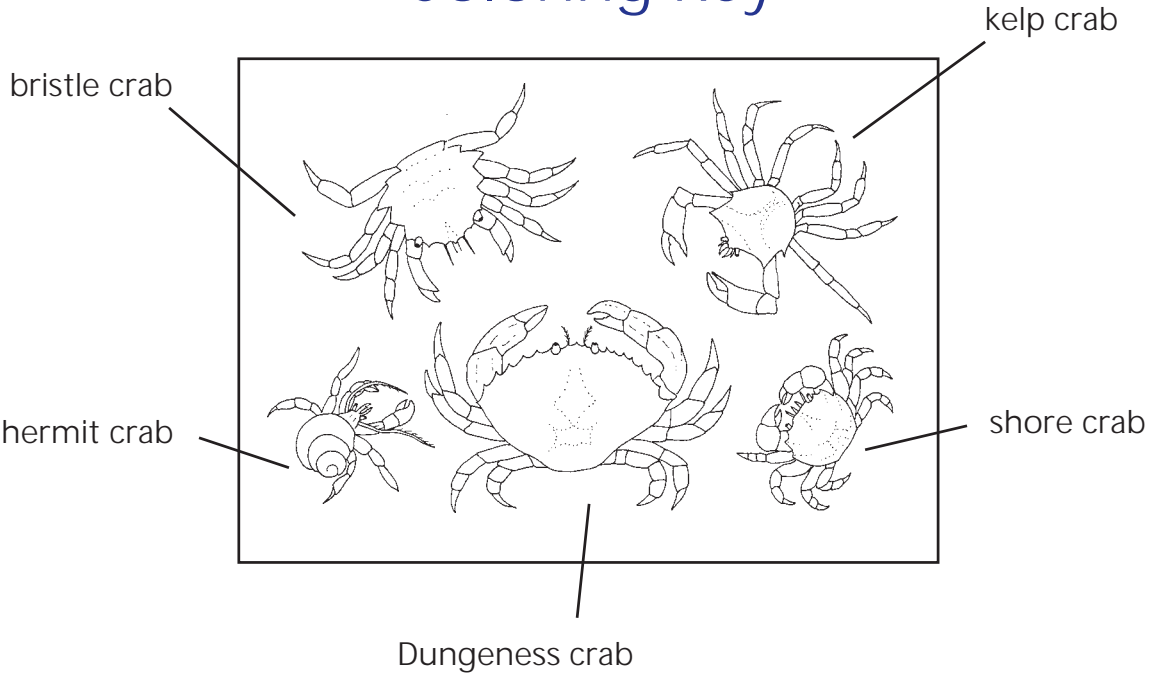
seastars

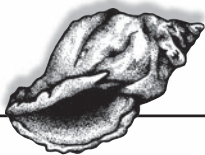




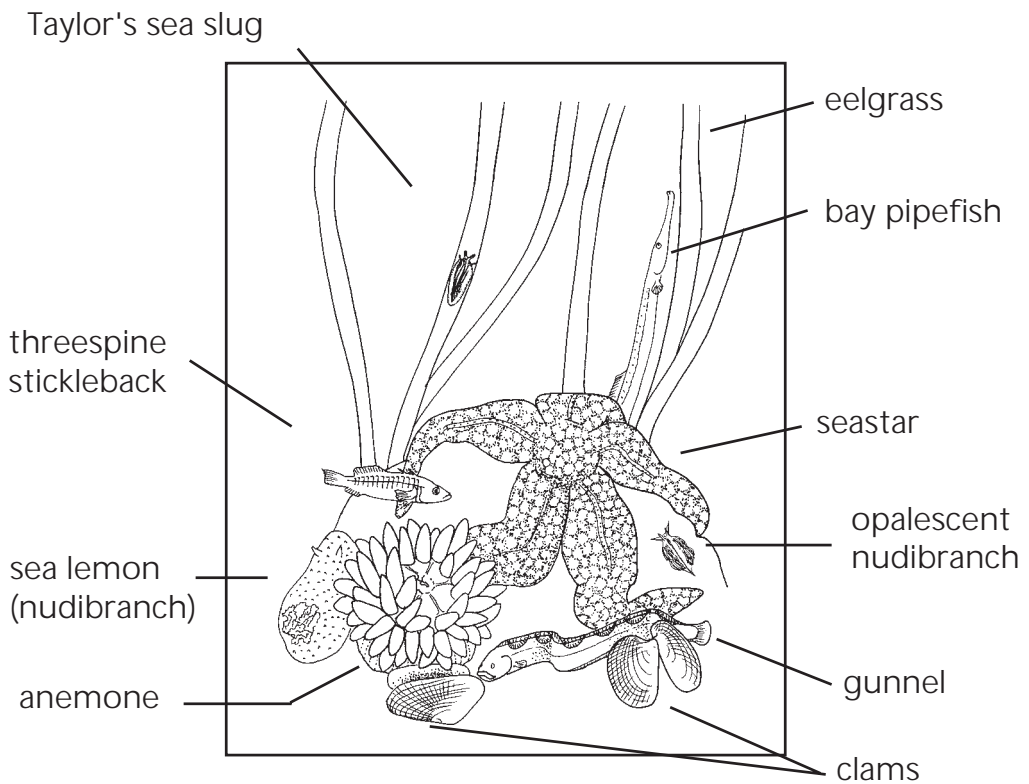
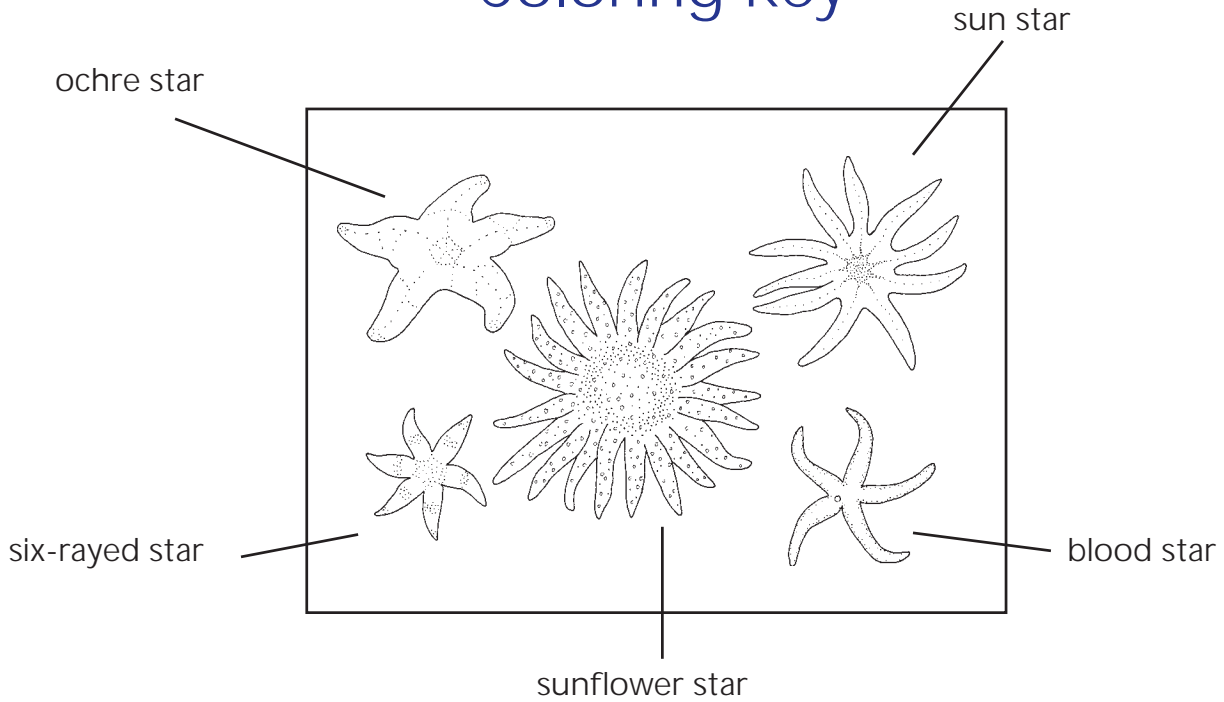


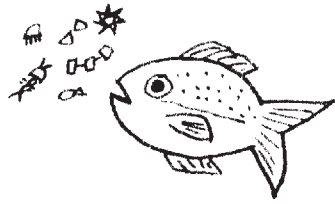
Coloring Key



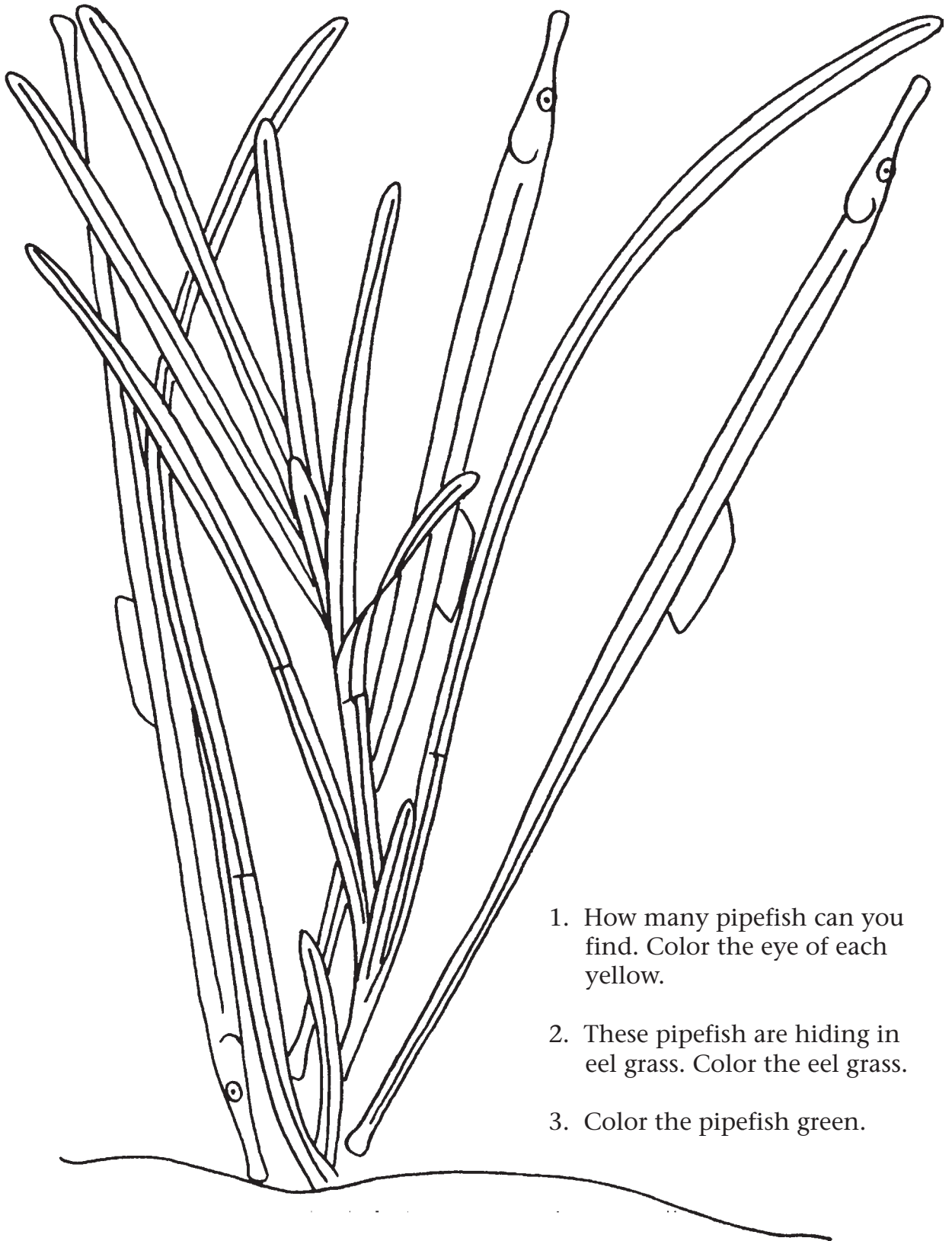


Coloring Key

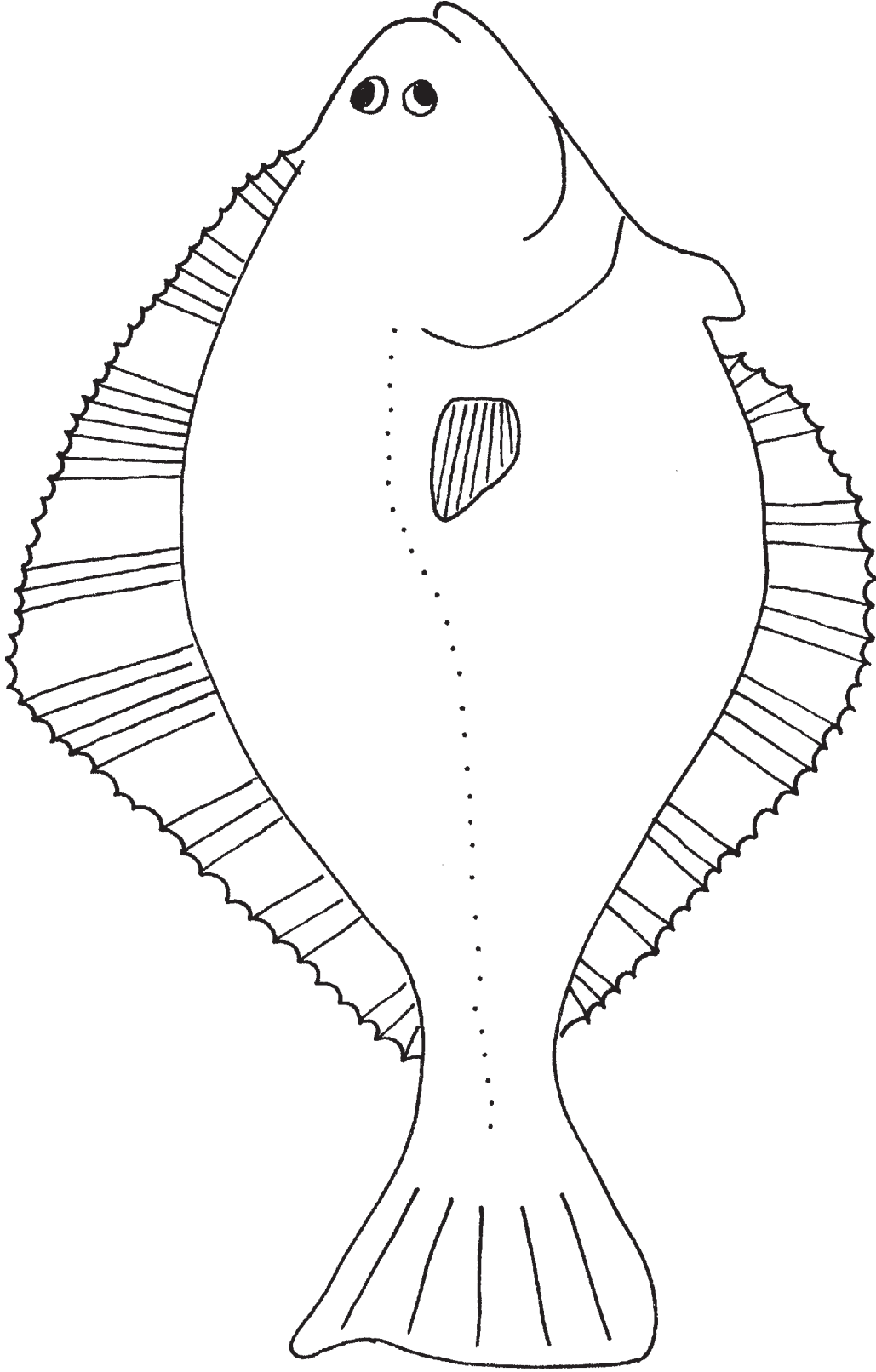




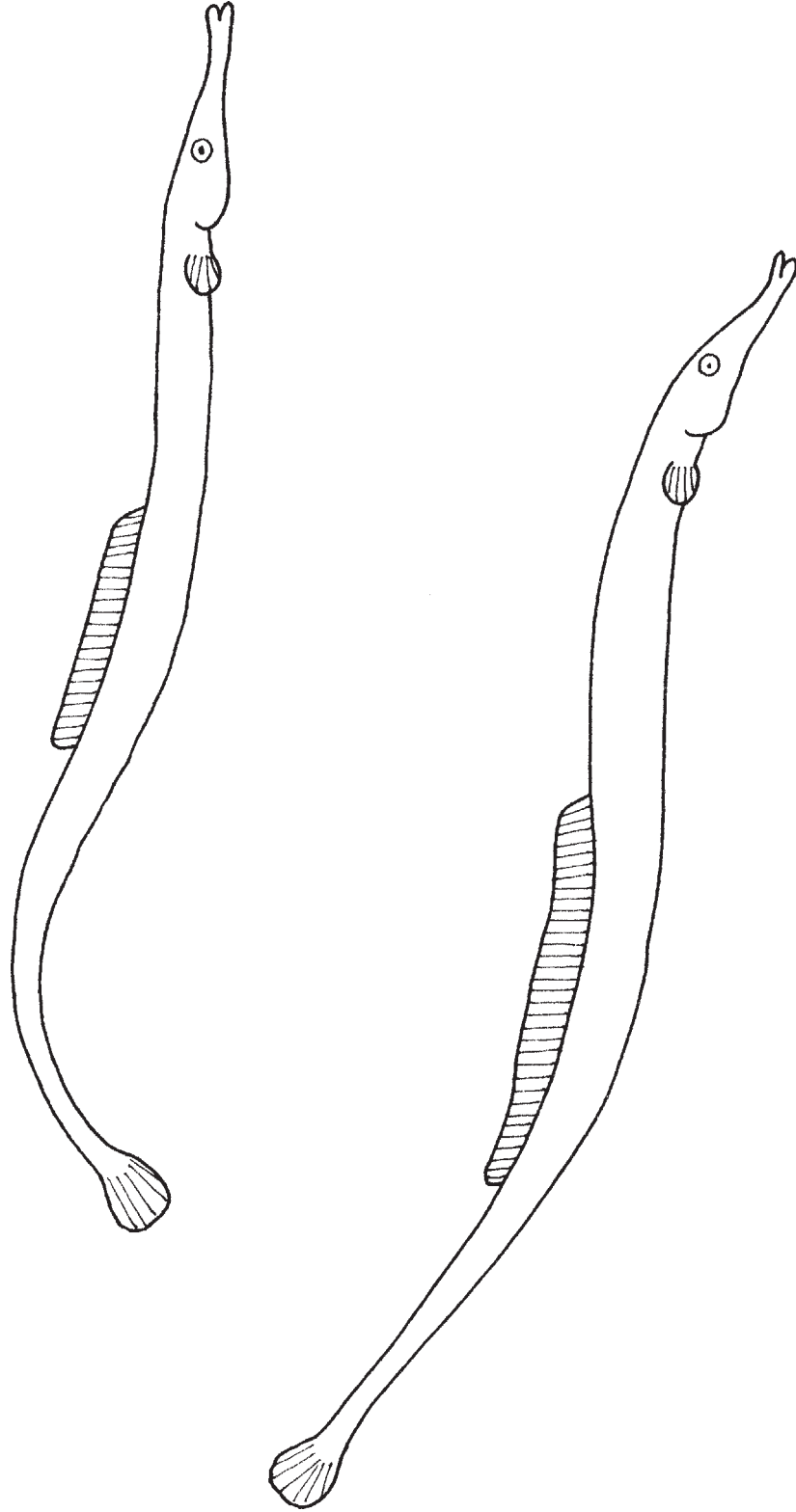
Many animals eat other animals. What might eat this fish?



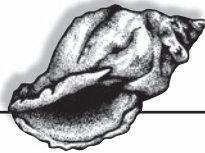
1. How many pipefish can you find. Color the eye of each yellow.
2. These pipefish are hiding in eel grass. Color the eel grass.
3. Color the pipefish green.



Flounder can change color quickly to match their surroundings.
Give your flounder a background, then color the flounder to match.



Color the pipefish. Glue on green paper eelgrass to help them hide.



The Camouflage Game

This simple game demonstrates how camouflage works.

Spread colored toothpicks or 1/2" squares of construction paper (5-10 pieces per student) around the playing area. An outdoor grassy or wooded area is best, but not necessary. Make the area large enough for your class to fit comfortably inside, but not so large that the toothpicks will get hopelessly lost. Try to have nearly equal numbers of each color - the more colors, the better.

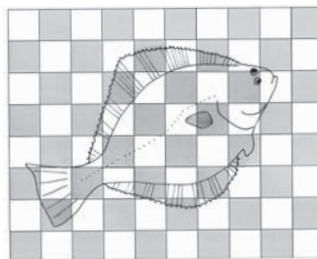
Give students a very short time (30 seconds) to look for the toothpicks. Put the whole group's collection together and see which colors they found. In a grassy area, there will most likely be very few green toothpicks in the collection. In a forest, browns and yellows may be missing.

Make a graph showing the number of each color found.

Send the children back into the play area to find the rest of the toothpicks. Which colors were the last to be found? Why?

Ask the class to name some animals that rely on camouflage for protection from predators.

You may want to have your students color the pipefish and/or flounder coloring pages as follow-up.

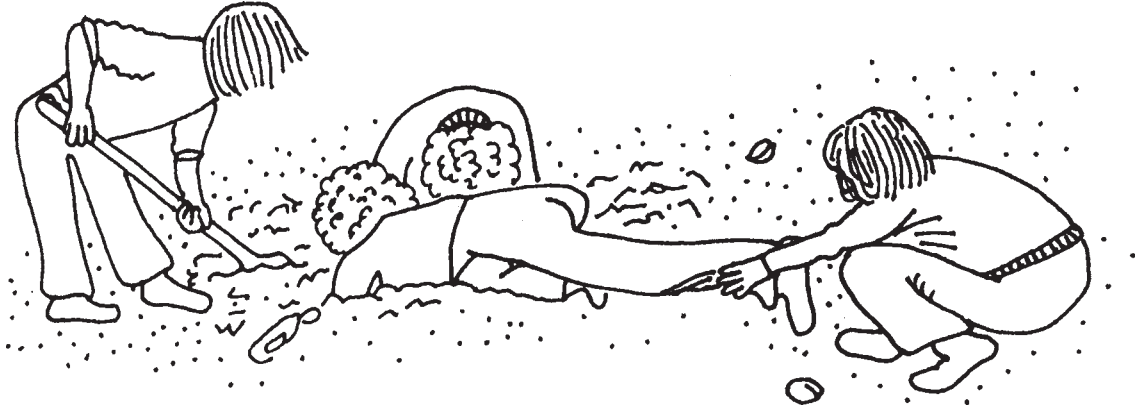


Flounder can change color quickly to match their surroundings.



What's Happening Here?

Use your imagination. Look at this picture and write a story describing what is going on. Don't forget a title for your story.





Afternoon In An Estuary

This is a creative drawing (and listening) exercise to be read aloud to your class as they draw.

Imagine that you are in a boat going down a river. After two hours of going downstream, you come to the mouth of the river where it meets the ocean. This area, where fresh water from the river meets the salt water from the ocean, is called an ESTUARY. In the center of your paper near the top, draw the boat on top of the water in the estuary . . .

Although the estuary will be deep where the main channel of the river is, it will be shallow along the shore and in much of the estuary itself. Draw some areas of shallow bottom under your boat . . . Now draw yourself lowering an anchor to measure the depth of the estuary . . . Leave the anchor on the bottom so the next tide does not carry you away. Now you have time to look down into the water.

Because the water is so shallow in an estuary, a lot of sunlight can get through the water to the plants that grow on the bottom. The river that flows into the estuary carries soil from the land, bringing lots of nutrients for the plants to use for making food. These nutrients, along with the sunlight and shallow water, allow many plants to grow. Draw lots of algae and eelgrass on the estuary's floor . . .

Many estuary plants are so tiny that one needs a microscope in order to see them! These plants are eaten by tiny animals. The tiny plants and animals that live suspended in the water are called PLANKTON. Draw lots of these microscopic plants and animals in the water under your boat . . .

Many animals like clams, mussels, barnacles and sponges eat this floating food by filtering it from the water. Draw some of the filter-feeders on the bottom of your estuary . . . When animals and plants die, they drift to the bottom and decay, becoming DETRITUS. Some kinds of worms eat this decaying matter. Draw several worms living in the muddy bottom . . .



Afternoon In An Estuary

Small fish not only find food in an estuary, they can also hide from predators in the algae and eelgrass. Draw lots of little fish, feeding and hiding in the plants . . . Because there are so many little fish, larger fish will live in an estuary. Draw a large salmon looking for a tasty meal . . . Now draw an animal that might eat a salmon — for example, a harbor seal or bald eagle . . . Now that you know there are large salmon in your estuary, you are getting hungry. On the back of your paper, draw yourself eating a tasty meal from an estuary . . .

Adapted from “Clean Water, Streams, and Fish”,
Washington State Office of Environmental Education





Estuary Stories

Read or tell a story that explains a natural phenomenon, and then let the students create their own tales.

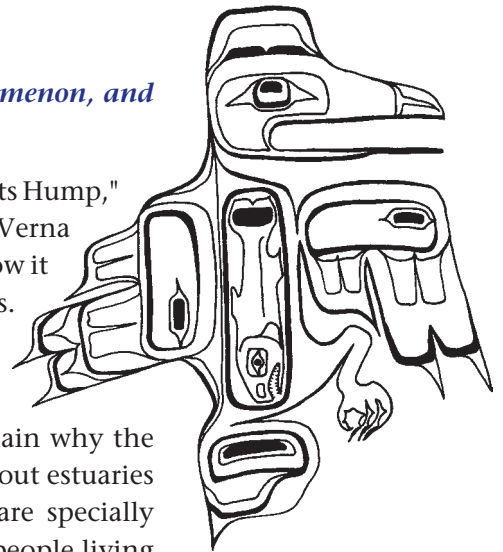
Rudyard Kipling's *Just So Stories* ("How the Camel got its Hump," etc.) and *Why Mosquitoes Buzz in People's Ears*, by Verna Aardema, are familiar examples of stories that tell "how it came to be." Choose a story to read aloud to your class. Collections from other cultures are good sources for such a tale.

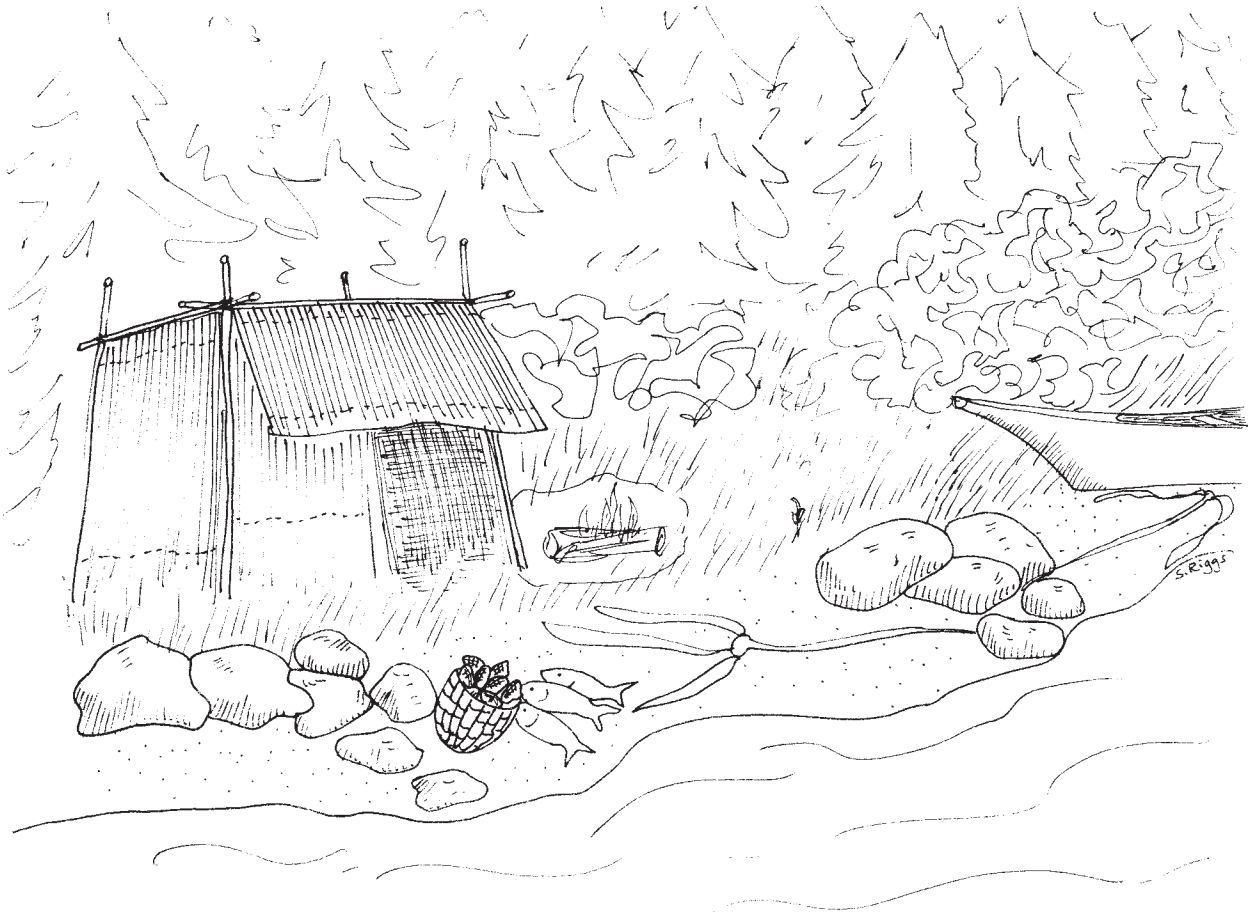
Introduce the story by talking about tales that explain why the world is the way it is. After reading the story, talk about estuaries and how they work so well. Name animals that are specially adapted to live in their estuary habitat. Talk about people living near and using estuaries. Imagine what it would be like if estuaries or estuary animals were different, perhaps not so well adapted.

Have your students create their own stories about something in the estuary. (How the crab came to have claws, the great blue heron's long legs, why worms burrow into the mud, why the river always runs down to the sea, etc.) Send copies of your stories to Padilla Bay. We'd love to share them!

An excellent "estuary tale" is the Tahtlan story from Northern British Columbia which explains the tidal cycle. "Why the Tides Ebb and Flow" is the story of how Raven provided food for the people by making intertidal plants and animals available to them. Raven discovers a great big man sitting on a hole in the earth. If the man gets up, the water pours into the hole, the tide goes down, and people have food. By placing sharp rocks under the man, Raven convinces him to stand up twice every day, long enough to let the water recede so that the people can gather seafood on the shores.

"Why the Tides Ebb and Flow" can be found in the book, *How the People Sang the Mountains Up*, by Maria Leach, published in 1967 by Penguin Books. It is also available in the collection, *Wetland Tales*, published by Washington State Department of Ecology. Call the Publications Office at (360) 407-7472 for a free copy (Publication No. 92-17).

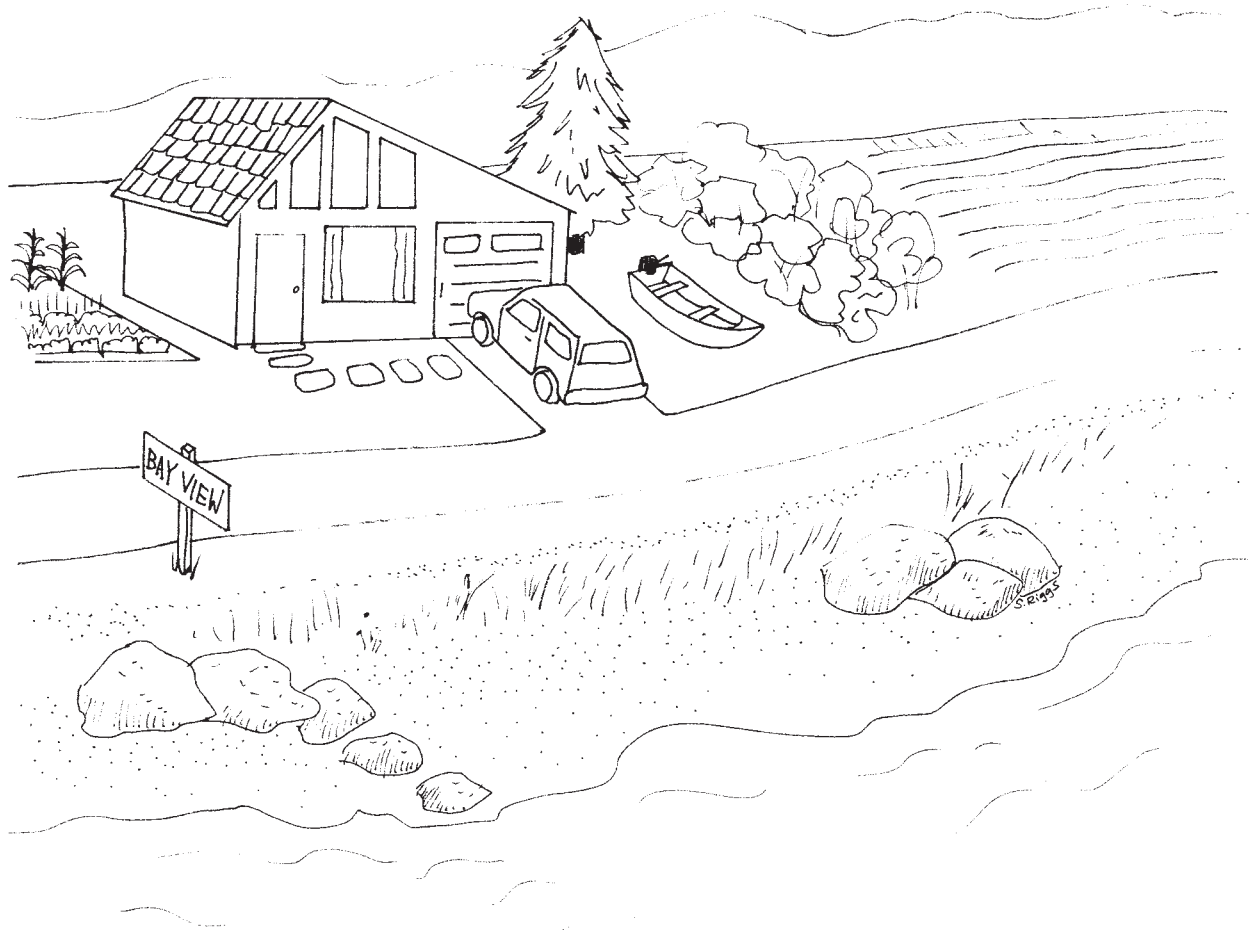




A Samish Home -- 1850's

Siehu's Story

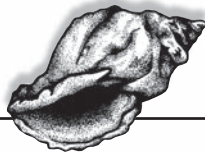
My name means heron. My home is built on the edge of Padilla Bay. It is made of cedar boards. My family travels only by water in a canoe that was carved out of a cedar tree. We get much of our food from the estuary. I help my mother gather clams, crabs, oysters, and seaweeds when the tide is low. My father and brothers fish and hunt birds that come to the estuary. In the summer, I like swimming in the bay. It is fun to see all the animals that live on the beach. All my friends and relatives live here, too. In the winter, it can get very cold and windy by the water, and everyone has to work hard to stay warm and have enough food to eat. Still, I am very happy to be living by Padilla Bay.



A Modern Home -- 2000's

Elisabeth's Story

My home is a new house with cedar siding, built on the shore of Padilla Bay. Before it was built, the land here was a mudflat. The mudflat was diked and drained to make good farmland. Almost all of our food comes from a store in town, 12 miles away. We have a car and a motor boat. My parents both work in town. In the winter it is cold, wet, and windy here by the water. But in the summer I like to swim and play at the beach. Sometimes we dig for clams or go crabbing or fishing. We live far away from the mall and most of my school friends. Still, I am very happy that I live by Padilla Bay.



Make a Food Chain

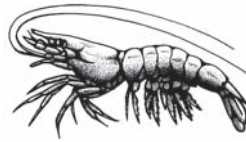
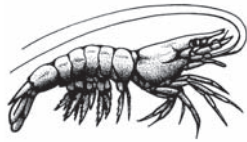
Each of the strips below makes a link in a food chain. Cut on the dotted lines and tape or staple the links together in the order you think is correct, beginning with the plants.

Then start adding links of your own. As you add estuary eaters, your chain will quickly become a **food web**.

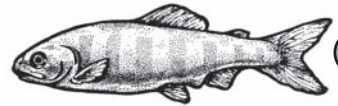
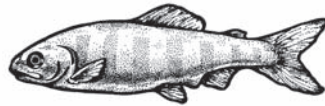
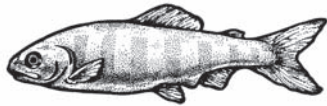
Extra: Add a link that says "Me" to a link that you like to eat.



Shrimp



Salmon



Zooplankton



Phytoplankton



Eagle





Make a Food Chain

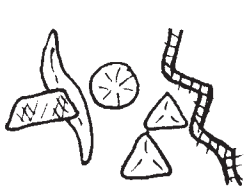
A series of ten horizontal dashed lines, each flanked by a gray circle on the left and a gray circle on the right, providing a template for writing a food chain.



Food Chain Game

Students role play an estuary food chain to learn about energy transfer and the challenges facing estuary animals.

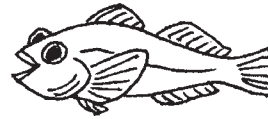
The food chain in this game consists of four links:



phytoplankton
(popcorn)



zooplankton

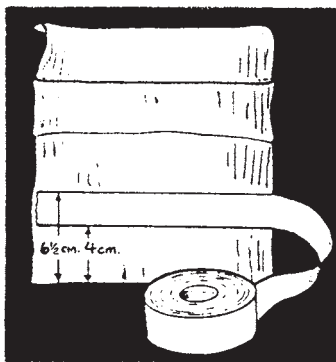


sculpins



great blue herons

Popcorn represents the phytoplankton. Students play the roles of zooplankton (plant eaters), sculpins (which eat zooplankton), and great blue herons (which eat the sculpins). Each student tries to get enough to eat without being eaten during the timed course of the game.



You will need:

- 1 large paper bag of unsalted popcorn
- 1 timer
- roll of 1" masking tape
- 1 plastic sandwich bag (stomach) for each student. Place a strip of masking tape parallel to the bottom of the bag, 1 1/2" from the bottom.
- color coded "sashes" (fabric or paper)

For every 3 students, make 2 zooplankton sashes, 1 sculpin sash, and 1 great blue heron sash.

How to play:

1. Briefly review food chains. Outline the boundaries of the game area, an area big enough for a controlled game of tag. This game is best played outdoors or on an uncarpeted area.
2. Spread the phytoplankton (popcorn) over the area. Tell your class you are spreading out the phytoplankton for the zooplankton to eat.



Food Chain Game

3. Divide the students into 3 groups and distribute the sashes and plastic bag stomachs. Give one group **zooplankton** sashes and tell them they need to fill their plastic bags with popcorn to the bottom of the tape to survive. Give a second group **sculpin** sashes and instruct them to fill their bags to the top of the tape. The third group gets **great blue heron** sashes and must fill their stomach to the top to survive. Great blue herons tag sculpins. Sculpins eat zooplankton, and zooplankton eat the phytoplankton (popcorn). If a great blue heron tags a sculpin the sculpin must surrender the contents of its stomach and leave the game. If a sculpin tags a zooplankter, the zooplankter must surrender the contents of its stomach to the sculpin and leave the game.
4. Set the timer for five minutes and "GO!" The first game usually lasts only a few seconds with one of two things happening. The zooplankton are gobbled up before they have a chance to forage, or the sculpin are gobbled up and the zooplankton continue to eat popcorn.
5. Record the number of each kind of animal that survived. Have students suggest rules that might allow all four links of the chain to still have survivors after five minutes of play. Suggestions may include:
 - a. Change the ratio of zooplankton to sculpins and herons.
 - b. Let each zooplankter come back as another zooplankter once after being captured and transferring its stomach contents.
 - c. Provide a "safety zone" for zooplankton and /or sculpins.
 - d. Timed releases. Let zooplankton go first to forage. After one minute, release the sculpins, and then one minute later, the herons.
6. Replay the game and modify your rules several times until a balance is achieved.


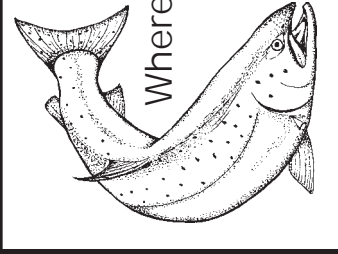
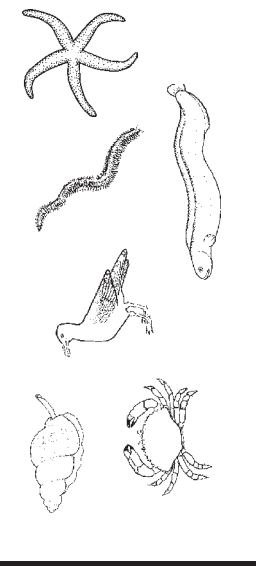

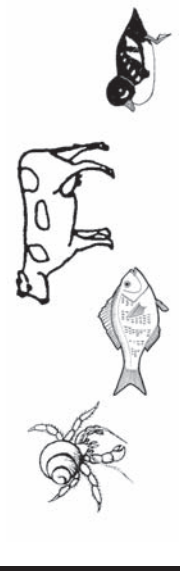

Conclusion: Analyze the results of each game. Compare this game to a real food chain. How are your rules similar to or different from how it really works?

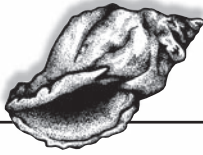
How about making extra popcorn to eat?!

Padilla Bay

Whiz Quiz

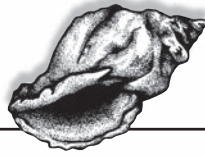
My name is _____

<p>What 2 kinds of water mix in an estuary?</p> <p>1. _____ 2. _____</p>	<p>Do you like to eat:</p> <table border="0"> <tr> <td></td> <td>yes</td> <td>no</td> </tr> <tr> <td>1. clams</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>2. crabs</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>3. oysters</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>4. salmon</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> <tr> <td>5. seaweed</td> <td><input type="checkbox"/></td> <td><input type="checkbox"/></td> </tr> </table>		yes	no	1. clams	<input type="checkbox"/>	<input type="checkbox"/>	2. crabs	<input type="checkbox"/>	<input type="checkbox"/>	3. oysters	<input type="checkbox"/>	<input type="checkbox"/>	4. salmon	<input type="checkbox"/>	<input type="checkbox"/>	5. seaweed	<input type="checkbox"/>	<input type="checkbox"/>	<p>Draw an animal that swims with the tide.</p>
	yes	no																		
1. clams	<input type="checkbox"/>	<input type="checkbox"/>																		
2. crabs	<input type="checkbox"/>	<input type="checkbox"/>																		
3. oysters	<input type="checkbox"/>	<input type="checkbox"/>																		
4. salmon	<input type="checkbox"/>	<input type="checkbox"/>																		
5. seaweed	<input type="checkbox"/>	<input type="checkbox"/>																		
<p>Draw an animal living in mud.</p> 	<p>Where do salmon hatch?</p> 	<p>Circle the animal with one foot.</p> 																		
<p>Floating plants and animals are called _____</p> 	<p>"X" the animal that doesn't belong in an estuary.</p> 	<p>Draw an animal that lives on rocks.</p> 																		



The Eating Song

1. This is the way the seastar eats,
The seastar eats, the seastar eats.
This is the way the seastar eats,
Slipping its stomach inside the clam.
2. Clam --
Slurping its food through its siphon.
3. Amphipod --
Chewing detritus on the beach.
4. Barnacle --
Catching plankton with feathery feet.
5. Anemone --
Grabbing food with its tentacles.
6. Limpet --
Scraping up plants with its jagged tongue.
7. Crab --
Slicing up meat with its pinchers.



Three Little Salmon

(Tune: Three Little Fishes)

1. Down in the meadow in an itty bitty pool
Swam three little salmon where the water was cool.
"Swim" said a voice, "swim if you can"
And they swam and they swam right over the dam.

**Boomp boomp ditum dattum wattum choo
Boomp boomp ditum dattum wattum choo
Boomp boomp ditum dattum wattum choo
They swam and they swam right over the dam.**

2. Down in the estuary they got fat
Eating copepods and amphipods and things like that.
Then the three little salmon went off on a spree
And they swam and they swam right out to the sea.

**Boomp boomp ditum dattum wattum choo . . .
They swam and they swam right out to the sea.**

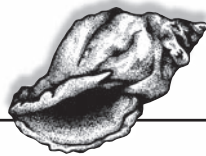
3. "Help," cried the salmon, "look at the whales!"
Seals and tuna were hot on their tails.
Then came that voice, it said, at last,
"Go back to the place that you were hatched."

Boomp boomp ditum dattum . . .

4. Swimming up the river came the salmon run.
They couldn't stop for anything, no time for fun.
When they came to the dam they could not stop.
They had to get over the top.

"Jump!" said the voice, "No time for rest."
"Jump!" said the voice and they jumped their best.
Some had to try three or four times.
Then they swam and they swam right over the dam.

Boomp boomp ditum dattum . . .



Eelgrass Song

(Food chain version)

Call and response song to the tune of "The Green Grass
Grew All Around"

Oh Padilla is a bay.

Oh Padilla is a bay.

And it is an estuary.

And it is an estuary.

'Bout the prettiest estuary

'Bout the prettiest estuary

That you ever did see

That you ever did see

**Oh, Padilla is a bay and it is an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.**

Now in that bay,

There is an eagle.

'Bout the prettiest eagle

That you ever did see.

**Oh the eagle's in the bay and the bay's an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.**

Now in that eagle, there is a duck . . .

Now in that duck, there is a crab . . .

Now in that crab, there is a copepod . . .

Now in that copepod, there is detritus . . .

**and the eelgrass grows all around, all around,
and the eelgrass grows all around.**



Eelgrass Song

(Botany Version)

Oh Padilla is a bay.

Oh Padilla is a bay.

And it is an estuary.

And it is an estuary.

'Bout the prettiest estuary

'Bout the prettiest estuary

That you ever did see

That you ever did see

**Oh, Padilla is a bay and it is an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.**

Now in that bay,

Now in that bay,

There was some mud.

There was some mud.

'Bout the prettiest mud

'Bout the prettiest mud

That you ever did see.

That you ever did see.

**Oh, the mud was in the bay and the bay's an estuary,
and the eelgrass grows all around, all around,
and the eelgrass grows all around.**

Now in that mud, there was a root.

Now on that root, there was a blade . . .

Now on that blade, there was a flower . . .

Now on that flower, there was a seed . . .

**and the eelgrass grows all around, all around,
and the eelgrass grows all around**



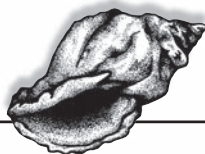
Did You Ever See a Barnacle?

(Tune: Did You Ever See a Lassie?)

Did you ever see a barnacle, a barnacle, a barnacle?
Did you ever see a barnacle go this way and that?
Go this way and that way
Go this way and that way
Did you ever see a barnacle go this way and that?

2. Jellyfish
3. Some eelgrass
4. Heron
5. Eagle
6. Crab
7. Anemone
8. Pipefish
9. Worm
10. . . .

This is a good action song!



Roll On Columbia, Roll On

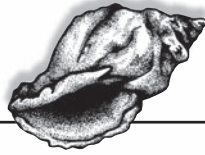
by Woody Guthrie

Green Douglas firs where the waters cut through
Down her wild mountains and canyons she flew
Canadian Northwest to the ocean so blue
Roll on, Columbia, roll on.

Roll on, Columbia, roll on
Roll on, Columbia, roll on
Your power is turning our darkness to dawn
So roll on, Columbia, roll on.

Other great rivers add power to you
Yakima, Snake and the Klickitat too
Sandy Willamette and Hood River too
It's roll on, Columbia, roll on.

Try adapting this song to your local river. Let the kids make up verses. (Roll on, Skagit, roll on . . .)



If You're a Crab and You Know It

(Tune: "If You're Happy and You Know It")

If you're a **crab** and you know it, walk sideways.
If you're a crab and you know it, walk sideways.
If you're a crab and you know it, then your walk will surely show it.
If you're a crab and you know it, walk sideways.

If you're a **seastar** and you know it, stretch your arms.
If you're a seastar and you know it, stretch your arms.
If you're a seastar and you know it, then your arms will surely show it
If you're a seastar and you know it, stretch your arms.

If you're a **jellyfish** and you know it, float around.
If you're a jellyfish and you know it, float around.
If you're a jellyfish and you know it, then your shape will surely show it.
If you're a jellyfish and you know it, float around.

If you're a **clam** and you know it, close your shells.
If you're a clam and you know it, close your shells
If you're a clam and you know it, then your shells will surely show it.
If you're a clam and you know it, close your shells.

If you're a **worm** and you know it burrow down.
If you're a worm and you know it burrow down.
If you're a worm and you know it, then your squirms will surely show it.
If you're a worm and you know it burrow down.

Now add your own verses . . .



More Ideas

- Make a list of words describing an estuary. Turn them into a poem.
- Write a story from the point of view of an animal living in an estuary.
- Write a letter to Padilla Bay on how you felt about your trip and what you experienced there. You may want to give students questions to answer in their letters. For example: Why are estuaries important? What can you do to help estuaries?
- Write a riddle about a "sea treasure." Have others guess.
- Make chimes from driftwood and clam shells.
- Make Japanese fish prints (Gyotaku). Latex house paint washes up easily and is permanent on T-shirts or cloth when dry.
- Create a mural of an estuary and have each student add an animal or plant. Fish prints, shell rubbings and tissue paper eelgrass make interesting additions.
- Color egg carton "barnacles." Cut apart sections of an egg carton. Use 2" pieces of pipe cleaner for the feathery feet. The feet can be pulled in as the tide goes out.
- Make a list of the foods we eat that come from an estuary.
- Talk about seaweed and its nutritional value. Investigate what foods are made with algin and carrageenan, derivatives of seaweeds.
- Visit an Asian market or talk to a Japanese chef. Taste some seaweed products.
- Play fish net tag. Three people hold hands to form the net. Everyone else is a fish. When the net tags a fish, the fish joins on to become part of the net. Continue until everyone is in the net. This is a game without losers!
- Play charades: Have students act out how an animal moves or eats for the rest of the class to guess. Have a group of students act out an estuary food chain.



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Musical Recordings.....	84





Resources

Children's Books

Baldwin, Robert F. *This is the Sea that Feeds Us*. Nevada City, CA: Dawn Publications, 1998. A catchy rhyme about the marine food web—including humans.

Carle, Eric, *A House for Hermit Crab*, Saxonville, Massachusetts: Picture Book Studio, Ltd., 1987. Colorfully illustrated story of a hermit decorating its shell only to outgrow it and move on.

Cole, Joanna, *The Magic School Bus at the Water Works*. New York: Scholastic Inc., 1990. Ms. Frizzle's look at how we use water.

Cole, Joanna, *The Magic School Bus on the Ocean Floor*. New York: Scholastic Inc. 1992. Fanciful tale of a field trip to the ocean floor.

Cole, Sheila, *When the Tide is Low*, New York: Lothrop, Lee & Shepard Books, 1985. A lyrical story of waiting for the tide. A good introduction to tides and the seashore.

Cone, Molly, *Come Back Salmon*, San Francisco: Sierra Club books for Children, 1992. An exciting account of students in Everett, WA who clean up their stream to restore a historical salmon run.

Dean, Jana, *Wetland Tales; A Collection of Stories for Wetland Education*, Washington State Department of Ecology Publication # 92-17. Delightful stories from the oral traditions of many cultures.

Glaser, Michael, *Does Anyone Know Where a Hermit Crab Goes?*, Massachusetts: Knickerbocker Publishing company, 1983. A charmingly simple poem about the adventures of a hermit crab.

Crewe, Sabrina, *The Salmon*. Austin: Raintree Steck-Vaughn Publishers, 1997. Basic and simple salmon facts.

Holling, Holling Clancy, *Pagoo*, Boston: Houghton Mifflin Company, 1957. A classic tale about the often dramatic encounters of a young hermit crab, full of "lessons."

James, Simon, *Sally and the Limpet*, New York: Macmillan Publishing Co., 1990. A comical tale with a conservation message.

Lionni, Leo, *Fish is Fish*, New York: Pantheon, 1970. A wonderful story about fish, easily understood by preschoolers.

Waterton, Betty, *A Salmon for Simon*, Vancouver, B.C.: Douglas & McIntyre, 1978. How a small boy saves the life of the salmon he intended to catch.

Peters, Lisa Westberg, *The Sun, the Wind, the Rain*, New York: Henry Holt & Co, 1988. A simple story of coastal geology.



Resources

Magazines

Clearing: Nature and Learning in the Pacific Northwest

Environmental Education Project

PO Box 751

Portland, OR 98207

A valuable network of people and places, information on happenings, ideas, activities and resources for teaching about the environment.

Naturescope Our Big Backyard, and Ranger Rick

National Wildlife Federation

1412 Sixteenth Street, NW

Washington, D.C. 20036-3366

Wildlife education curriculum and outstanding childrens magazines

Reference Books

Berrill, J.J. and Jacquelyn, ***1001 Questions Answered About the Seashore***, New York: Dover Publications, 1957.

Coulombe, Deborah, ***The Seaside Naturalist***, New York: Prentice-Hall, Inc., 1984.

Flora, Charles and Eugene Fairbanks, M.D., ***The Sound and the Sea***, Bellingham, WA: Western Washington Press, 1983.

Kozloff, Eugene, ***Seashore Life of the Northern Pacific Coast***, Seattle: University of Washington Press, 1983.

Snively, Gloria, ***Exploring the Seashore of British Columbia, Washington and Oregon***, Vancouver, BC: Gordon Soules Book Publishers Ltd., 1978.

Yates, Steve, ***Marine Wildlife***, Connecticut: The Glove Pequot Press, 1988.

Zim, Herbert and Lester Ingle, ***Seashores: A Guide to Animals and Plants Along Beaches***, New York: Golden Guide Press, 1955.

Curricula

Alaska Sea Week Curriculum Series

Alaska Sea Grant College Program

University of Alaska

Fairbanks, AK 90701

A wonderful series of interdisciplinary beach and classroom activities in all aspects of marine studies, for elementary grades; award winner



Resources

Aquatic Project Wild

Project Wild Coordinator

Washington State Department of Fish and Wildlife

600 Capital Way North

Olympia, WA 98501-1091 (360) 902-2200

A compilation of diverse, interdisciplinary activities for all ages. Available through teacher workshops only.

Project WET

Rhonda Hunter, Project Coordinator

Washington State Department of Ecology

PO Box 47600

Olympia, WA 98504-7600 ((360) 407-6145

An interdisciplinary water education program promoting awareness, appreciation, knowledge and stewardship of water resources. Available through teacher workshops. K-12.

ORCA: Ocean Related Curriculum Activities

Marine Education Project

Pacific Science Center

200 Second Avenue N

Seattle, WA 98109 (206) 443-2001

"High Tide, Low Tide" and "Life Cycle of the Salmon" for grades 3-4 can be adapted for lower grades; excellent information and activities.

Project For Sea

Marine Science Center

PO Box 2079

Poulsbo, WA 98370 (360) 779-5549

Extensive and exemplary curriculum includes animal and plant identification and ecological concepts; award winner.

The Seattle Aquarium Curriculum

The Seattle Aquarium

Pier 59, Waterfront Park

Seattle, WA 98101 (206) 622-1868

Curriculum for all grades, preschool as well, to supplement visits to the aquarium; teacher information, pre- and post-visit activities included.

Naturescope

National Wildlife Federation

1412 Sixteenth Street, NW

Washington, D.C. 20036-3366

A wonderful series of books filled with easy to use activities and lessons on topics such as oceans, birds, mammals, and wetlands.



Resources

Places

Bellingham Maritime Heritage Center

1600 Centre Street
Bellingham, WA 98225
(360) 676-6806
Salmon hatchery; education programs available.

Marine Life Center

1801 Roeder Ave.
Bellingham, WA 98225
(360)671-2431
Touch tanks, aquaria with NW animals; education programs available.

Point Defiance Zoo & Aquarium

5400 North Pearl Street
Tacoma, WA 98407
(206) 591-5335
An exemplary zoo with aquariums; education programs available.

Port Townsend Marine Science Center

Fort Worden State Park
Port Townsend, WA 98368
(360) 385-5582
Touch tanks and exhibits; education programs available.

Poulsbo Marine Science Center

PO Box 2079
Poulsbo, WA 98370
(360) 779-5549
Marine center with comprehensive school programs.

The Seattle Aquarium

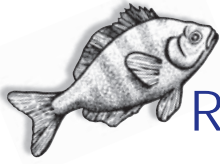
Pier 59, Waterfront Park
Seattle, WA 98101
(206) 622-1868
Extensive aquariums and exhibits; school programs.

The Whale Museum

62 First Street N
Friday Harbor, WA 98250
(360) 378-4710
Museum and research dedicated to whales; elementary curriculum.

Washington State Office of Environmental Education

2800 NE 200th
Seattle, WA 98155
(206) 365-3893
A resource center; offers curriculum materials, films, videos, workshops.



Resources

Organizations

Northwest Association of Marine Educators (NAME)

Kathleen Heidenreich
W 697 Elk Ridge Road
Shelton, WA 98584

An active organization of educators and enthusiasts interested in marine and aquatic education in Alaska, British Columbia, Washington, and Oregon. NAME is the regional chapter of the National Marine Education Association (NMEA).

Environmental Education Association of Washington (EEAW)

PO Box 4122
Bellingham, WA 98227

Promotes environmental education in Washington; sponsors annual conference.

Salish Sea Expeditions

271 Wyatt Way NE #102
Bainbridge Island, WA 98110
(206) 780-7848

Offers classroom study and boat-based field research opportunities in Puget Sound.

Sound Experience

2310 Washington Street
Port Townsend, WA 98368
(360) 379-0438

Environmental Education and Marine Science programs on board the 101 foot historic schooner, *Adventuress*.

Musical Recordings

Salish Sea, Holly Arntzen and the Saltwater Singers, ©2000 Artist Response Team (ART), PO BOX 91, Brentwoor Bay, BC V8M1R3
(250) 544-4006, art@pacificcoast.net

Singable songs with a strong environmental message. The “Salish Sea.” refers to waters of northern Puget Sound, the Georgia Strait and the Strait of Juan de Fuca.

The Ways of the Bay, Billy Brennan, Billy B. Productions, PO BOX 5623, Takoma Park, MD 20913, (301) 622-1025

Songs for kids about bays and estuaries with ecological information and an environmental message.